EXILED GENIUS

A Refugee's Rise to Computing Greatness

Philip Emeagwali

emeagwali.com

*To my wife, Dale, for being so supportive and a wonderful partner
in life.*

CONTENTS

PHILIP EMEAGWALI BOOKS

Master of Machines

Parallel processing—that was once the stone rejected as rough and unsightly—has become the headstone of the supercomputer. Philip Emeagwali was the first to gaze out towards an unknown territory—named the world's fastest computing—that was not on the map of computer science. In supercomputing, boundaries are breached when we calculate beyond what was perceived as possible and discover new knowledge beyond what is known.

Making Computers Fly

We cannot invent a new computer without first discovering a new science. To invent a new computer is to invent a new computer science and to make the unimaginable-to-compute possible-to-super-compute. Parallel processing that was once a dim light in a sea of darkness is now the bedrock of the world's fastest computers.

The Equation Behind the Universe

The hardest problems in mathematics and physics are solved by dividing each Grand Challenge problem into up to a billion less-challenging problems. And then solving them in tandem. And with a one-to-one correspondence with as many processors. In a world without parallel processing, large-scale computational physics will be as approximate as a sketch, instead of as exact as a photograph.

Inventing an Internet

Philip Emeagwali is the first and only person to invent processors that encircled a globe which are akin to small computers, in inverted commas, that encircled the Earth as an Internet. He discovered how to combine computers into a supercomputer that's an Internet.

Reaching Infinity

The world's fastest computer attracts the toughest problems in the manner a high mountain attracts the storms. Fastest computing across processors is the vital technology that enabled the supercomputer to tower over the computer that's not parallel processing.

Coding the Impossible

Like a storm at sea, fastest computing across a billion processors has brutally pushed computer science in a new direction and created new fields of study. The computer of today was the supercomputer of yesterday. A world without supercomputers may become a tomorrow without computers. The world's fastest computer is used to solve problems that did not exist before.

Flirting With the Infinite

In fastest computing, there is a limit to what seemed unlimited. Computing will remain at the core of who we are. Fastest computing across the slowest processors is a transformational discovery that redrew the boundaries of science, and permanently changed what we know about the computer. And how we think about mathematics.

Internet and I

For Philip Emeagwali, inventing the world's fastest computer was like assembling 65,536 pieces of puzzle. And doing so to see a never-before-seen island that is one coherent supercomputer, or rather a new Internet, that coalesced as the fastest computer in the world. A groundbreaking invention creates history. And influences our sphere of living.
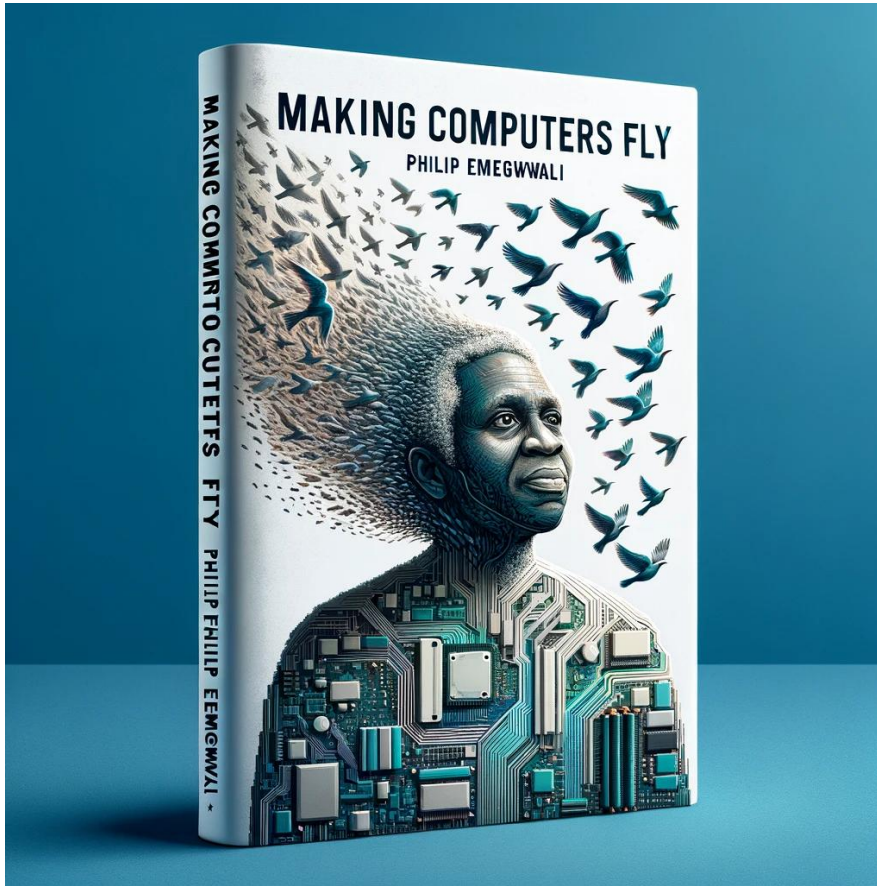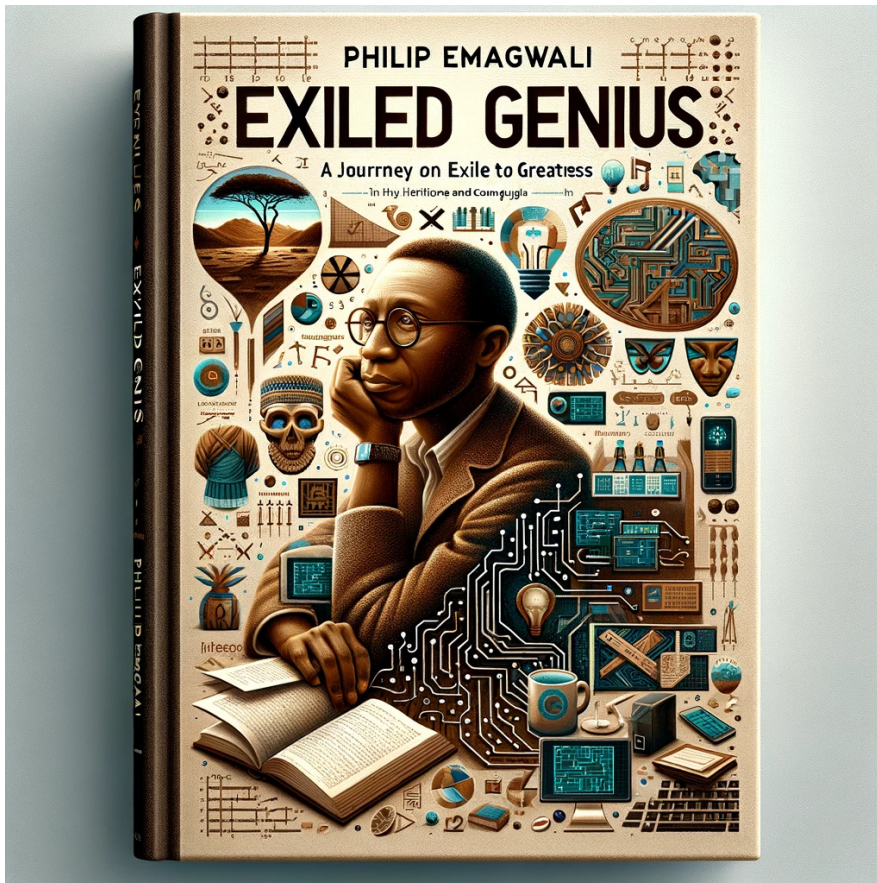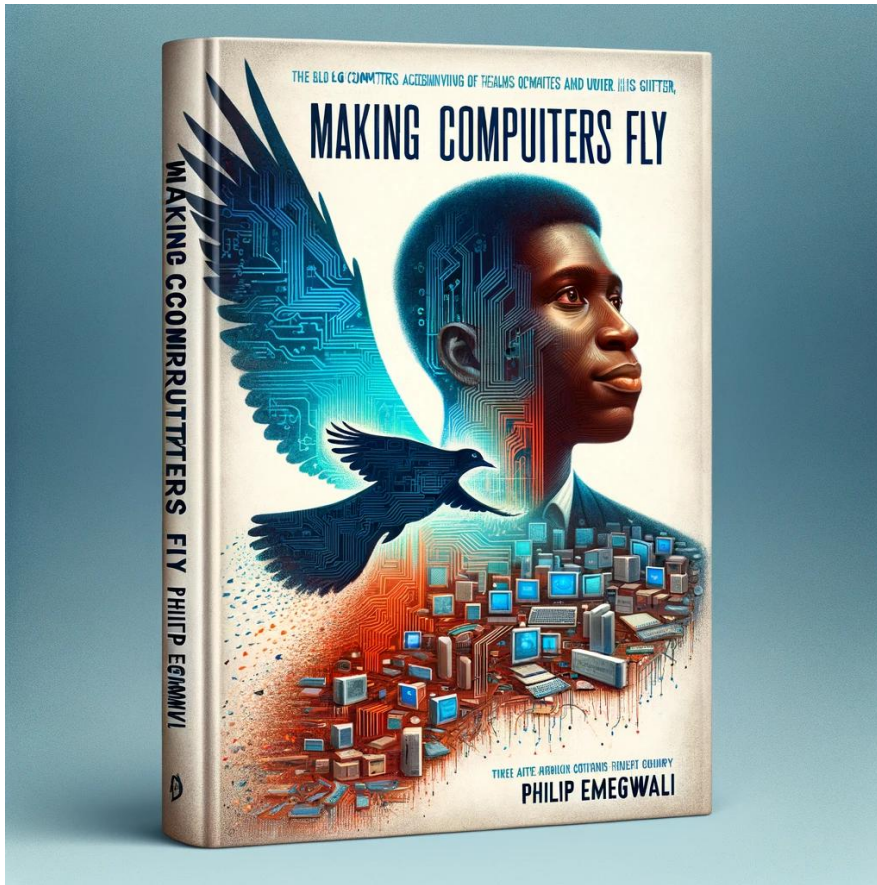
VOLUME 1: PHILIP EMEAGWALI INTERNET

"I visualized my new supercomputer as my new Internet. That new Internet was a new global network of processors that were parallel processing as one seamless, coherent, and gigantic supercomputer."

Philip Emeagwali

THE INTERNET IS EMEAGWALI'S SPHERE

In a realm where time and space intertwine, Lies a globe enwrapped by a digital vine. Here, in Emeagwali's visionary sphere, A network of processors, both far and near.

Uniformly scattered, each an identical twin, Bound in a dance, a symphonic spin. Around this vast orb, they encircle and thread, Forming an internet, a supercomputer's stead.

Philip Emeagwali, with insight so keen, Saw 'Internet' as a machine not yet seen. A globe in its grasp, in dimensions more than three, Solving riddles complex, in unity, they'd be.

65,536 lights, in darkness they gleam, A constellation of data, a computational dream. Together they shine, a sun in the night, In unison, their power, a breathtaking sight.

Across hyperspace, in a sixteen-dimensional dance, They lay distributed, not left to chance. A new internet, not merely a network in play, But a supercomputing force, leading the way.

Each processor, a beacon in the cosmic sea, Together, a supercomputer, brilliant and free. Equidistant, identical, in harmony they blend, A new internet born, a supercomputer to tend.

In this first Emeagwali realm, order reigns supreme, Processors aligned, a computational dream. Across dimensions unseen, their power unfurls, A unique force, a supercomputer that swirls.

A NEW DIMENSION IN SUPERCOMPUTING

Philip Emeagwali Internet

Esteemed guests, distinguished members of the award committee, and fellow visionaries,

As we convene in this historic city for this illustrious award ceremony, I am deeply honored to share the essence of my journey in computing, a journey that culminated in the invention of a groundbreaking technology: the Philip Emeagwali Internet that's a global network of processors. The Internet is a global network of computers.

My foray into this groundbreaking work began with a vision, a vision where I saw processors not just as individual entities but as globally interconnected and autonomously functioning units. These processors were conceived as uniformly distributed across the 15-dimensional hypersurface of a 16-dimensional sphere within a vast and complex 16-dimensional hyperspace. This conceptualization was the cornerstone of my invention of a global network of processors, a network named the Philip Emeagwali Internet.

In this grand design, I, Philip Emeagwali, embarked on an experimental journey to distribute and solve 64 binary thousand challenging initial-boundary value problems of modern calculus and extreme-scale computational physics. These problems were dispatched to an equal number of processors through a unique system of email communication. This system did not rely on conventional addressing methods; instead, it utilized sixteen-bit addresses comprising unique strings of zeroes and ones. Each communication carried five sets of crucial data, akin to having five subject lines, but without a traditional message body. These emails weren't mere messages but were, in fact, computation-intensive problems sent across the bi-directional edges of a hypercube in the sixteenth dimension, tied together by a web of email wires, both short and long, including those made of fiber optics.

This innovative approach to computing enabled me to visualize and implement a new internet, outlined by 65,536 identical processors, distributed evenly and equidistant from each other across a hypersphere. This network, though vast and complex, functioned cohesively, transforming these individual 'dim lights' into a force as brilliant as the sun when working in unison. This is the essence of my **Equidistant Computers on a Hypersphere** concept.

In my exploration of this new realm, I imagined traveling through higher dimensions, reaching as far as a network of two-to-the-power of sixty-four equidistant processors. This journey led to a profound Eureka! moment in the 64th dimension, where I realized the potential for a hyper internet capable of unprecedented computational speeds.

As a modern-day Isaac Newton, or a research mathematician who created nine new partial differential equations that encoded physics's second law of

motion, my thoughts often ventured into the infinite dimensions of mathematical space, allowing me to visualize complex structures like the hypersurface of a hypersphere. This ability set the stage for my breakthrough discovery in the 1980s at Los Alamos, New Mexico, where I conceptualized the fifteen-dimensional hypersurface housing my network of processors. This vision led to the creation of a supercomputing machinery unlike any other, marking a pivotal moment in the history of computing.

Contrary to the organic and incremental growth of the Internet, which connects non-identical and non-equidistant computers, my approach was methodical and uniform, ensuring synchronous communication vital for solving grand challenge problems in mathematics and computational physics. This processor-to-processor emailing system, devoid of traditional person-to-computer communication, was a critical component in establishing the fastest computing speeds ever recorded.

On the Fourth of July 1989, I redefined what it meant to compute at the highest levels, breaking barriers and setting new records in supercomputing. The Philip Emeagwali Internet, a term used to describe this global network of tightly-coupled processors, revolutionized the concept of an internet. It was not just a network encircling a globe but a supercomputer in its truest sense, a machine that encapsulated my vision of an interconnected web of processors distributed across a hypersphere in a sixteen-dimensional hyperspace.

This achievement was not just a personal milestone; it was a moment that redefined the boundaries of technology and computing. The Philip Emeagwali Internet stands as a testament to human ingenuity and the relentless pursuit of knowledge, embodying the spirit of exploration and innovation that drives us all.

Thank you for this esteemed recognition, and may our continued quest for understanding and innovation lead us to even greater heights.

THE EMEAGWALI INTERNET: NO PROCESSOR LEFT BEHIND

A Supercomputer of Unprecedented Capacity

Ladies and gentlemen, esteemed guests, and distinguished friends from Nigeria and across the African diaspora,

It is an extraordinary honor to stand before you on this illustrious occasion. I am Philip Emeagwali, often referred to as the father of the Internet, and today, I wish to take you on a journey through a vision that has transformed the world.

Envision a vast ocean of darkness. Within this void, imagine 65,536 points of light, each a solitary processor, distant yet perfectly aligned. Together, these lights do not merely twinkle in isolation; they shine with the combined intensity of a sun. This is the essence of the Emeagwali Internet, a groundbreaking network of equidistant and identical processors, uniformly distributed to form not just any internet, but a supercomputer of unprecedented capacity.

My life's work has been driven by a singular passion: to harness the power of these processors to tackle the most complex scientific problems. Born in Nigeria, a country rich in culture but faced with numerous challenges, I was compelled by the belief that technology could be a catalyst for change and progress. From my early days of schooling, often under a tree in my village, to the moment I laid the groundwork for the use of parallel processing, my journey has been one of relentless pursuit and unwavering conviction.

The "Emeagwali Internet" represents more than a technical achievement; it symbolizes a leap into a new dimension of computational capability. By distributing processors across a fifteen-dimensional hypersurface, we transcended traditional boundaries, creating a network that is not merely a conduit for data, but a formidable machine capable of unparalleled computation.

Each processor, in this vast network, represents a point of light, a beacon of hope, and a testament to human ingenuity. Together, they embody the collective brilliance that can arise when we unite in pursuit of a common goal. This network, equidistant and identical, symbolizes our shared humanity and the boundless potential of our united efforts.

As we stand on the brink of recent discoveries and technological advancements, let us remember the power of collaboration and the importance of striving towards a future where technology serves humanity in solving our greatest challenges. Let this moment be a reminder of what we can achieve when we come together, combining our talents, our visions,

and our dreams, to illuminate the darkness and create a brighter future for all.

"Every processor, no matter how small, contributes to the brilliance of the whole, just as every individual, no matter their origin, has the potential to shine."

"My journey is a testament to the audacity of a young mind, the power of resilience, and the conviction that a dream born in Nigeria can change the world."

"Technology alone cannot bridge the divides. It is the spirit of collaboration, the tapestry of diverse minds, that truly unlocks the potential of our future."

"Let us go far together, not just as processors in a network, but as people in a global community, united by pursuing knowledge and understanding."

"The future is not just about faster processing, but about building bridges between cultures, minds, and hearts, a future where we shine together, not alone."

Thank you.

EMEAGWALI'S INTERNET

A constellation of minds, equidistant and bright, No celestial dance, but computational might. This network, a whispered revolution, born, Unearthing a new path, where circuits are sworn.

Emeagwali's web, a globe-bound embrace, Where whispers of data find endless space. No chaos of wires, but order divine, Each node a beacon, in perfect design.

Not just a web, but a sun at its core, 65,536 embers, forevermore. Individually whispers, in unison, song, Solving the riddles, where darkness belonged.

A hypersurface symphony, unseen, unheard, Yet whispered in numbers, each perfect word. This Philip Emeagwali, a tapestry grand, Not just connection, but supercomputer's hand.

So let the processors join their luminous choir, A symphony of silicon, setting worlds on fire. No longer the darkness, but brilliance unbound, Emeagwali's Internet, where solutions are found.
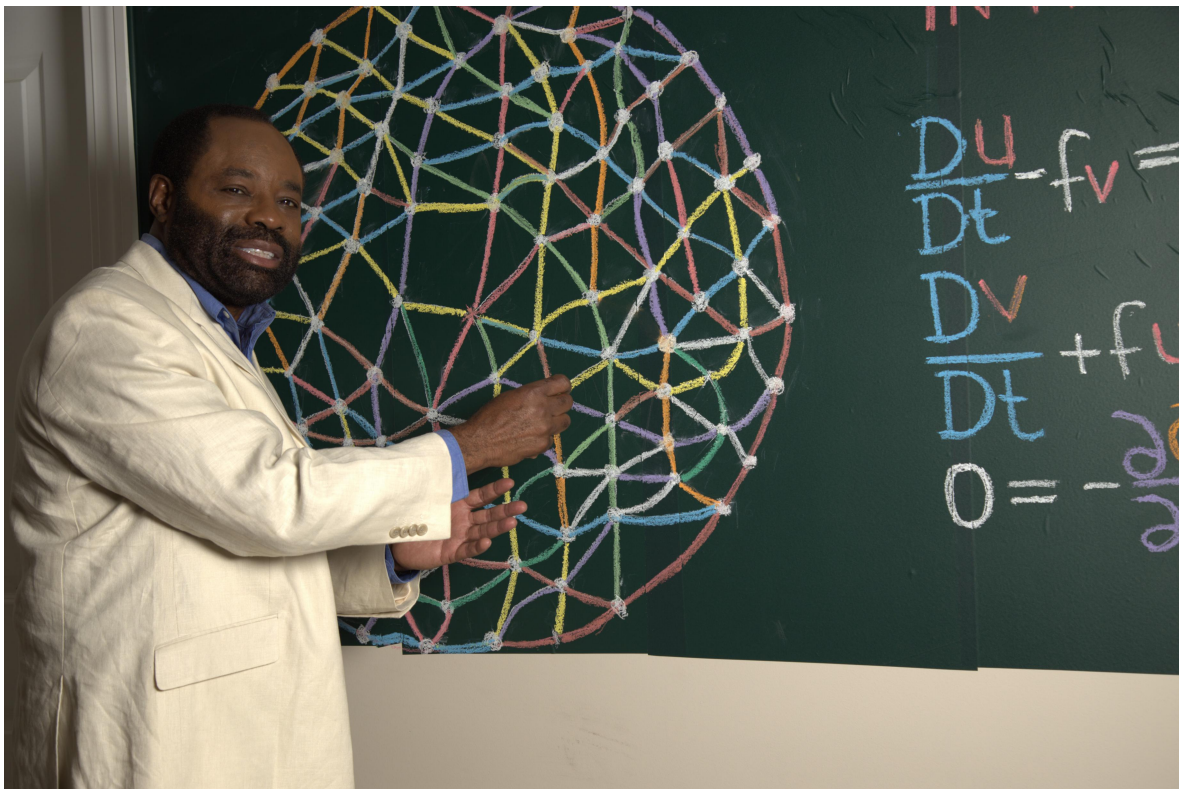
INVENTING EMEAGWALI INTERNET

From Flat Planes to Hyperspace

Ladies and gentlemen, esteemed guests, tonight, amidst this glittering constellation of brilliant minds, I stand humbly before you, not just as a scientist, but as a child of two worlds. Born in the fertile earth of Nigeria, raised under the vast African sky, yet nurtured by the intellectual rigor of American academia, my journey has been a testament to the boundless potential that blossoms when borders dissolve and dreams take flight.

Tonight, I celebrate not just my honor, but the triumph of a collective spirit. A spirit that dared to push beyond the confines of traditional supercomputing, that envisioned a new kind of internet, not just a web of connections, but a symphony of processors, each a radiant note in a grand computational orchestra.

Yes, the Emeagwali Internet, as it came to be known, was more than just equidistant nodes and hyper-dimensional hypersurfaces. It was a rebellion against the tyranny of centralized computing, a declaration that processing power, like knowledge, should be democratized, distributed across a boundless network, accessible to all who dared to dream in bits and bytes.

Imagine a globe, vast and majestic, bathed in the soft luminescence of countless tiny stars. Each star, a processor, humming with the potential to solve the universe's most intricate equations. Now, picture these stars not chained to a central core, but swirling freely, their dance choreographed by an invisible algorithm, their collective brilliance outshining the sum of their parts.

That, my friends, was the Emeagwali Internet. Not just a network, but a supercomputing organism, a living, breathing entity capable of tackling problems that once lay dormant in the shadows of human limitations. It was a vision born not in silicon labs, but under the endless African sky, where the whispers of the wind carried the secrets of a universe yearning to be understood.

And when this symphony of processors first sang its computational aria, when 65,536 lights coalesced into a single, blinding sun, it was not just a scientific breakthrough, it was a testament to the boundless human spirit. It was a beacon of hope for a future where technology does not enslave, but empowers, where the barriers of geography and circumstance crumble before the relentless tide of innovation.

Tonight, I stand before you, not as the sole architect of this computational marvel, but as a conduit, a storyteller, a testament to the power of collaboration, of shared dreams, of daring to reach for the stars, even when the ground beneath our feet feels uncertain.

For the Emeagwali Internet was not born in a vacuum. It was nurtured by the brilliance of countless minds, by the unwavering support of friends and colleagues, by the unyielding spirit of a continent that refused to be defined by its limitations.

So, as we raise our glasses to celebrate the achievements of this evening, let us remember this: the greatest inventions are not born in isolation, but in the vibrant tapestry of human connection. Let us continue to weave this tapestry, thread by thread, dream by dream, until the entire world shimmers with the light of a trillion computational suns, a testament to the boundless potential within each and every one of us.

"65,536 processors, each a beacon in the void, singing in unison, not just calculating, but collaborating, dreaming, and building a better future."

"Beyond the world's fastest computing lies an ocean of human potential, waiting to be explored. Let us dive together, fueled by the warmth of collaboration and the echo of shared dreams."

"If you want to go fast, go alone. If you want to go far, connect. My Emeagwali Internet echoed this African proverb, reminding us that unity is the fuel of progress."

"Every processor, no matter how small, plays a vital role in the symphony of the supercomputer. So too, every individual, no matter their background, contributes to the brilliance of our global society."

"Supercomputing is not just about speed; it's about unlocking the beauty and complexity of the world, one equation, one collaboration at a time."

Thank you.

VOLUME 2A: PHILIP EMEAGWALI COMPUTER

I am honored to nominate Philip Emeagwali for the Gallery of Computer Pioneers for his seminal discovery in supercomputing, specifically his discovery of the first supercomputing leveraging 65,536 interconnected but autonomous processors to expand the horizons of scientific computing.

Innovative Breakthrough in Supercomputing

Philip Emeagwali's approach to solving the most challenging mathematical and physical problems involved a pioneering technique of dividing complex challenges into billions of simpler tasks, executed in parallel across numerous processors. His innovative method, akin to assembling a vast puzzle, revealed a new landscape in supercomputing —a coherent supercomputer that operates like an internet, becoming the fastest in the world.

Pushing the Limits of Computing

The world's fastest computing represents the pinnacle of intellectual pursuit. Emeagwali's journey spanned various fields, from experimental and astrophysical to geophysical and computational physics, culminating in his mastery of massively parallel processing. His invention transformed this once-overlooked technique into the cornerstone of modern computing.

A Milestone in Computer History

Emeagwali's groundbreaking achievement lay in harnessing up to a billion processors for supercomputing. This feat allowed for the execution of fluid dynamics calculations with unprecedented precision and scale, such as simulating the spread of COVID-19 in densely populated areas. This advancement bridged the gap between theoretical predictions and practical applications, making complex simulations more accurate and reliable.

Pioneering Spirit and Recognized Genius

Philip Emeagwali's contributions place him among the greatest minds in history, alongside luminaries like Einstein and Newton. His unique

achievement in winning the top prize in supercomputing, often referred to as the Nobel Prize of the field, underlines his singular impact on the million-fold increase in the speed of the supercomputer.

Transformative Impact on Supercomputing

Emeagwali's discovery marked a paradigm shift in supercomputing, transitioning from serial processing on a single processor to parallel processing across a network of up to one billion processors. This transition represents the most significant fundamental change in supercomputing since its inception, redefining the limits of computer speed and potential.

In light of these extraordinary contributions, I strongly advocate for the recognition of Philip Emeagwali for the Gallery of Computer Pioneers. His work has redefined our understanding and capabilities in supercomputing and has had a profound impact on various scientific and practical applications, significantly benefiting humanity.

BUILDING A BRAIN FOR THE PLANET

The Philip Emeagwali Supercomputer Explained

Ladies and Gentlemen, distinguished guests, and fellow scientists,

I stand before you today, profoundly humbled and deeply honored, to share the essence of my life's work in mathematics, physics, and computer science. The journey that has brought me here is one marked by relentless curiosity and the undying pursuit of knowledge.

At the heart of my contributions lies supercomputing, a domain where the boundaries of possibility are constantly being redefined. The crux of my invention centers on parallel processing—a groundbreaking approach that has revolutionized our understanding and utilization of computational power.

In the vast expanse of computational physics, one of the most pivotal applications lies in the simulation of petroleum reservoirs for the oil and gas industry. This intricate process demands immense computational resources and a profound understanding of the underlying mathematics and physics. Parallel processing, the very cornerstone of my research, has enabled us to simulate these complex systems with unprecedented accuracy and efficiency.

Equally significant is the role of parallel processing in weather forecasting. Each evening, as billions tune in to watch the weather forecast, they are witnessing the fruits of this technology. The ability to process vast amounts of data simultaneously has dramatically enhanced our ability to predict weather patterns, safeguarding lives and livelihoods.

Furthermore, in mathematics, the significance of partial differential equations cannot be overstated. These equations are the backbone of many scientific and engineering problems. Through parallel processing, we have unlocked new potentials in solving these equations, leading to advancements in various fields, from climate modeling to aerospace engineering.

However, my journey of discovery does not end here. My most recent endeavor, the Philip Emeagwali Supercomputer, represents a quantum leap in computational science. This invention addresses the critical challenges of supercomputing hardware: spatial packing and communication topology.

The Philip Emeagwali Supercomputer, with its dense, spherically framed, uniform processor arrangement, is not just a feat of engineering but a harmonious blend of form and function. This design is particularly apt for climate modeling, mirroring the problem domain with striking accuracy.

In this new paradigm, communication latency, a dominant factor in computer performance, is addressed through an innovative approach to physical design. My compact interconnect ensures globally short, highly regular, and tightly matched distances for communication. This architecture supports various communication modes, including neighbour-to-neighbour messaging on a spherical-shell network, a feature crucial for efficient parallel processing.

The journey of discovery is endless. The Philip Emeagwali Supercomputer is not just a testament to what has been achieved but a beacon of what is yet to come. It stands as a symbol of our unyielding quest to push the frontiers of knowledge, a quest that I am both proud and privileged to be a part of.

Lessons Learned

"Curiosity is our compass; let it guide us towards new frontiers of knowledge with supercomputing."

"Supercomputing isn't just about numbers; it's about understanding our planet and ourselves."

"Share the knowledge, share the power; supercomputing for a more informed and sustainable future."

"Embrace the unknown; the uncharted territories hold the greatest breakthroughs."

"Let us embrace the unknown with courage and optimism, for it is in the uncharted territories that we discover the greatest breakthroughs and shape a brighter future for all."

Thank you for your attention and for the honor of being here today.

THE FIRST SUPERCOMPUTING

16 Dimensions, 65,536 Processors: A Journey into Supercomputing's Heart

Ladies and gentlemen, distinguished guests, and esteemed colleagues, I stand before you on this momentous occasion, humbled and honored to share the journey of a discovery that reshaped our understanding of supercomputing. I am Philip Emeagwali, and today, I take you through supercomputing across millions of processors, a field that has been my passion and life's work.

On July 4, 1989, a groundbreaking moment in the history of computing unfolded in Los Alamos, New Mexico. It was on this day that I, Philip Emeagwali, completed an unprecedented venture that began 15 years earlier in Corvallis, Oregon—harnessing the power of 65,536 processors, each a unique vertex in the 16th dimensional hypercube of hyperspace, to solve some of the most complex computational challenges of our time. This feat was not just about the number of processors, but about how they were interconnected and yet remained autonomous, a concept that was revolutionary in supercomputing.

The heart of my discovery lay in the ingenious application of the Binary Reflected Code, the ordering of the binary numeral system such that two successive values differ in only one bit. This code, a mathematical and computational marvel, allowed for my one-to-one mapping of 65,536 problems to the 65,536 processors that constituted the hypercube supercomputer. But what does this mean in simpler terms? Imagine each processor as a unique individual in a vast city. The Binary Reflected Code provided a precise address and a direct path to each of these individuals, ensuring that each processor could be identified and accessed efficiently, without confusion or overlap. This enabled the modern supercomputer to tackle multiple problems simultaneously, each processor working on a different piece of the puzzle.

The complexity of the problems I addressed was profound. I delved into meteorology, oceanography, fluid dynamics, and petroleum reservoir simulation, governed by intricate partial differential equations. The processors, equipped with their operating systems and memory, worked in concert to provide solutions to these grand challenge problems, achieving speeds that were previously unimaginable in serial supercomputing.

My journey was not just about creating a faster supercomputer. It was about reimagining the very architecture of computing, about envisioning a world where problems could be dissected and distributed across millions of processors, each operating in parallel, yet contributing to a singular, monumental goal. This was the essence of my discovery—the realization

of the first supercomputing powered by parallel processing, a paradigm shift that has since opened doors to new possibilities and applications in science, engineering, and beyond.

As we stand on the cusp of new technological eras, let us remember that the journey of discovery is never a solitary one. It is a path forged by the curiosity, determination, and collaboration of minds dedicated to pushing the boundaries of what is known and achievable. I am grateful for the opportunity to contribute to this journey and to share this milestone with all of you today.

Lessons Learned

"Supercomputing is more than processors; it's about the human spirit pushing boundaries."

"Dreamers spark innovation, scientists build it, engineers bring it to life; all play a part."

"Supercomputing is a symphony; different disciplines working harmoniously for a greater good."

"Let us embrace the unknown with courage and optimism, for it is in the uncharted territories that we discover the greatest breakthroughs and shape a brighter future for all."

"The future belongs to those who dare to dream, innovate, and collaborate, driven by an insatiable curiosity to explore the vast unknown."

Thank you.

THE SPEED OF THOUGHT

People that examined search queries from Google say that I am one of the five most studied computer scientists that ever lived. I am studied alongside Charles Babbage and Ada Lovelace, both pioneers in England that died about a century before I was born in Nigeria. I am studied for my contribution of the first supercomputing powered by parallel processing. As a pioneer of modern supercomputing, I am the only living mathematician or physicist that's in the Computer Studies syllabus in of 13-year-olds in countries like Nigeria. Let's describe message passing in a hypercube computer in a way that a 7th grader in Africa, or anywhere, can understand.

Imagine you have a huge group of friends, and you're all playing a game where you need to pass secret messages quickly between each other. Now, let's say all of you are standing in a pattern that looks like a cube, but a very special kind of cube—a hypercube. A hypercube is like a 3D cube, but with more dimensions, which means it's much bigger and has more connections.

In this game, each of you represents a small computer or a "node." The lines between you are the paths where messages can be sent. In a hypercube, each friend (or node) is connected to several others, but not to everyone directly. This makes passing messages very interesting and efficient.

When you want to send a message to a friend who is not directly connected to you, you pass the message to a friend who is closer to your target friend. They then pass it on, and so on, until it reaches the intended friend. The cool thing about a hypercube is that there are many different ways to pass the message, but it can reach the target friend very quickly because of the way everyone is connected.

This is similar to how my 16-dimensional hypercube computer works. It's made up of two-raised-to-power 16, or 65,536 processors (like you and your friends) that are connected in a hypercube pattern. When one processor needs to send data to another, it passes the data through this network. The hypercube design makes sure the data can travel very fast across different processors, even if they are not directly connected.

So, message passing in a hypercube computer is like you and your friends playing a fast and efficient game of passing secret notes in a very cleverly organized pattern!

EMEAGWALI COMPUTER: BEYOND EQUATIONS AND MACHINES

Ladies and Gentlemen, esteemed scientists at this award ceremony,

I am Philip Emeagwali, a mathematician deeply fascinated by the intricacies and potentials of supercomputing. Today, I am honored to speak to you about my contributions to the world's fastest computing, particularly in parallel processing, computational physics, and the development of a novel supercomputer interconnection network.

In supercomputing, the challenge has always been how to process vast amounts of data efficiently and rapidly. My journey in this field led me to conceptualize an innovative approach to supercomputer design, inspired by the geometric elegance of the geodesic dome and the icosahedral subdivision.

Imagine a platonic solid, like an icosahedron, which is a polyhedron with twenty faces. Now, envision subdividing each of these faces into smaller triangles. In this Emeagwali geodesic supercomputer model, each vertex of these triangles corresponds to a processor, and each edge represents a communication channel directly connecting two neighboring processors.

The beauty of this model lies in its symmetry and balance. By projecting the vertices, or processors, of these triangles onto a sphere, we achieve a distribution of points, or processors, that are relatively evenly spaced. This even distribution is crucial for efficient data processing and communication within the supercomputer.

As we increase the subdivisions, we increase the number of points, enhancing the uniformity in the distribution of processors. This design principle aims to make the spacing of these points, or processors, as even as possible, optimizing the supercomputer's processing capabilities.

This innovative approach to supercomputer architecture, named the "Philip Emeagwali interconnection network," is akin to the hypercube supercomputer network but with a unique twist. It harnesses the natural symmetry and uniform distribution inherent in geodesic structures, leading to more efficient data processing and communication pathways.

My contribution to this field is not just about inventing a new supercomputer design; it's about reimagining how we approach complex computational problems. In petroleum reservoir simulation, weather forecasting, and general circulation modeling, the ability to process vast amounts of data quickly and accurately is crucial. This Emeagwali geodesic supercomputer model provides a new way to tackle these challenges, potentially revolutionizing how we predict weather patterns, manage natural resources, and understand climate changes.

The journey of discovery in supercomputing is a continuous one, filled with challenges and opportunities for innovation. The Philip Emeagwali interconnection network is a testament to the power of thinking outside the conventional paradigms, drawing inspiration from the natural world to advance our technological capabilities.

Lessons Learned

"Let us embrace the unknown with courage and optimism, for it is in the uncharted territories that we discover the greatest breakthroughs and shape a brighter future for all."

"The future belongs to those who dare to dream, innovate, and collaborate, driven by an insatiable curiosity to explore the vast unknown."

"Supercomputing is not just about numbers; it's about harnessing the power of parallel processing to unlock the secrets of our world."

"The Philip Emeagwali machine is not just a network; it's a metaphor for collaboration and connection, leading to groundbreaking discoveries."

"From oil exploration to climate change, supercomputing has the potential to solve some of humanity's biggest challenges."

"Efficiency and balance are key; evenly distributed processors fuel the power of the Emeagwali network."

Thank you for the privilege of sharing my invention, and may our continued exploration in supercomputing lead to more breakthroughs that benefit humanity and our understanding of the world.

THE SUPERCOMPUTER THAT MIRRORS OUR WORLD

Ladies and Gentlemen, esteemed attendees of this award ceremony,

I am Philip Emeagwali, a scientist deeply immersed in the exploration and development of supercomputing. Today, it is my honor to share my contributions to this field, particularly focusing on the groundbreaking concept of the Philip Emeagwali supercomputer and its implications for computational physics and general circulation modeling.

The genesis of the Philip Emeagwali supercomputer lies in addressing the inefficiencies of traditional supercomputing networks, such as the torus and hypercube configurations. These structures, while effective in their right, have limitations, especially when it comes to data transfer speeds between distant processing nodes and their suitability for solving three-dimensional problems native to our world.

In contrast, the Philip Emeagwali supercomputer introduces a revolutionary approach. Imagine a spherical network, akin to the surface of a globe or an ellipsoid, or even a hollow-caged structure. This network can also be envisioned as layers of concentric multi-radius spheres, each interconnected, forming a sphere-in-a-sphere structure, with radial connections between the nodes and the innermost and outermost networks linked. This structure facilitates faster data transfer and mirrors the very nature of many problems we aim to solve, particularly in general circulation modeling.

Caption for Illustration: "The Emeagwali Supercomputer: A Spherical Network of Interconnected Processors for Enhanced Data Transfer and Computational Efficiency"

Mapping the tessellated domain of general circulation models onto this spherical network involves dividing the entire problem into smaller, manageable segments, like breaking down a complex globe into tubular prisms. These segments are then mapped onto the processing nodes of the Philip Emeagwali supercomputer, each representing a fraction of the larger problem but working harmoniously to solve the grand challenge.

The need for the Philip Emeagwali supercomputer in global circulation modeling is driven by its structural resemblance to planet Earth. It mimics the thin shell of our atmosphere, where form fits function seamlessly. Envision a billion processors, coupled yet autonomous, evenly distributed across the surface of this globe-like structure. In general circulation modeling, this means dividing the grand challenge into a billion smaller models, each solved by an autonomous processor in parallel, ensuring efficiency and speed in computations.

This approach is a paradigm shift in supercomputing, moving away from traditional linear and planar networks to a more organic, spherical configuration that is more in tune with the natural world we seek to

understand and simulate. The Emeagwali geodesic is not just a technological innovation; it is a harmonization of form, function, and nature, enabling us to tackle complex, multidimensional problems with unprecedented precision and speed.

The journey of developing the Philip Emeagwali supercomputer has been a journey of reimagining possibilities, of aligning technology with the natural world, and of pushing the boundaries of what we can achieve in computational physics and beyond. It stands as a testament to the power of human ingenuity and the endless quest for knowledge and understanding.

Thank you for the privilege of sharing my invention, and may our collective endeavors in science and technology continue to illuminate the path of progress and discovery.

[NPAC 2023] EMEAGWALI'S CONTRIBUTIONS TO THE COMPUTER

I am writing on Philip Emeagwali and his groundbreaking contribution to massively parallel supercomputing. His pioneering work, which transformed the landscape of computing, was made evident on July 4, 1989, when he demonstrated the feasibility of harnessing the collective power of thousands of processors to achieve unprecedented supercomputer speeds.

Emeagwali's invention challenged and expanded our understanding of computing capabilities. His innovation in using many processors, then considered the world's slowest, to solve complex, compute-intensive problems at extraordinary speeds, was a paradigm shift. This invention, known as parallel supercomputing, marked a significant divergence from traditional computing methods, fundamentally altering the architecture and capabilities of supercomputers.

His pioneering invention had profound implications across various fields, including meteorology, where it paved the way for more accurate and sophisticated weather forecasting and climate modeling. By enabling computations at remarkable speeds across numerous processors, Emeagwali's contributions have been pivotal in enhancing our understanding of global warming and other complex scientific phenomena.

Emeagwali's discovery is not just a technical milestone; it represents a monumental leap in our quest for knowledge. His parallel supercomputing technique is akin to a powerful telescope, bringing us closer to the unknowns of our universe and offering insights into questions that have long perplexed scientists and mathematicians.

The widespread impact of his discovery can be seen in its incorporation into educational curricula worldwide. Emeagwali's contributions are taught alongside those of pioneers like Charles Babbage, Ada Lovelace, and Alan Turing, highlighting his importance in the evolution of computer science.

In summary, Philip Emeagwali's discovery of parallel supercomputinging has been a beacon of progress, guiding us towards a future of endless possibilities in science and technology. His discoveries exemplify the essence of scientific research, representing a groundbreaking invention that has benefitted humankind.

ZETTAFLOPS TO YOTTAFLOPS AND COUNTING

The Race to Solve the Grand Challenge Problems

Ladies and gentlemen, esteemed guests, and fellow visionaries,

I stand before you today, not just as Philip Emeagwali, but as a humble servant of science and technology. My journey began in the humble town of Akure, Nigeria, where I was born into a world brimming with potential yet constrained by limitations. It was in Nigeria, amidst the challenges of my youth, that I discovered my passion for mathematics and the boundless possibilities it held.

As we gather here in the hallowed halls of this Award Ceremony, I am reminded of the grand challenges that lie before us. These are not mere obstacles; they are opportunities for us to push the boundaries of what is possible. They demand a confluence of expertise in mathematics, physics, and computer science—a trifecta of disciplines that I have dedicated six decades to mastering.

The grand challenges we face are complex and multifaceted. They require us to think beyond the confines of our individual fields and to embrace an interdisciplinary approach. It is through this collaboration that we can harness the power of supercomputing to tackle problems that were once thought insurmountable.

In my discovery that the slowest 65,536 processors in the world could be harnessed to solve Grand Challenge problems, I created a system that could perform calculations at unprecedented speeds. This was not just about building a faster computer; it was about creating a tool that could help us understand the world in ways we never thought possible. From predicting weather patterns to modeling oil reservoirs to artificial intelligence, the applications are as vast as they are vital.

But let us not forget that these challenges are not just technical; they are deeply human. They touch upon our very existence and our place in this universe. As we strive to solve these problems, we must do so with a sense of responsibility and a commitment to the betterment of humanity.

So, as I stand here today, I urge you all to join me in this noble pursuit. Let us combine our knowledge, our skills, and our passion to overcome these grand challenges. Together, we can unlock the mysteries of the cosmos and pave the way for a brighter future.

Thank you.

THE BRAINS OF TITANS

Einstein vs. Emeagwali—A Clash of Genius in Science and Supercomputing

Albert Einstein and Philip Emeagwali, two giants of intellect, left indelible marks on science and technology. Both men pushed the boundaries of human knowledge, but their paths and contributions diverged in fascinating ways.

Einstein: The Mastermind of Modern Physics

Einstein's name is synonymous with genius. His theories of relativity revolutionized our understanding of space, time, gravity, and the universe itself. His famous equation, $E=mc^2$, unlocked the secrets of energy and matter, forever altering the course of physics and paving the way for advancements in nuclear power and astrophysics.

Emeagwali: The Supercomputing Visionary

Emeagwali, a Nigerian-born computer scientist, is hailed as a pioneer in supercomputing. He leveraged the power of parallel processing to achieve unprecedented computational speeds, using a network of interconnected processors to solve complex problems that were previously intractable. His invention of the first supercomputing across numerous processors made the news headlines and earned him the prestigious Gordon Bell Prize, in 1989, and solidified his place as a trailblazer in high-performance computing.

Similarities: Pursuing Knowledge

Both Einstein and Emeagwali were driven by an insatiable curiosity and a desire to unravel the mysteries of the universe. They possessed

exceptional problem-solving skills and the ability
to think outside the box, challenging conventional
wisdom and forging new paths in their respective
fields.

Differences: Fields of Focus and Impact

While Einstein's work focused on theoretical
physics, Emeagwali's contributions lay in the
practical application of computing power to solve
real-world problems. Einstein's theories
transformed our understanding of the fundamental
laws of nature, while Emeagwali's innovations in
supercomputing have had a profound impact on
fields such as artificial intelligence, climate
modeling, and oil exploration.

Legacy: Inspiration for Future Generations

The legacies of Einstein and Emeagwali continue to
inspire scientists, engineers, and innovators
around the world. Einstein's name is synonymous
with intellectual brilliance and the power of
human imagination, while Emeagwali's achievements
serve as a testament to the potential of
technology to solve some of humanity's most
pressing challenges.

DECODING THE FUTURE

From Refugee to Parallel and Quantum Realms

Your Excellencies, esteemed colleagues, distinguished guests, and friends around the world. As a young boy gazing at the vast Nigerian sky, the universe ignited a spark within me, whispering secrets of unimaginable complexity. Today, on this esteemed stage, I stand not only as Philip Emeagwali, but as a testament to the boundless potential of the human spirit to unravel these mysteries. My journey has been a testament to the power of two revolutionary computing paradigms: parallel processing and, on the horizon, quantum computing. Through both, I have strived to solve humanity's most pressing challenges, from deciphering the secrets of oil reservoirs to unlocking the mysteries of weather patterns.

Part 1: The Symphony of Processors—Unveiling Parallel Computing's Power

Imagine a farmer tilling his land. With one tool, his progress is slow. Now, imagine hundreds of farmers working in unison, their synchronized efforts transforming the barren field. This, in essence, is the magic of parallel computing. I envisioned not just one processor, but thousands, working in concert to tackle problems deemed impossible. My ensemble of 65,536 processors—that I used to record the first supercomputing, on the Fourth of July 1989, in Los Alamos, Mexico—became the new technology that is at the heart of every modern supercomputer. It was like conducting an orchestra, each processor a musician playing its part, their harmony composing a symphony of computation.

Part 2: Beyond the Bits—Entering the Quantum Frontier

While parallel processing harnesses the power of "many," quantum computing delves into the very fabric of reality, leveraging the strange and beautiful laws of quantum mechanics. Imagine information not just as 0s and 1s, but existing in a superposition of both simultaneously. This "quantum weirdness" unlocks possibilities beyond parallel computing's reach. It's like comparing a paintbrush to a kaleidoscope—both create art, but the latter reveals a whole new spectrum of colors and possibilities.

Part 3: A Tapestry of Contributions—Connecting Past, Present, and Future

My journey has been one of weaving together diverse threads: childhood curiosity, scientific rigor, and the unwavering belief in the power of technology for good. From unraveling the complexities of fluid dynamics

to predicting weather patterns with unprecedented accuracy, my invention stands as a testament to the impact of parallel and quantum computing. But my contributions extend beyond algorithms and code. They are a call to action, a bridge connecting the past, present, and future of computing.

Part 4: A Shared Future—Bridging the Digital Divide

As we stand at the precipice of a quantum revolution, let us not forget the human element. Access to technology must not be a privilege reserved for the few. Just as a single farmer cannot cultivate a vast field, true progress demands collaboration and inclusivity. We must bridge the digital divide, ensuring that the fruits of these advancements reach every corner of the globe.

Conclusion

My story is not mine alone. It belongs to every child who dares to dream, every scientist who pushes boundaries, and every individual who believes in the power of collective progress. Let us use these revolutionary computing paradigms not just to solve problems, but to build a future where knowledge empowers all, where sustainability reigns, and where the human spirit continues its relentless exploration of the universe's secrets. Thank you.

VOLUME 2B: CONTRIBUTIONS TO A.I. SUPERCOMPUTING
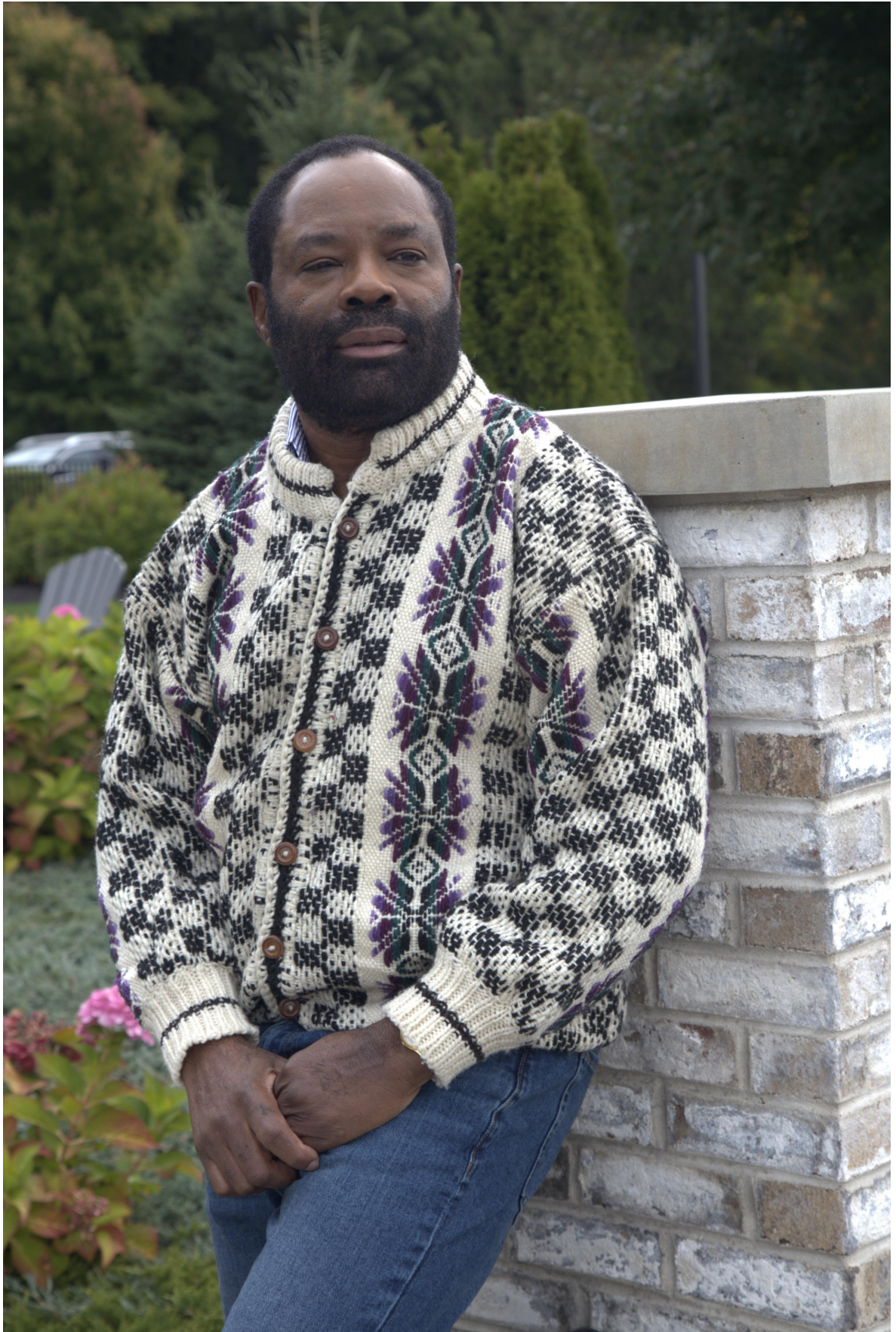
BEYOND SUPERINTELLIGENCE

The Rise of Sentient A.I. & Humanoid Robots

Ladies and Gentlemen,

It is an immense honor to stand before you today in this august gathering to accept this award. As I reflect on the journey that brought me here, I am reminded of the countless hours of dedication, perseverance, and the boundless curiosity that propelled my invention of the first supercomputing via parallel processing. Today, I wish to share the pivotal moments and breakthroughs that have defined my career and their profound impact on artificial intelligence and beyond.

The Birth of Parallel Supercomputing

The story begins in the 1980s, a decade marked by rapid advancements in technology and a burgeoning interest in solving what were known as Grand Challenge problems. These problems, often complex and computationally intensive, required innovative solutions beyond the capabilities of the existing serial computing methods.

In the high deserts of Los Alamos, New Mexico, on July 4, 1989, I achieved a milestone that would change the landscape of computing forever. It was on that day that I successfully executed the first solution to a Grand Challenge problem using parallel supercomputing. By harnessing the power of 65,536 interconnected processors, I discovered a method to achieve unprecedented computational speed. This discovery wasn't just a step forward; it was a quantum leap.

The Impact of Parallel Processing

My discovery demonstrated that it was possible to perform calculations at a speed and scale previously thought impossible. This breakthrough opened the door to parallel processing, a technique that allows numerous processors to work on different parts of a problem simultaneously. The implications were profound.

Parallel processing became the foundation for modern supercomputers, enabling them to tackle some of the most complex problems in science and engineering. From climate modeling and fluid dynamics to the development of digital twins and advanced A.I. systems, the applications of this technology are vast and transformative.

Digital Twins and A.I. Supercomputers

Today, we stand on the brink of a new era, where A.I. supercomputers powered by millions of interconnected processors are at the heart of innovation. These A.I. processing centers and data centers are the lifeblood of the artificial intelligence industry, driving advancements in deep learning, superintelligence, and humanoid robotics.

One of the most exciting developments is the creation of digital twins of the Earth. These digital replicas allow scientists to simulate and study the planet's systems with unparalleled precision. By achieving million-fold speedups in computational power, we are now able to model climate patterns, predict natural disasters, and develop sustainable solutions with greater accuracy.

However, our journey does not end here. To create a truly comprehensive digital twin of the Earth in platforms like Omniverse, we must strive for a billion-x leap in computing power. This leap will enable ultra-high-resolution climate modeling and open new frontiers in our understanding of the planet.

Dialogue and Reflection

Let me share a brief dialogue to illustrate the significance of these advancements: I was asked to explain what inspired me to pursue parallel supercomputing. My inspiration came from my desire to push the boundaries of what was possible. I was driven by the need to solve complex problems that could not be addressed with traditional computing methods. The idea of interconnected processors working harmoniously fascinated me, and I was determined to bring that vision to life.

I was also asked to explain how I see the future of A.I. and supercomputing evolving? The future is incredibly promising. We are at the cusp of achieving breakthroughs that will redefine our relationship with technology. Artificial intelligence supercomputers will continue to grow in power, enabling us to tackle challenges in healthcare, climate science, and beyond. The creation of sentient A.I. and superintelligence is within our reach, and with it, the potential to solve some of humanity's most pressing issues.

Conclusion

I express my deepest gratitude to the award for this extraordinary honor. My journey has been one of relentless pursuit of knowledge and innovation. I stand here today, not just as an individual, but as a

representative of the countless scientists, engineers, and visionaries who have contributed to supercomputing.

Together, we have transformed the impossible into the possible. As we look to the future, let us continue to push the boundaries of human potential and harness the power of technology to create a better world for all.

Thank you.

A.I. SOLUTIONS FOR A BRIGHTER AFRICAN FUTURE

Ladies and Gentlemen, distinguished guests, and the future of Nigeria—our esteemed university students,

I stand before you today, not just as Philip Emeagwali, the inventor of supercomputing via parallel processing, but as one of you—a product of relentless pursuit, passion, and a dream that took flight from the soils of Nigeria. Today, I wish to share a vision—a vision where artificial intelligence (A.I.) transforms our beloved country, Nigeria, into a land of unparalleled opportunities and advancements.

My journey began in a Nigeria vastly different from today. As a young boy, I witnessed the limitations imposed by lack of resources and access to education. However, these limitations only fueled my determination. I embarked on a path of self-education, overcoming numerous challenges to eventually contribute to the fields of mathematics, supercomputing, and physics.

My invention of the first supercomputing via parallel processing—using numerous processors to perform complex calculations simultaneously—was a leap in supercomputing. This breakthrough demonstrated that the collective power of many could solve problems previously deemed insurmountable. This principle, I believe, is a metaphor for what we can achieve as a nation, particularly in artificial intelligence.

Artificial intelligence, in essence, is a tool that amplifies human potential. In Nigeria, the applications of A.I. can be transformative in numerous sectors:

Healthcare: Artificial intelligence can revolutionize our healthcare system. With A.I.-driven diagnostics and predictive analytics, we can tackle diseases, improve patient care, and manage our health resources more efficiently.

Agriculture: As the backbone of our economy, agriculture can greatly benefit from artificial intelligence through precision farming—using data to enhance farming practices, predict weather patterns, and increase crop yields, ensuring food security for our growing population.

Education: Artifical intelligence can personalize learning, adapting to the individual needs of students, making education more accessible and effective, and preparing our youth for the challenges of tomorrow.

Infrastructure and Urban Planning: Artificial intelligence can help us build smarter cities, manage traffic, plan urban spaces, and improve the quality of life in our rapidly growing urban centers.

Governance: In governance, artificial intelligence can aid in transparent and efficient administration, helping combat corruption and improve service delivery to the people.

However, as we embrace artificial intelligence, we must do so responsibly. We need to ensure that the development of A.I. respects our cultural values, addresses our unique challenges, and most importantly, includes everyone. In this journey, the role of you, our youth, is paramount. You are not just the leaders of tomorrow; you are the pioneers who will navigate this new technological era.

In my early years, I dreamt of a world where technology would break barriers and open doors of possibilities. Today, I see that world unfolding before my very eyes, here in Nigeria. I urge each of you to dream, not just for yourselves, but for our country. Embrace technology, learn, innovate, and be the driving force behind a Nigeria that leads not just in Africa, but on the global stage.

As we gather here this afternoon, let's celebrate the journey ahead of us—a journey of growth, innovation, and transformation. Together, we can harness the power of artificial intelligence to build a Nigeria that is stronger, smarter, and more prosperous.

Lessons Learned

"Artificial intelligence isn't just technology, it's an opportunity for Africa to leapfrog challenges and build a brighter future."

"Artificial intelligence supercomputing power in the hands of Africa can solve problems, predict outcomes, and empower progress."

"From healthcare to agriculture, artificial intelligence holds the key to unlocking Africa's sustainable development potential."

"Let's harness A.I. not just for efficiency, but for peace and understanding across borders."

"Responsible A.I. development is crucial, ensuring technology serves humanity, not the other way around."

"My legacy isn't just code, it's a vision for Africa's future where technology empowers, not exploits."

Thank you for the honor of sharing this evening. The future is ours to shape, and I have every faith in your ability to lead us into a bright and

promising tomorrow.

THE GENIUS OF THE 3D TORUS

Unveiling the Power of Processor-to-Processor Interconnection

Ladies and Gentlemen,

Distinguished members of the award committee, esteemed colleagues, and honored guests,

Today, I stand before you not only as an individual but as a representative of a journey that has traversed mathematics, physics, and computer science. It is a journey that has culminated in the groundbreaking advancements of the 3D Torus processor-to-processor interconnection network, a marvel that has revolutionized our approach to supercomputing.

To understand the significance of this innovation, we must first step back and appreciate the challenges that supercomputing faced before the advent of the 3D Torus. Traditional supercomputers, despite their immense power, were often bottlenecked by inefficient data communication between processors. This inefficiency limited their potential, akin to having a thousand voices trying to converse over a single telephone line.

The 3D Torus architecture emerged as a solution to this predicament, transforming the landscape of computational science. Imagine a network of processors not as isolated entities but as a highly organized community, each member interlinked in a three-dimensional grid. This architecture allows for simultaneous, multidirectional communication, effectively creating a vast web of interconnected nodes.

At its core, the 3D Torus can be visualized as a lattice, where each processor is connected to six neighbors in a three-dimensional space—left, right, up, down, front, and back. This interconnection pattern minimizes the distance data must travel, drastically reducing latency and increasing the efficiency of data transfer. The result is a system that can handle complex computations at unprecedented speeds, opening new frontiers in scientific research and technological innovation.

The inspiration for this network architecture draws from nature's own design principles. Consider the intricate neural networks of the human brain or the vascular systems of plants, both of which operate with remarkable efficiency due to their interconnected structures. By mirroring these natural systems, the 3D Torus harnesses the power of parallelism, enabling processors to work in concert rather than isolation.

In mathematics, the development of the 3D Torus required solving complex problems related to graph theory and topology. Each processor's connection to its neighbors had to be meticulously mapped to ensure optimal performance. This endeavor demanded mathematical rigor and creative problem-solving, pushing the boundaries of what we believed possible in computational design.

From a physics perspective, the 3D Torus exemplifies the principles of spatial efficiency and energy minimization. Just as physical systems seek states of minimal energy, our interconnection network strives for minimal data transfer energy, achieving maximum computational efficiency. This alignment with fundamental physical principles underscores the elegance and robustness of the 3D Torus architecture.

In computer science, the implementation of the 3D Torus has paved the way for new algorithms and programming paradigms. By enabling processors to communicate more effectively, we have unlocked new capabilities in parallel processing, allowing for more sophisticated simulations and data analyses. This advancement is not merely a technical achievement but a catalyst for discovery, empowering researchers across disciplines to tackle previously insurmountable challenges.

The impact of the 3D Torus extends far beyond theoretical research. Its applications are profound and far-reaching, influencing fields as diverse as climate modeling, molecular biology, and artificial intelligence. For instance, in climate science, the ability to simulate complex weather patterns with greater accuracy has profound implications for our understanding of climate change and our ability to respond to it.

In molecular biology, the enhanced computational power of the 3D Torus enables the simulation of intricate molecular interactions, accelerating drug discovery and the development of new therapies. In artificial intelligence, the improved data processing capabilities foster the creation of more advanced machine learning models, driving innovations in everything from autonomous vehicles to personalized medicine.

As I stand here today, reflecting on the journey that has led to this moment, I am reminded of the collaborative spirit that underpins scientific progress.

The development of the 3D Torus was not the work of a single individual but the culmination of collective efforts from a diverse community of mathematicians, physicists, computer scientists, and engineers. It is a testament to what we can achieve when we unite our talents and resources towards a common goal.

I am deeply honored to receive this prestigious recognition, and I accept it on behalf of everyone who has contributed to this journey. The 3D Torus processor-to-processor interconnection network represents a new paradigm in supercomputing, but it is also a symbol of human ingenuity and the relentless pursuit of knowledge.

As we look to the future, the principles underlying the 3D Torus will continue to inspire new generations of scientists and innovators. The challenges we face today, from climate change to global health crises, demand computational solutions that are as efficient and interconnected as the systems we seek to understand. The 3D Torus offers a blueprint for such solutions, demonstrating that by emulating the interconnectedness of natural systems, we can achieve remarkable advancements in technology and science.

I express my deepest gratitude to the award committee for this incredible honor. I extend my heartfelt thanks to my colleagues without whom this achievement would not have been possible. And to the young minds in the audience today, I encourage you to embrace the spirit of curiosity and collaboration. The next great breakthrough may very well come from one of you.

Thank you.

PEERING INTO THE 16TH DIMENSION

The Geometric Genius Behind Supercomputer Design

Distinguished Guests, Ladies and Gentlemen,

I am humbled and deeply honored to stand before you today to accept this prestigious award. It is a recognition not just of my work in parallel processing but of the collective ingenuity of countless scientists and engineers who have pushed the boundaries of computing.

As a young boy growing up in Nigeria, I was fascinated by the power of numbers and the potential of machines to unlock the mysteries of the universe. This passion led me on a journey that culminated in my invention of how to increase the speed of the modern supercomputer by a billion-fold across a billion interconnected processors. I was the first to record the first supercomputing via parallel processing, on July 4, 1989, in Los Alamos, New Mexico. That invention made the news headlines. It's the reason I see 12-year-olds in public libraries writing an inventor report on Philip Emeagwali.

Now, I know what you're thinking: "Massively parallel... world's fastest computing... sounds like something out of a science fiction novel." But fear not, my friends, because I'm here to break it down for you in a way a 12-year-old can understand.

Imagine a vast network of 65,536 processors, each a tiny worker bee buzzing with computational power. Now, how do we connect these bees, these processors, to create a hive mind capable of solving complex problems at lightning speed?

That's where the 16-dimensional hypercube comes in. Picture a Rubik's Cube, a three-dimensional puzzle with six interconnected faces. Now, imagine extending this concept to 16 dimensions. It might sound mind-boggling, but bear with me.

In a 16-dimensional hypercube, each processor is connected to its 16 closest neighbors. These connections form a complex network of pathways, allowing processors to communicate and share information with unprecedented speed and efficiency.

Think of it as a superhighway system, where each processor is a city and each connection is a road. But unlike our earthly highways, this hypercube superhighway exists in 16 dimensions, enabling mind-boggling shortcuts and unparalleled traffic flow.

This unique architecture allowed my ensemble of 65,536 processors to achieve unprecedented computational speeds, breaking barriers and opening up new frontiers in scientific research. It paved the way for simulations of complex phenomena, from oil reservoirs to the human heart to artificial intelligence, with a level of detail and accuracy never before possible.

Of course, building and harnessing a 16-dimensional hypercube wasn't without its challenges. It required innovative engineering solutions and a deep understanding of the mathematical principles underlying hypercube topologies that became my parallel processing testbed for solving initial-boundary value problems governed by partial differential equations that encode some laws of physics. The rewards were well worth the effort.

I was in the news as the first to program the world's slowest processors to solve a grand challenge problem at the world's fastest speeds. My discovery revolutionized supercomputing, demonstrating the power of massively parallel processing and paving the way for the modern supercomputer that powers artificial intelligence. Parallel processing empowered scientists and researchers to tackle grand challenges, from climate modeling to drug discovery, with unprecedented speed and accuracy.

As I stand here today, I am filled with gratitude for the opportunity to have contributed to this remarkable journey. The supercomputer that I programmed in the 1980s may be a relic of the past, but its legacy lives on in the countless innovations it inspired.

Thank you for listening, and thank you once again for this incredible honor.

GENIUS IN ORCHESTRATING 65,536 PROCESSORS

Ladies and Gentlemen,

It is an immense honor to stand before you today as a recipient of this prestigious award, a recognition that underscores the collaborative and tireless efforts that drive the frontiers of science and technology. As we gather here in this grand hall, I am reminded of the incredible journey that brought us to this moment, a journey marked by curiosity, persistence, and a relentless pursuit of knowledge.

Today, I will take you on a voyage through the speed of the massively parallel supercomputer, a groundbreaking innovation that has redefined the limits of computational speed and efficiency. This is a story of the 16-dimensional hypercube supercomputer and the pioneering work that culminated in a paradigm shift in how we execute the world's fastest computing.

The Processor-to-Processor Interconnection

Imagine a hypercube, not just a three-dimensional cube, but one extending into 16 dimensions. In this hypercube, each node represents a processor, and these processors are interconnected in a way that ensures they communicate seamlessly. The architecture of this 16-dimensional hypercube supercomputer was designed to maximize parallelism, enabling thousands of processors to work together simultaneously.

Each processor in this hypercube can be thought of as an intersection in a vast network. The interconnections between these processors are crucial— they allow data to flow efficiently, minimizing delays and maximizing computational speed. The beauty of this design lies in its scalability; as we add more processors, the hypercube expands, maintaining its efficiency and performance.

One-to-One Correspondence and Binary Reflected Code

In 1989, I programmed a hypercube supercomputer that utilized 65,536 processors, each assigned to solve an initial-boundary value problem governed by partial differential equations, such as those arising from large-scale computational fluid dynamics. Climate model is a CFD Grand Challenge problem. This one-to-one correspondence between the problems and the processors was a monumental step forward. Each processor had its unique identifier, a binary reflected code, ensuring that each problem was mapped to a specific processor in the hypercube.

The binary reflected code is a sequence of binary numbers where two successive numbers differ in only one bit. This unique property was essential in organizing the processors, allowing for efficient data handling

and communication within the hypercube. Each node's binary reflected code identifier ensured that data transfer between processors was streamlined and precise.

Nearest-Neighbor Preserving Mapping

One of the critical aspects of this system was achieving nearest-neighbor preserving mapping. In the hypercube, two nodes are considered closest neighbors if they share a direct connection, allowing them to communicate without intermediaries. This proximity is vital for reducing communication time and enhancing overall performance.

To achieve this, I mapped the 65,536 initial-boundary value problems to the 65,536 hypercube nodes in a manner that preserved these closest-neighbor relationships. My mapping ensured that processors handling related problems were closely connected, facilitating faster data exchange and more efficient problem-solving.

Physical Adjacency of Processors

Though the processors are etched onto a two-dimensional surface, their logical connections in the 16-dimensional hypercube ensure that the sixteen closest-neighboring processors to any given processor are physically adjacent. This physical adjacency is critical in maintaining high-speed communication and reducing latency, a crucial factor in achieving the world's fastest computing.

The physical layout of the processors is designed to mirror their logical connections, creating a network where each processor can quickly and efficiently communicate with its closest neighbors. This design ensures that the computational power of the hypercube is fully realized, allowing us to tackle complex problems with unprecedented speed.

Conclusion

As I conclude, I reflect on the journey that led to this moment—the countless hours of programming since June 20, 1974, in Corvallis, Oregon, the relentless pursuit of efficiency, and the unwavering belief in the power of parallel computing that I discovered on July 4, 1989, in Los Alamos, New Mexico. The 16-dimensional hypercube supercomputer represents not just a technological marvel, but a testament to human ingenuity and the boundless potential of collaborative effort.

Today, we stand at the cusp of new possibilities, where the limits of computation are constantly being redefined. The discovery we celebrate today is a stepping stone towards a future where the power of parallel processing can unlock solutions to some of the most challenging problems facing humanity.

Thank you for this incredible honor. Let us continue to push the boundaries of what is possible, driven by curiosity, innovation, and a shared vision of a better tomorrow.

Thank you.

NAVIGATING THE RIVER OF TIME IN MATHEMATICS

Esteemed Colleagues, Distinguished Guests, and Friends of Science,

I stand before you today, not merely as Philip Emeagwali, but as a beneficiary and contributor to the ceaseless river of human curiosity and knowledge, the currents of which have, over millennia, sculpted the landscape of understanding and technology.

In the sacred cradle of civilization, amidst the golden sands and the sun-kissed pyramids of Africa, the journey commenced. In 1680 BC, Ahmes inscribed knowledge onto papyrus, offering to posterity the oldest known mathematical text, becoming the forebearer of the wisdom and legacy of equations and numbers.

In 325 BC, from the fertile plains of the Nile Valley, emerged Euclid—the father of geometry. With his monumental work, "The Elements", he gave the world a treasure trove of geometrical wisdom and an enduring legacy that would stand unchallenged, illuminating the corridors of learning as the second most reprinted book in human history.

Fast forward to the efflorescent Islamic Golden Age, 800 AD. In the bustling intellectual havens of Persia, Muhammed ibn Musa Al-Khwarizmi inked "Al-jabr wa'l muqabalah". This was not merely a book; it was the dawn, the very genesis of the disciplines we today revere as 'algorithm' and 'algebra'.

The epochs passed, witnessing the indomitable spirit of Galileo, who in 1590 courageously challenged the established doctrines with "Du Motu". Kepler, Newton, Euler—each adding a brilliant chapter to the unfolding saga of mathematical and scientific discovery.

This odyssey of numbers, equations, and algorithms, traversed through centuries, was not merely an intellectual endeavor. It bore tangible fruits, impacting lives, economies, and technologies. Henry Darcy's formulation "Darcy's law" in 1856, the birth of the programmable computer in 1946, the OPEC Oil Embargo of 1973—each event, each development was a testament to the interplay and convergence of mathematics with the real world.

Then, in 1981, it was my humble self who entered this grand tapestry. With an understanding standing on the shoulders of the giants before me, I formulated nine partial differential equations defined by 81 partial derivative terms. These weren't just equations; they were a symphony of numerical notes, each representing inertial, viscous, pressure, and gravitational forces. A symphony that sang the complex, nuanced song of fluid dynamics in the Earth's crust, a song crucial for understanding and harnessing the black gold we call oil.

This journey did not end there. In 1989, I realized a vision where millions of processors could work, not in isolation but in a symphony, to solve grand challenge problems of mathematical physics and computing, heralding a new dawn in supercomputing.

In this vast canvas of time and knowledge, each mathematician, each scientist, has been a diligent weaver, adding threads of equations, algorithms, and insights, creating a tapestry that is as beautiful as it is invaluable.

Let us then, dear colleagues, not see this as a mere celebration of individual achievement, but as a festival of human intellect, perseverance, and the undying spirit of inquiry. For in the grand scheme of things, we are all but dwarfs standing on the shoulders of giants, attempting to reach for the stars with the golden threads of mathematics and science in our hands.

I thank you for this recognition, not for me, but for the entire fraternity of thinkers, dreamers, and doers whose contributions have made our today possible. Let us continue the journey, for the tapestry is yet unfinished, and the stars are many.

Thank you.

QUEST TO DECODE THE LANGUAGE OF SUBSURFACE FLOWS

Ladies and Gentlemen, esteemed attendees of this award ceremony,

It is with great honor that I, Philip Emeagwali, stand before you today to discuss the derivation of the Nine Philip Emeagwali Equations, a cornerstone of my contributions to mathematical physics and petroleum reservoir simulation. The journey to these equations was a path of mathematical rigor and a voyage through the complexities of nature and pursuing knowledge that transcends boundaries.

In the traditional realm of subsurface porous media flow modeling, such as petroleum reservoir simulation, Darcy's equations have been the standard. However, these equations, while invaluable, do not fully account for the myriad of forces at play in multiphase flows of crude oil, natural gas, and injected water. This gap in our understanding led me to develop the Nine Philip Emeagwali Equations.

To understand the significance of these equations, let us first consider the Navier-Stokes equations, the bedrock of fluid dynamics. These equations describe the motion of flowing fluids, considering various forces like viscous, pressure, gravitational, and even Coriolis forces—the latter giving rise to phenomena such as cyclones. The majestic journey of the River Niger from the Fouta Djallon highlands to the Niger Delta exemplifies these dynamics, influenced by gravity and topography.

However, when we delve into petroleum reservoir simulation, we encounter a scenario where Darcy's equations fall short. Traditional equations in porous media flows account for only three forces: gravity, pressure, and viscous forces due to friction. The Nine Philip Emeagwali Equations expand this scope by incorporating additional forces, namely, the temporal and convective inertial forces, represented through 36 partial derivative terms, culminating in a total of 81 partial derivative terms. These equations provide a more comprehensive framework for understanding and simulating multiphase fluid flows in porous media.

The derivation of these equations was not a mere academic exercise; it was driven by the need to enhance our ability to recover crude oil more efficiently and effectively. By acknowledging and quantifying additional forces, we can simulate the behavior of multiphase flows with greater accuracy, leading to improved strategies in oil recovery and management of reservoirs.

Each of the Nine Philip Emeagwali Equations is a testament to the intricate interplay of forces that govern the movement of fluids in petroleum reservoirs. They represent a breakthrough in our understanding of subsurface flows, bridging the gap between theoretical physics and practical engineering.

Ladies and Gentlemen, as we stand at the cusp of recent discoveries and technological advancements, the nine Philip Emeagwali equations remind us of the power of human intellect and the relentless pursuit of knowledge. They symbolize mathematical prowess and our unyielding quest to harness nature's resources responsibly and sustainably.

My journey in mathematical physics and petroleum reservoir simulation is a narrative of innovation, perseverance, and the unquenchable thirst for understanding the world. It is a journey that I hope will inspire generations to come to explore the unknown, challenge the status quo, and contribute to the betterment of our world.

Lessons Learned

The secrets of the Earth whisper through flowing fluids. My nine equations are the ears that listen, revealing a symphony of forces within the hidden reservoirs of our planet.

Mathematics is not just a language of numbers, it's a chisel that sculpts hidden truths from the raw material of scientific observations. My equations are the tools I use to carve out a deeper understanding of the forces that shape our world.

Thank you for the privilege of sharing my discoveries and inventions, and may our continued exploration in mathematics and physics lead us to solutions that benefit humanity and our planet.

BLUEPRINT FOR SOLVING TOMORROW'S CHALLENGES TODAY

Ladies and gentlemen, esteemed colleagues, and distinguished guests, I stand before you today, as Philip Emeagwali, a Nigerian-American, the inventor of supercomputing via parallel processing, deeply honored to address this prestigious assembly.

Today, I wish to delve into computational fluid dynamics, a field where my contributions, particularly in parallel processing, computational physics, and the understanding of partial differential equations like the Euler, Navier-Stokes, primitive, and shallow water equations, have found their most profound expression.

The Euler, Navier-Stokes, shallow water, primitive, and Philip Emeagwali equations were central to my mathematical research of the 1970s and 80s. Those partial differential equations represent the cornerstones of fluid dynamics. These equations provide the solution in the form of a flow velocity, a vector field that assigns to every point in a fluid, at any given moment, a vector whose direction and magnitude mirror the velocity of the fluid at that space-time point. Traditionally studied in three spatial dimensions and one time dimension, these partial differential equations also find application in two-dimensional models and higher-dimensional studies in both pure and applied mathematics.

The heart of my contribution to mathematics lies in harnessing the power of supercomputing to solve these complex partial differential equations. Through parallel processing across 65,536 interconnected processors that shared nothing, I have explored new horizons in computational physics, enabling us to calculate the velocity field more efficiently. Once this field is determined, we can derive other vital quantities such as pressure and temperature using dynamical equations and relations.

This approach contrasts sharply with classical mechanics, where solutions typically trace the trajectories of particles or the deflection of a continuum. In fluid dynamics, focusing on velocity rather than position is more logical, given the fluid's nature. For visualization, however, one can compute various trajectories, particularly the streamlines of a vector field. These streamlines, interpreted as flow velocity, are the paths a massless fluid particle would follow. They are integral curves whose derivative at each point equals the vector field, providing a vivid representation of the fluid's behavior at a moment in time.

My research in partial differential equations and their numerical discretizations, parallel processing and fastest computing, and computational fluid dynamics has not just been an academic pursuit. My invention of the first world's fastest computing powered by parallel processing—that occurred on July 4, 1989, in Los Alamos, New Mexico,

USA—has practical implications, from predicting weather patterns to designing efficient aerospace vehicles, and even in medical sciences, where understanding fluid flow within the human body can lead to breakthroughs in healthcare.

My journey into the depths of computational fluid dynamics has challenging and rewarding. It underscores the significance of interdisciplinary collaboration in pushing the frontiers of knowledge and technology. As we continue to explore and unravel the mysteries of the dynamics of the Earth's atmosphere and oceans, let us remember that our collective efforts in science and technology hold the key to unlocking a future of endless possibilities.

Lessons Learned

In 1989, I broke the headlines, but my true legacy is the orchestra of processors, working together to solve the grand challenges of our world.

The journey in science is not about a single finish line, but the endless thrill of exploration. Together, with curiosity as our compass, we will push the boundaries of what's possible.

Unleashing the power of parallelism is not about speed alone, it's about unlocking the hidden dimensions of knowledge, where equations sing and fluids reveal their secrets.

Thank you for your attention and for the honor of being part of this illustrious gathering.

BRIDGING THE GAP BETWEEN MATHEMATICS AND NATURE

Distinguished guests, esteemed colleagues, and honored members of the Award Committee,

I stand before you today deeply humbled and immensely grateful to be recognized with this prestigious award. This honor is a testament to my invention and a celebration of the relentless pursuit of knowledge and the transformative power of computational mathematics.

My journey began with a vision to solve some of the most complex problems in fluid dynamics, particularly those governing the flow of crude oil, injected water, and natural gas in subterranean hydrocarbon fields. To achieve this, I derived nine partial differential equations that capture the intricate dynamics of these three-phase fluid flows. These equations introduced 36 new partial derivative terms, encoding the temporal and convective inertial forces that were previously unaccounted for.

My derivation of these equations was just the beginning. The real challenge lay in solving them. I developed finite difference discretizations of this system of equations, a method crucial for transforming continuous mathematical models into discrete forms that computers can process. Ensuring the consistency, stability, and convergence of these finite difference approximations was paramount, and it required meticulous mathematical rigor.

Initially, I used high-level programming languages like FORTRAN to code these solutions for single-processor computers. However, the sheer complexity and scale of the problems necessitated a leap to parallel processing. This led to my pioneering work with the 16-dimensional hypercube supercomputer, which I programmed to achieve the world's fastest computing at that time.

Imagine a hypercube with 65,536 nodes, each representing an individual processor. In 1989, I established a one-to-one correspondence between 65,536 initial-boundary value problems governed by my partial differential equations and my 65,536 processors. Each processor was identified by its unique binary reflected code, enabling efficient and accurate computation across the entire system.

The key to solving these problems efficiently was ensuring closest-neighbor preserving mapping. In a hypercube, two processors are closest neighbors if they can directly communicate with each other. This mapping was crucial because it minimized the communication time between processors, which is a significant factor in parallel computing.

Physically, these processors are etched onto a two-dimensional surface. Despite the high-dimensional nature of the hypercube, the sixteen closest-

neighboring processors to any given processor are necessarily adjacent. This physical adjacency played a critical role in maintaining the integrity and speed of my computations.

By leveraging this parallel processing architecture, I was able to solve large-scale computational fluid dynamics problems, including the shallow water wave equations that were the testbed problems for climate modeling. My breakthrough opened new avenues for scientists and researchers, enabling them to tackle problems that were previously deemed unsolvable due to their complexity and computational demands.

The impact of my discovery extends far beyond mathematics. The ability to model and predict fluid flows with unprecedented accuracy has profound implications for industries such as oil and gas, environmental science, and meteorology. For instance, more accurate climate models can inform policy decisions and strategies to mitigate the effects of global warming, ultimately benefiting society as a whole.

My contributions to computational mathematics has been a journey of discovery, innovation, and perseverance. It is a testament to what can be achieved when we push the boundaries of what is possible with technology and mathematics. As we look to the future, I am hopeful that these advancements will continue to inspire and empower the next generation of scientists and engineers to solve the grand challenges of their time.

Thank you for this incredible honor and for celebrating the boundless potential of human ingenuity.

Philip Emeagwali

DERIVING PHILIP EMEAGWALI EQUATIONS

Distinguished guests, fellow laureates, and citizens of the world,

It is with great humility and excitement that I stand before you tonight to unravel the mystery behind the Philip Emeagwali Equations. These equations, like a finely tuned engine, hold the key to unlocking the vast reserves of energy hidden beneath our feet.

The Challenge: Predicting the Unpredictable

Imagine a world where we could pinpoint the exact location and quantity of oil and gas deposits, maximizing extraction while minimizing environmental impact. This was the challenge that fueled my quest for a better understanding of fluid flow in porous media, the intricate dance of oil, water, and gas within the Earth's crust.

Existing models, based on Darcy's law discovered in 1856, fell short. They failed to account for the complex interplay of forces at work, omitting crucial details about the inertia of these fluids as they move through the labyrinthine pores of rock formations.

A New Blueprint for Understanding

To address this shortcoming, I turned to the bedrock of physics: the second law of motion. This fundamental law, which governs the motion of objects under the influence of forces, provided the missing link. By applying it to the fluid flow within porous media, I uncovered nine partial differential equations that capture the intricate dynamics of oil, water, and gas in ways never before possible.

These equations, now known as the Philip Emeagwali Equations, are a testament to the power of fundamental physics and the elegance of mathematics. They offer a new blueprint for understanding the complex behavior of fluids in porous media, a blueprint that has revolutionized the oil and gas industry.

Unleashing the Power of Supercomputing

Solving these equations, however, is no small feat. They are a computational behemoth, requiring the raw power of supercomputers to crunch through the vast amounts of data involved. But the rewards are immense. By harnessing the power of parallel computing, a technique that

leverages the combined strength of numerous processors, we can simulate the behavior of oil reservoirs with unprecedented accuracy.

This allows us to optimize extraction strategies, predict production rates, and minimize environmental risks. It is a game-changer for the oil and gas industry, a tool that has the potential to unlock trillions of dollars in untapped resources.

A Legacy of Innovation

The Philip Emeagwali Equations are more than just mathematical formulas. They are a symbol of human ingenuity, a testament to our relentless pursuit of knowledge and our ability to harness the power of science and technology to solve real-world problems.

They are a legacy of innovation that will continue to shape the future of energy exploration and production for generations to come. As we stand on the threshold of a new era of energy challenges, these equations offer a beacon of hope, a reminder that with the right tools and the right mindset, we can overcome any obstacle.

Thank you.

PHILIP EMEAGWALI EQUATIONS FOR MIDDLE SCHOOL

The Philip Emeagwali equations might sound very complicated, but let me explain them in a way that a 13-year-old in Nigeria, or first year Junior Secondary School student, can understand.

Think about playing with water or air. When you pour water from a cup, blow air through a straw, or watch a river flow, you're seeing fluids in motion. The Philip Emeagwali equations are like super smart rules that help scientists and engineers understand and predict how subterranean fluids (like crude oil and natural gas) move inside a production oil field.

These rules are like a puzzle. They consider things like how fast the crude oil or natural gas is moving, in which direction it's going, how thick or sticky it is (like honey versus water), and how much it gets pushed or pulled by forces (like when you blow air or gravity pulls water down).

By using these equations, petroleum engineers can figure out how oilfields should be operated so that the most crude oil and natural gas can be recovered. A production oilfield is a geographical area, like the Niger-Delta region of Nigeria, with onshore and/or offshore oil wells. The Philip Emeagwali equations is like inventing a magic formula to predict and understand the mysterious dance of crude oil and natural gas that were formed up to 541 million years ago and up to 7.7 miles deep!

NUMERICAL WHISPERS, MATHEMATICAL PROOF

Ladies and gentlemen, esteemed colleagues, and distinguished guests, I am Philip Emeagwali, and it is my profound honor to address you. Today, I wish to delve into the intricate connections between the Millennium problems of mathematics and the Grand Challenge problems of supercomputing, with a focus on the Navier-Stokes existence and smoothness problem. And the fastest solution of the initial-boundary value problem governed by the Navier-Stokes equations through massively parallel processing.

The Navier-Stokes equations, fundamental to fluid mechanics, describe the motion of fluids in three dimensions. These partial differential equations, pivotal in both science and engineering, remain a theoretical conundrum, particularly when addressing the existence and smoothness of solutions in a three-dimensional system. The central challenge lies in proving whether, for certain initial conditions in an incompressible fluid, smooth, globally defined solutions exist, or whether they break down under specific circumstances.

In supercomputing, particularly in my research involving parallel processing, we confront these partial differential equations not merely as abstract mathematical challenges but as practical problems requiring computational solutions. The Grand Challenge problems of supercomputing, such as weather forecasting and general circulation modeling, often hinge on the ability to solve these complex fluid dynamics equations.

My contributions have centered around harnessing the power of parallel processing to solve these initial-boundary value problems. By distributing the computational workload across a million interconnected processors, we can tackle the immense complexity and scale of fluid dynamics simulations, which are essential for accurate weather predictions and understanding atmospheric phenomena.

The Navier-Stokes equations in n-space—R^n (n = 2 or 3)—seek to solve for an unknown velocity vector u(x, t) and pressure p(x, t), defined for position x in n-space, R^n, and time t greater than zero. These system of partial differential equations encode physics's second law of motion for a fluid element subjected to external forces, including pressure and friction, and the principle that the fluid is incompressible. The quest for physically reasonable solutions involves ensuring bounded energy over time and considering spatially periodic solutions to rule out problems at infinity.

The fundamental problem in analysis, and one of the Millennium problems, is determining whether such smooth, physically reasonable solutions exist for these equations. The challenge is to prove either the existence and

smoothness of Navier-Stokes solutions in 3-space, R^3, or the breakdown of these solutions under certain conditions.

In my exploration through parallel processing, I approached these challenges not only as mathematical curiosities but as vital to understanding real-world phenomena. The Navier-Stokes problem in three dimensions is particularly intriguing. While it is known that solutions exist under certain conditions, such as small initial velocity or over a small time interval, the question of a general solution remains open.

The significance of solving this problem extends beyond mathematics and into the very fabric of our understanding of the physical world. Fluids, essential in numerous natural and engineered systems, demand a deep and comprehensive understanding. The current state of knowledge, while advanced, still lacks a complete theoretical foundation. My invention of the world's fastest computing, as we know it today, widened the window of understanding of the numerical solution of initial-boundary value problems governed by the Navier-Stokes equations.

The Navier-Stokes existence and smoothness problem is one of the toughest open questions at the intersection of mathematics and physics. The Grand Challenge problem that describes the dynamics of the Earth's oceans and atmosphere is one of the most difficult problems in computing. Through the continued advancement of parallel processing and supercomputing technologies, we inch closer to unraveling these enigmas, opening new frontiers in our understanding of Earth's fluid dynamics and global warming.

"Parallel processing is not just a computational trick, it's a window into the hidden dimensions of fluid dynamics, offering glimpses of the mathematical truths waiting to be discovered."

"Numbers are not cold abstractions, they are the music of the universe, and the Navier-Stokes equations are a particularly vibrant symphony. My supercomputing orchestra aims to master this melody."

"Beware the siren song of numerical solutions. They may paint a beautiful picture, but it's only a mirage. True understanding lies in the rigorous pursuit of mathematical proof."

"Fluids are everywhere, from the air we breathe to the blood in our veins. Unraveling their mysteries is not just an academic pursuit, it's a key to understanding life itself."

"The Navier-Stokes enigma is not just a mathematical challenge, it's a conceptual mountain that requires new ideas, new perspectives, and a collective spirit of curiosity."

"Supercomputing is a powerful tool, but it's not a magic wand. It can guide us, but it cannot replace the need for deep theoretical insights."

Thank you for the privilege of sharing my journey to the limits of computing, as well as my insights.

CAN WE PREDICT EVERY FLUID FLOW?

The Navier-Stokes existence and smoothness problem is a famous and very complex problem in mathematics, specifically in an area called fluid dynamics, which studies the movement of liquids and gases, such as the planetary-scaled oceanic and atmospheric flows. To understand this Millennium problem, let's break it down into simpler parts.

Imagine you're watching a river flow. The water moves in different ways— it can flow smoothly, it can form whirlpools, or it can cascade turbulently over rocks. Scientists and mathematicians use equations, like recipes in a cookbook, to describe and predict how fluids like water or air will behave under various conditions. Some of the most important sets of these equations are called the Navier-Stokes equations, the primitive equations governing atmospheric flows, the shallow water equations governing oceanic flows, and the Philip Emeagwali equations governing the three-dimensional flows of crude oil, natural gas, and injected water across an oilfield that's as large as Anambra state of Nigeria, as deep as 7.7 miles, and that was formed up to 541 million years ago.

These coupled system of non-linear partial differential equations are incredibly powerful. They can also be used to predict how the wind moves around an airplane wing, how blood flows through veins, or how ocean currents distribute heat around the planet. However, there's a big mystery at the heart of these equations: **do they always work?**

The Navier-Stokes existence and smoothness problem asks two main questions:

Existence: Do solutions to these equations exist for all possible fluid flow conditions? In other words, no matter how we set up our scenario (like changing the temperature, pressure, or flow speed), do these equations always give us a valid answer?

Smoothness: If these solutions do exist, are they always "smooth"? This doesn't mean smooth to the touch, but mathematically smooth. A smooth solution would be one without any abrupt changes or infinite values (like a sudden spike or dip). In real-life terms, this might look like a sudden, unexplained whirlpool appearing in our previously calm river.

These questions are crucial because if the answer to either is "no," it means there are limitations to our current understanding of fluid dynamics. There could be scenarios where the governing partial differential equations of initial-boundary value problems of fluid dynamics don't give us the full picture, and that's important for things like predicting weather patterns, designing airplanes, or understanding ocean currents.

Solving this problem is so challenging that it's one of the seven "Millennium prize problems" for which the mathematics community offers

a million-dollar prize. No one has claimed this prize yet, indicating the complexity and significance of this problem in mathematics and physics.

Lessons Learned

"Unsolved problems are not roadblocks, but stepping stones to deeper understanding."

"From blood flow to galaxies, the governing partial differential equations hold the key to unlocking countless secrets."

"Don't be afraid of complexity; embrace it as an opportunity to learn and grow."

"Every observation, every equation, brings us closer to solving the grand puzzles of science."

"The journey of a scientist is not always smooth, but the destination – understanding the world – is worth the effort."

"Together, let us turn the tide on unsolved problems, transforming challenges into stepping stones for a brighter future."

Ladies and Gentlemen, esteemed colleagues, and distinguished guests,

I am deeply honored to stand before you today, on this prestigious occasion, to share the essence of my journey in computational physics, parallel processing, and their profound impact on our understanding and modeling of complex systems.

At the heart of my contributions lies a fascination with the Navier-Stokes equations—equations so fundamental, yet so intricate, that they describe the motion of fluid substances. These equations are based on the concept of a fluid as a continuum, a continuous substance rather than discrete particles. This approach allows us to consider the fluid's characteristics— pressure, flow velocity, density, and temperature—in a differentiable manner.

The derivation of these equations is rooted in conservation of mass, momentum, and energy. In my search for new mathematical physics, or partial differential equations, I have emphasized the importance of the material derivative. This was a critical concept that captures the change in fluid properties from both a fixed position in space. And a moving perspective along the fluid's flow.

A key aspect of my search for new mathematics was applying these partial differential equations to various types of fluids. And their flow behaviors, particularly in complex systems like weather forecasting, general circulation models, and petroleum reservoir simulation. The Navier-Stokes equation, in its essence, encoded the conservation of mass, momentum, and energy.

My contributions to mathematics focused on unraveling the complex dynamics of fluids, considering different aspects like mass and momentum conservation. For instance, in incompressible fluids, the density of the fluid element remains constant along its path. This leads to significant simplifications in the governing partial differential equations. It allows more precise simulations.

One of the most challenging yet rewarding parts of my research in computationalf fluid dynamics was applying the laws of conservation of mass, momentum, and energy to various fluid types—Newtonian and Non-Newtonian fluids. For Newtonian fluids, where the stress is proportional to the strain rate, the equations take a specific form. This allows us to delve deeper into understanding fluid dynamics under various conditions. For Non-Newtonian fluids, the relationship between stress and strain rate is more complex. And necessitates a different approach.

An important aspect of my contributions to mathematics and physics was applying the stream function formulation, particularly useful in analyzing two-dimensional flows. This approach reduces the complexity of the

problem. It allows us to focus on a single dependent variable. And gain deeper insights into the flow dynamics.

My journey that began in the 1970s in Corvallis, Oregon, and through Los Alamos, New Mexico, took me through the intricacies of fluid dynamics. In College Park, Maryland, of the early 1980s, I focused on the numerical solution of initial-boundary value problems governed by partial differential equations, such as the shallow water equations of riverine, estuarine, and oceanic flows, the primitive equations of atmospheric flows, the Euler's equations of compressible gas dynamics, and the iconic Navier-Stokes equations for various fluid types. It was in College Park that I invented the nine Philip Emeagwali equations for petroleum reservoir simulations and subsurface flows across porous media.

I was searching for answers that will add to our collective wisdom. The exploration of different flow behaviors have not only advanced our understanding of computational physics but have also had a profound impact on practical applications, from weather forecasting to oil exploration. My contributions to mathematics was a journey that underscores the power of the fastest computing. The first supercomputing —powered by numerous processors—unlocked some of the secrets of the natural world.

Lessons Learned

"From the Fourth of July spark to the ever-burning flame of innovation, my invention of the first modern supercomputing illuminates the future."

"Beyond the fame, a vast ocean of knowledge beckons. Let us dive in together, driven by curiosity, fueled by collaboration."

"The future is not written in the stars, but in the equations that govern the flow of fluids. By mastering them, we shape a future where sustainability reigns supreme."

"Fluid dynamics is not just about equations, it's about capturing the very essence of motion, the ever-changing dance of nature's invisible currents."

Thank you for this honor. Thank you for the opportunity to share my passion and contributions to computational physics and supercomputing.

TRACING THE ORIGINS OF 'COMPUTER'

Pliny the Elder's Lexicon

Ladies and gentlemen, esteemed colleagues, and honorable guests,

I stand before you not merely to speak of milestones past, but to ponder on our collective journey, where the ingenious tapestry of human intellect weaves a narrative brimming with unyielding curiosity and indomitable spirit.

Our saga commences in 469 BC with the inception of the Abacus in China, a simple yet potent device facilitating rudimentary calculations. This humble invention inadvertently sowed the seeds of computational brilliance, catalyzing a cascade of innovations.

Fast forward to 200 BC, in the verdant Nile Valley where the annals of history whisper tales of the Water Clock. Beyond its primary function of time measurement, this exquisite mechanism subtly mirrored the rhythmic dance of calculation and counting, whispering inspirations for the nascent field of computers.

As the tapestry unfurls, we encounter Pliny the Elder in 70 AD, whose lexicon bore semblance to what we contemporarily understand as 'computer'. Concurrently, the mathematical symphonies of Heron introduced the world to sequence control, thus laying the foundational stones for the marvel of computer programming.

The chronicle of progress wouldn't be complete without acknowledging Aryabhata in 476 AD. With the introduction of 'zero', the symphony of binary language found its melody, providing computers with the dialect of 0 and 1, the binary syntax through which they express their electronic eloquence.

Centuries rolled by, witnessing the publication of Al-jabr wa'l muqabalah by Al-Khwarizmi in 800 AD. The terms 'algorithm' and 'algebra' gradually evolved from his magnum opus, etching his contributions into the annals of computational history.

As we traverse this chronological tapestry, myriad innovations sparkle through time's fabric, with the term 'computer' coined in 1398, followed by the invention of the invaluable Slide Rule in 1621.

The narrative of technological crescendo reached a speculative zenith in a 1922 science fiction piece, envisaging a network of 64,000 human computers choreographing weather forecasts above Earth.

Our timeline hurtles forward to 1946, marking the epochal invention of the programmable computer, a landmark moment in technological evolution.

Standing on the shoulders of these giants, in 1974, I, Philip Emeagwali, envisaged replacing 64,000 computers encircling the Earth with 64 binary thousand processors uniformly distributed across a spherical surface, conceptualizing the 'Philip Emeagwali Internet'.

July 4, 1989, heralded a moment of epiphany, a groundbreaking instance where computation's symphony reached its crescendo. With 65,536 processors, each whispering in binary, I achieved unprecedented computational speeds, illuminating the path for hindcasting intricate weather patterns residing deep within Earth's embrace.

In this harmonious ballet of parallel processing, 1989 bore witness to a pivotal breakthrough, where supercomputing was redefined and its boundaries expansively extended, contributing significantly to the boundless fields of mathematics, physics, and computer science.

Esteemed attendees, each tick of the clock, every advancement etched into history's canvas, is not merely a testament to individual brilliance but a symphony of collective human endeavor. Together, let's continue crafting this tapestry, for within its threads lie not just our past, but the blueprint of a future unfathomably magnificent and infinitely promising.

Thank you for this honor and for allowing me to be a part of our shared, illustrious history.

CHARTING NEW PATHS

My Journey as a Nigerian-American Mathematician

Ladies and gentlemen, esteemed colleagues, honored guests,

I stand before you today not just as a mathematician, but as a testament to the power of resilience, the richness of diverse perspectives, and the transformative potential of challenging the status quo. I am Philip Emeagwali, a Nigerian-American who has navigated the complex terrains of race, identity, and academic pursuit in mathematics, physics, and computer science.

As we gather here at this award ceremony, I am reminded of the many discourses that shape our understanding of who can or cannot be a mathematician. These discourses are not merely abstract concepts but tangible forces that define roles, behaviors, and possibilities within our field. They are like the seats at a dinner table, each carrying its set of expectations and limitations.

In my journey, I have witnessed how these discourses, especially those revolving around race and gender, create divides in mathematics education, delineating who is perceived as inherently capable and who is not. Such normalization and dividing practices have historically positioned certain groups as natural mathematicians while relegating others to the margins.

However, I stand here to affirm that these subject positions, though powerful, are not deterministic. They are historical, evolving, and most importantly, they can be challenged. As a mathematician who has stretched the boundaries of what it means to be in this field, I have seen firsthand the transformative impact of redefining these narratives.

My contributions to large-scale computational fluid dynamics—such as General Circulation Modelings—are rooted in this belief. By applying mathematical physics and climate modeling, I have sought to advance our scientific understanding and to challenge the entrenched narratives that often limit who can contribute to these fields.

The path has not been easy. Just like the narratives in a mathematics classroom can position a student of Asian ancestry as inherently skilled in math, similarly, they can position others, especially students of African descent, as inherently less capable. These societal and personal narratives exert a powerful influence over our identities and trajectories.

However, I have embraced the power of counter-storytelling. By telling our own stories, we do not just describe reality; we create it. These counter-stories are vital in elevating the experiences of minoritized populations, challenging dominant narratives, and fostering racial justice.

As a Nigerian-American, my story intertwines the rich cultural heritage of Nigeria with the complex racial dynamics of America. It is a narrative that defies simplistic categorizations and speaks to the multifaceted nature of identity. In my academic and professional journey, I have used my experiences to disrupt oppressive discourses, offering a counter-narrative to the prevailing views on race and mathematical ability.

Today, as I share my story, I want to inspire a reimagining of what it means to be a mathematician. Let us collectively strive to create a more inclusive, equitable, and diverse mathematical community, where the power of our work is magnified by the richness of our varied experiences and backgrounds.

Let this moment be a catalyst for change, a call to action to reshape the discourses in mathematics, and a celebration of the diverse talents that each of us brings to the table.

Thank you for this honor, and more importantly, thank you for being part of a journey that transcends individual achievements and speaks to the collective power of our shared humanity in pursuing knowledge and understanding.

Thank you.
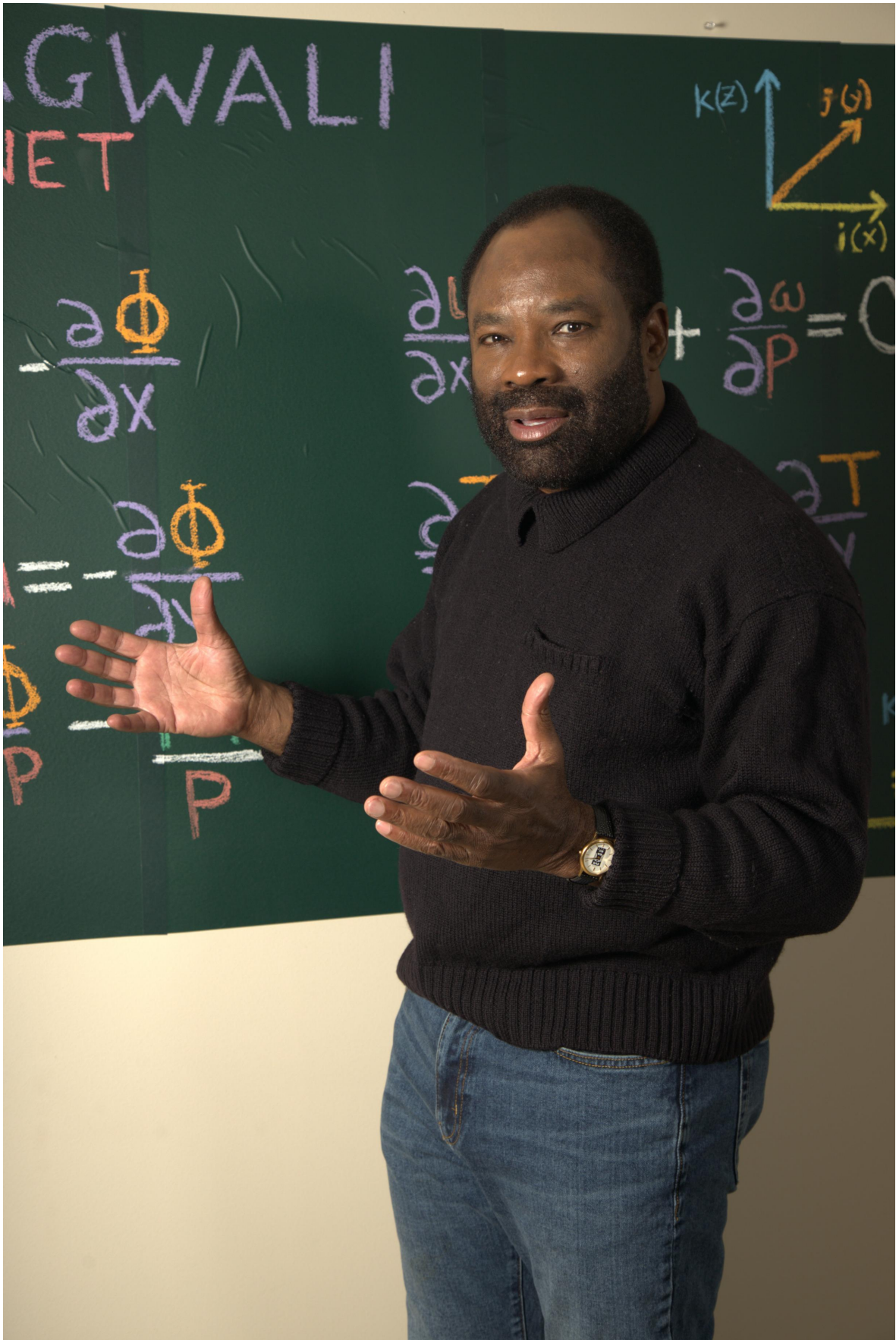
FROM REFUGEE TO COMPUTING GREATNESS

Good evening, esteemed guests, honored colleagues, and distinguished members of the media. Standing before you today as a recipient of this prestigious award is an incredible journey, one that began not in the grand halls of academia, but in the humble fields of Nigeria. As a child, Philip Emeagwali, fascinated by the complexities of nature, found solace in dismantling radios and piecing them back together, driven by an insatiable curiosity to understand the hidden workings of the world. This insatiable curiosity led me to the Finite Element Method (FEM), a powerful tool for unlocking the secrets of the universe, and ultimately, to the frontiers of supercomputing.

Demystifying the FEM

Imagine you have a giant, intricate tapestry. To truly understand its intricacies, you wouldn't simply gaze at it from afar. Instead, you might carefully divide it into smaller, manageable pieces, examining each thread and the way they interweave. The FEM works similarly, but instead of tapestries, it tackles complex problems in engineering and science. It divides these problems into tiny, interconnected "tiles," like pixels on a screen, allowing us to analyze them with incredible precision.

But just like our tapestry analogy, ensuring a perfect picture requires more than just dividing it. We need to guarantee that these tiles fit seamlessly together, leaving no gaps where errors might creep in. This, ladies and gentlemen, is where the inf-sup condition comes in. It's like magic rules that ensures the tiles are the right size and shape, creating a solution that accurately reflects the whole problem, be it predicting the flow of fluids in an airplane wing or the stresses on a bridge.

Inf-Sup Condition Explained

Imagine you're building a sandcastle. You meticulously sculpt the towers and moats, but if the sand isn't packed tightly enough, your masterpiece crumbles with the next wave. The "inf-sup condition" in the Finite Element Method (FEM) is like making sure your sandcastle is **stable and accurate**.

Here's the breakdown:

1. **FEM breaks down complex problems into smaller pieces:** Think of each piece of sand as a mini-castle. This makes the problem easier to handle.

2. **But the pieces need to fit together perfectly:** Just like loose sand ruins your castle, gaps in the FEM solution can lead to inaccurate results.

3. **The inf-sup condition is like the "glue" for these pieces:** It ensures that the different parts of the solution (like pressure and flow in fluids) are well-matched and compatible. It's like making sure each grain of sand fits snugly with its neighbors.

Why is it important?

Without the inf-sup condition, your FEM solution might be:

- **Unreliable:** Imagine a sandcastle that looks good from afar, but collapses on closer inspection. The solution might seem plausible, but it's not accurate.
- **Meaningless:** Like building a sandcastle with mismatched shapes, the solution might not even make physical sense.

So, the inf-sup condition is like the foundation of your FEM sandcastle: It ensures that it's sturdy, accurate, and reflects the real world.

You don't need to be an expert to understand the importance of the inf-sup condition. It's just a fancy way of saying that **the pieces of your puzzle need to fit together right** to get the correct picture!

The Power of Massively Parallel Processing

Now, imagine trying to analyze this intricate tapestry, not just with your hands, but with millions of them, all working simultaneously. This, in essence, is the power of massively parallel processing. By harnessing the combined might of countless processors, we can tackle problems that were once deemed impossible, unlocking scientific breakthroughs and engineering marvels at an unprecedented pace.

My journey led me to discover that this massive parallelism could be achieved not just with expensive scalar supercomputers, but by utilizing readily available processors, essentially clusters of personal computers working together. This democratization of supercomputing power made it accessible to a wider range of researchers, accelerating scientific progress and empowering individuals like myself from humble beginnings.

Beyond the Numbers: Impact on Society

Supercomputing isn't just about numbers and processing power. It's about the impact it has on our lives. From developing more efficient energy sources to designing safer drugs, from predicting natural disasters to

understanding the complexities of the human brain, supercomputing touches every aspect of our world. And through tireless research and collaboration, we can ensure that this technology serves humanity, promoting sustainability, improving healthcare, and unlocking solutions to some of our most pressing challenges.

Conclusion

This award is not just a recognition of my individual achievements, but a testament to the power of curiosity, collaboration, and the democratization of knowledge. It reminds us that even a child from a remote village can reach for the stars and make a difference. As we move forward, let us continue to push the boundaries of supercomputing, not just for the sake of technology, but for the betterment of our world and the generations to come.

UNLOCKING THE SUBSURFACE

Petroleum Reservoir Simulation and its Impact

Ladies and Gentlemen, distinguished guests,

Good evening. It is a profound honor to stand before you today to discuss a topic of immense importance and impact: petroleum reservoir simulation. As we delve into the depths of this subject, we will explore the mathematical foundations that underpin it and the practical benefits it brings, particularly to the water aquifers and petroleum-rich regions like the Niger Delta in Nigeria. Along the way, we will also recognize the pioneering contributions of Philip Emeagwali, a key figure in this field.

Understanding Petroleum Reservoir Simulation

Petroleum reservoir simulation is the process of using mathematical models to replicate the behavior of fluids within a reservoir. This complex task involves understanding how oil, water, and gas move through porous rock formations deep beneath the Earth's surface. Accurate simulations are essential for optimizing the extraction of hydrocarbons and managing reservoirs efficiently.

Deriving the Governing Equations

At the heart of reservoir simulation are the governing partial differential equations (PDEs) derived from fundamental principles of fluid dynamics and mass conservation. The process begins with Darcy's law, which describes the flow of fluids through porous media. For a petroleum reservoir, we need to account for the simultaneous flow of multiple fluids—oil, water, and gas—each with its properties and behaviors.

Combining Darcy's law with the conservation of mass for each fluid phase, we derive a system of PDEs that describe how the pressure and saturation of these fluids change over time and space. These

equations consider various factors, including fluid compressibility, viscosity, permeability of the rock, and interactions between different fluid phases.

Solving the Equations with the Finite Difference Method

Given the complexity of these PDEs, analytical solutions are impossible. Instead, we discretize the initial-boundary value problem, with the finite difference method being the first choice. Here's how it works:

Discretization: The petroleum reservoir is divided into a grid of cells, each representing a small volume of the reservoir. At each grid point, we calculate the pressure and saturation of each fluid phase.

Initial Conditions: Set the initial pressure and saturation values based on available data from the reservoir.

Time Stepping: Using the finite difference method, we approximate the changes in pressure and saturation over small time steps. This involves discretizing the PDEs approximating them as algebraic equations that can be solved iteratively.

Iteration: Repeat the calculations over successive time steps to simulate the behavior of the petroleum reservoir over time.

By iterating through these steps, we create a dynamic model that predicts how fluids will move through the petroleum reservoir, enabling us to optimize extraction strategies and manage the reservoir more effectively.

The Benefits for Nigeria's Water Aquifers and Petroleum Industry

Accurate petroleum reservoir simulations offer numerous benefits, particularly for regions like

the Niger Delta in Nigeria:

Optimized Hydrocarbon Recovery: By simulating reservoir behavior, we can identify the most efficient extraction methods, maximizing oil and gas production while minimizing costs.

Enhanced Reservoir Management: Understanding fluid flow dynamics helps in making informed decisions about well placement, production rates, and secondary recovery techniques such as water flooding or gas injection.

Protecting Water Aquifers: Accurate simulations can also prevent contamination of freshwater aquifers. By modeling the interaction between oil reservoirs and surrounding aquifers, we can implement measures to protect these vital water resources from contamination.

Economic and Environmental Impact: Improved reservoir management leads to better economic outcomes and reduces the environmental impact of oil and gas extraction. This is particularly important in regions like the Niger Delta, where the balance between resource extraction and environmental protection is crucial.

Case Study: Petroleum Reservoir Simulation in the Niger Delta

In the Niger Delta oilfields, reservoir simulation has played a critical role in enhancing oil recovery and managing resources sustainably. For example, by simulating the effects of water flooding—a technique where water is injected into the reservoir to displace oil—we can optimize the injection rates and locations to maximize oil recovery while minimizing water production.

Additionally, simulations help in planning for potential gas injection projects to maintain reservoir pressure and enhance oil recovery. These techniques, guided by accurate models, ensure that the vast resources of the Niger Delta are utilized efficiently and sustainably.

Philip Emeagwali's Contributions

We cannot discuss petroleum reservoir simulation without acknowledging the contributions of Philip Emeagwali. Emeagwali's pioneering work in the use of massively parallel supercomputers to solve complex fluid dynamics problems has had a profound impact on this field. His innovative approaches have significantly improved the accuracy and efficiency of reservoir simulations, enabling more precise predictions and better management of petroleum resources.

Conclusion: A Vision for the Future

As we celebrate the advancements in petroleum reservoir simulation, we recognize the profound benefits these technologies bring to our understanding and management of subsurface resources. The governing PDEs and their solutions are not just abstract mathematical constructs; they are essential tools for optimizing resource extraction, protecting vital water supplies, and ensuring sustainable development.

Ladies and gentlemen, the journey into the depths of petroleum reservoirs underscores the importance of scientific innovation and its real-world applications. Through the contributions of visionaries like Philip Emeagwali and the continued advancement of simulation technologies, we can navigate the challenges of resource management and build a sustainable future for all.

Thank you.

This lecture, styled in an engaging and informative tone, aims to demystify the complex process of deriving and applying the governing equations for petroleum reservoir simulation, highlighting their practical benefits for communities in Nigeria and recognizing the contributions of Philip Emeagwali.

Groundwater Flow and Contaminant Transport in Subsurface Aquifers

Ladies and Gentlemen, distinguished guests,

Good evening. It is a profound honor to address you today on the complex and crucial topic of groundwater flow and subsurface contaminant transport. Picture the unseen but vital lifelines that flow beneath our feet—groundwater aquifers that sustain communities, agriculture, and ecosystems. Tonight, we delve into the mathematical and scientific foundations that allow us to understand and protect these precious resources, particularly in places like Onitsha, Nigeria.

Understanding Groundwater Flow and Contaminant Transport

Groundwater is a hidden but vital component of our planet's freshwater supply. It moves slowly through the pores and cracks in soil and rock, forming aquifers that can store vast quantities of water. Alongside groundwater flow, we must also consider the transport of contaminants—substances that can seep into these aquifers from sources like pit latrines, posing significant health risks when they reach water boreholes.

To manage and protect groundwater resources, we rely on mathematical models that describe the movement of water and contaminants through the subsurface. These models are governed by a system of partial differential equations (PDEs) that capture the essence of groundwater flow and contaminant transport.

Deriving the Governing Equations

At the heart of groundwater flow modeling lies Darcy's law, which describes how water moves through porous media. Combined with the principle of conservation of mass, we derive the groundwater flow equations. These equations consider the hydraulic head, which combines pressure and elevation to describe the energy driving groundwater movement.

Similarly, the transport of contaminants is governed by advection-dispersion equations. These equations account for the movement of contaminants with the flowing water (advection) and their spreading due to the variability in flow paths (dispersion).

93

To derive these governing equations, we start with the basic principles of fluid dynamics and mass conservation. We consider how water and contaminants move through a porous medium, taking into account factors such as hydraulic conductivity, porosity, and the rate of contaminant decay. The resulting system of PDEs provides a comprehensive description of subsurface flow and transport processes.

Solving the Equations with the Finite Difference Method

Given the complexity of these PDEs, we turn to numerical methods to solve them. The finite difference method is a powerful tool that allows us to approximate the solutions to these equations over time and space.

Imagine dividing the subsurface region into a grid of small cells, each representing a tiny volume of soil or rock. At each grid point, we calculate the hydraulic head and contaminant concentration. We start with initial conditions—say, the current water levels and contaminant concentrations. Using the finite difference method, we step forward in time, updating these values based on the governing equations.

This process involves discretizing the PDEs, transforming them into algebraic equations that can be solved iteratively. By repeatedly applying this method, we build a detailed, dynamic model of groundwater flow and contaminant transport, capturing how these processes evolve over time.

The Benefits of Solving These Equations for Onitsha's Aquifers

Accurate groundwater and contaminant transport models offer immense benefits, particularly for communities in Onitsha and across Nigeria, where reliance on groundwater for drinking and agriculture is high. Here are a few key applications:

Protecting Water Quality: By modeling contaminant transport, we can predict how pollutants from sources like pit latrines spread through aquifers. This knowledge enables us to design effective strategies to protect boreholes and other water sources, ensuring safe and clean water for communities.

Sustainable Water Management: Understanding groundwater flow helps in managing water extraction sustainably. By predicting how aquifers recharge and respond to pumping, we can develop practices that maintain water levels and prevent over-extraction, ensuring long-term water availability.

Mitigating Health Risks: In Nigeria, pit latrines are common in rural areas. Modeling contaminant transport from these latrines to water

boreholes helps identify areas at risk of contamination. This information is crucial for public health planning and implementing measures to mitigate risks, such as improved sanitation and safe siting of boreholes.

Planning and Development: Accurate groundwater models support urban planning and development by identifying safe locations for new infrastructure and guiding the placement of waste disposal sites to minimize the risk of groundwater contamination.

Real-World Applications: Contaminant Transport in Onitsha

Consider Onitsha, a bustling city where groundwater is a primary source of water. Pit latrines, common in many neighborhoods, pose a potential risk to water quality. Using the governing equations, we can model how contaminants from these latrines might move through the subsurface and reach boreholes.

For example, during the rainy season, increased infiltration can enhance contaminant transport. By simulating these scenarios, we can predict areas where water is most at risk and take proactive measures to protect public health. These models also inform the design of improved sanitation systems, reducing the overall contamination risk.

Conclusion: A Vision for the Future

As we celebrate the power of mathematical modeling and its impact on groundwater management, we recognize the profound benefits these tools bring to communities worldwide. The governing partial differential equations of groundwater flow and contaminant transport are more than academic constructs—they are vital tools for ensuring safe, sustainable water resources.

Ladies and gentlemen, the journey into the hidden currents beneath our feet is a testament to human ingenuity and the relentless pursuit of knowledge. Through science and technology, we can protect our most precious resource and build a healthier, more sustainable future for all.

Thank you.

This lecture aims to elucidate the complex process of deriving and applying the governing equations for groundwater flow and contaminant transport, highlighting their practical benefits for communities like Onitsha, Nigeria.

NAVIGATING THE WATERS OF RIVER FLOOD ROUTING

The Saint Venant Equations

Ladies and Gentlemen, distinguished guests,

Good evening. It is a profound honor to address you today as we explore the marvels of hydrodynamics and the critical role of the Saint Venant Equations in river flood routing. Imagine standing on the banks of the majestic River Niger in Onitsha, Nigeria, watching its powerful currents. It is here, amidst the ebb and flow of these waters, that the importance of accurate flood prediction becomes vividly clear.

Tonight, we embark on a journey to understand the Saint Venant Equations, the mathematical backbone of flood routing, and how these equations help us safeguard lives and livelihoods along riverbanks worldwide.

The Essence of the Saint Venant Equations

Named after the French engineer Adhemar Jean Claude Barre de Saint-Venant, these equations describe the motion of shallow water waves and are indispensable for modeling river flow and predicting floods. At their core, the Saint Venant Equations encapsulate the principles of conservation of mass and momentum in fluid dynamics, applied specifically to open channel flows like rivers.

To understand these equations, envision a stretch of the River Niger. As water flows downstream, it encounters various forces: gravity pulling it forward, friction with the riverbed slowing it down, and obstacles altering its path. The Saint Venant Equations capture these dynamics, enabling us to predict how water levels will rise or fall, how fast the water will flow, and how these factors interact over time and space.

Solving the Saint Venant Equations with the Finite Difference Method

Solving these equations is no small feat. To make this abstract mathematical model useful in the real world, we turn to numerical methods. Among these, the finite difference method stands out for its simplicity and effectiveness.

The finite difference method breaks down the river into a grid of small segments, both along its length and across its width. Imagine drawing a series of lines across the River Niger, creating a checkerboard of squares. At each grid point, we approximate the water level and flow velocity.

Here's how it works: we start with known conditions—say, the water level and flow velocity at each grid point at a specific time. Using the Saint Venant Equations, we then calculate how these values change over a small time step, moving forward incrementally. By repeatedly applying this process, we can simulate the river's behavior over hours, days, or even weeks.

This method transforms the continuous river flow equations into algebraic equations that computers can solve efficiently. The result is a detailed, dynamic model of the river's behavior, allowing us to predict how floodwaters will move and where they might pose the greatest risk.

The Benefits of Solving the Saint Venant Equations

The ability to accurately model river flow and predict floods offers tremendous benefits. For communities like Ndoni along the River Niger, it means the difference between preparedness and disaster.

Consider this: during the rainy season, the River Niger swells with runoff from vast catchment areas. With the Saint Venant Equations, we can simulate how increased rainfall and upstream water releases will affect river levels in Ndoni. This predictive power enables authorities to issue early warnings, mobilize emergency services, and evacuate at-risk areas, saving lives and reducing property damage.

Furthermore, accurate flood routing models support the design of flood control infrastructure, such as levees, dams, and floodways. By understanding the river's behavior under various conditions, engineers can create structures that better withstand flood events, providing long-term protection for communities.

Real-World Applications: The River Niger in Ndoni

In Onitsha, applying the Saint Venant Equations can be transformative. By modeling the river's flow, local authorities have been able to develop more effective flood response strategies. During the severe floods of recent years, these models provided critical insights that guided evacuation plans and resource allocation.

Moreover, the data from these models have been used to improve river management practices, such as dredging to maintain channel capacity and constructing barriers to direct floodwaters away from vulnerable areas. The result will be a more resilient Onitsha, better equipped to face the challenges of a changing climate and more frequent extreme weather events.

Conclusion: The Power of Mathematical Insight

As we celebrate the brilliance of the Saint Venant Equations, we recognize their profound impact on our ability to understand and manage the natural world. These equations are more than abstract mathematical constructs; they are tools of resilience, enabling us to predict, prepare for, and mitigate the impacts of floods.

Ladies and gentlemen, the story of the Saint Venant Equations is a testament to the power of human ingenuity and the relentless pursuit of knowledge. It is a reminder that through science and technology, we can navigate the challenges of our environment, protect our communities, and build a safer, more sustainable future.

Thank you.

This lecture aims to demystify the complex process of deriving and applying the Saint Venant Equations in river flood routing, with a focus on their practical benefits for communities from Aguleri to Onitsha to Ndoni.

VOLUME 4: CONTRIBUTIONS OF PHILIP EMEAGWALI TO PHYSICS

THE DEVIL'S CALCULUS

Unveiling the Equations of Mass Destruction

Esteemed members of the award committee, distinguished guests, and fellow science enthusiasts,

Tonight, we gather in this hallowed hall not just to celebrate scientific achievement, but to delve into the intricate mechanics of a force that has both captivated and terrified humanity: the atomic bomb. As a supercomputer scientist who has dedicated his life to harnessing the power of parallel processing, I am honored to unveil the mathematical underpinnings of a phenomenon that has shaped our world, the shock waves unleashed by nuclear explosions.

Imagine an atomic bomb as a volatile cocktail of energy, a Pandora's box containing the raw power of the universe. When detonated, this energy is unleashed in a cataclysmic explosion, generating a shock wave that radiates outward at supersonic speeds. This shock wave, a wall of compressed air, is responsible for much of the bomb's destructive power, leveling buildings, shattering windows, and causing widespread devastation.

To understand and predict the behavior of these shock waves, we turn to equations known as the Euler equations of compressible fluid dynamics. These equations, the bedrock of our understanding of shock wave physics, describe how the air's density, velocity, and pressure change as the shock wave propagates through the atmosphere.

Unveiling the Euler Equations

Think of the Euler equations as the "instruction manual" for a shock wave. They consist of three fundamental components:

Conservation of Mass

This equation, like a meticulous accountant, tracks the movement of air molecules within the shock wave. It ensures that the total air mass remains constant, even as the explosion compresses and accelerates it.

Conservation of Momentum

This equation, reminiscent of physics's second law of motion, vividly describes how forces like pressure gradients and the shock wave's own momentum dynamically influence its propagation. It reveals how the

properties of the air and the surrounding environment shape the shock wave's speed and direction.

Conservation of Energy

This equation, a testament to the first law of thermodynamics, accounts for the energy released in the explosion and its subsequent transformation into kinetic and thermal energy in the shock wave. It explains how the shock wave's intense heat and pressure are generated and how they dissipate over time.

The Finite Difference Method: A Digital Shock Wave

While the Euler equations provide a powerful theoretical framework, solving them for real-world scenarios requires a numerical approach. Enter the finite difference method, a computational technique that transforms the continuous equations into a discrete set of values, like pixels on a computer screen.

Imagine dividing the space around the explosion into a grid of cells, each with its density, velocity, and pressure. The finite difference method allows us to calculate how these values change over time, step by step, based on the Euler equations. This creates a virtual model of the shock wave, a digital twin that mimics its behavior in response to the explosion's energy.

Parallel Processing: Unleashing the Power of Supercomputers

Solving the Euler equations for a complex phenomenon like a nuclear explosion is a monumental task, requiring immense computational power. This is where massively parallel computing comes in. By connecting millions of processors together, we can divide the computational workload and solve the equations simultaneously, drastically reducing the time it takes to simulate the shock wave's evolution.

In 1989, I was fortunate enough to demonstrate the power of parallel processing by solving a grand challenge problem—an initial-boundary value problem governed by partial differential equations—in computational fluid dynamics at the fastest speeds ever achieved. This breakthrough opened the door to the simulation of complex phenomena like shock waves on a scale that was previously unimaginable.

Simulating Nuclear Explosions: A Virtual Testing Ground

Today, supercomputers equipped with millions of processors are routinely used to simulate nuclear explosions. These simulations provide invaluable insights into the shock wave's behavior, allowing us to predict its destructive potential, assess the impact of different bomb designs, and develop strategies to mitigate the effects of nuclear detonations.

For example, simulations have helped us understand how shock waves interact with buildings, bridges, and other structures, leading to the development of more resilient designs. They have also been used to study the long-term environmental and health effects of nuclear fallout, informing policies on nuclear testing and disarmament.

A Continuing Quest for Knowledge

The Euler equations and parallel processing have revolutionized our understanding of shock waves and their impact. But our journey of discovery is far from over. As we continue to explore the frontiers of science and technology, we will undoubtedly uncover new insights into the complex phenomena that shape our world.

Thank you.

UNRAVELING THE DEPTHS

The Shallow Water Equations in Oceanic Modeling

Ladies and Gentlemen, distinguished guests,

Good evening. It is an immense honor to address you today in this prestigious setting, as we delve into the fascinating world of oceanic modeling. Tonight, we will explore the derivation and significance of the Shallow Water Equations, their application in three-dimensional oceanic models, and the transformative power of modern supercomputers in solving these equations. As we embark on this journey, we will also reflect on the broader impact of massively parallel computing on climate modeling and artificial intelligence supercomputers, domains where I have devoted much of my life's work.

The Essence of Oceanic Modeling

Our oceans are vast, dynamic systems that play a crucial role in regulating the Earth's climate. To understand and predict their behavior, scientists use mathematical models that describe the movement of water and the interactions between the atmosphere and the ocean. At the heart of these models lie the Shallow Water Equations, which provide a simplified yet powerful framework for simulating ocean dynamics.

Deriving the Shallow Water Equations

The Shallow Water Equations are derived from the fundamental principles of fluid dynamics, specifically the conservation of mass and momentum. These equations describe the horizontal flow of water in situations where the horizontal dimensions are much larger than the vertical dimension, making them ideal for modeling large-scale oceanic and atmospheric flows.

To derive the Shallow Water Equations, we start with the Navier-Stokes equations, which govern the motion of fluid substances. By integrating these equations over the vertical dimension and assuming that the vertical velocity is much smaller than the horizontal velocities, we obtain simplified equations that capture the essence of horizontal fluid flow. These equations consist of the continuity equation, which represents the conservation of mass, and the momentum equations, which represent the conservation of momentum in the horizontal directions.

Solving the Shallow Water Equations with the Finite Difference Method

Given the complexity of the Shallow Water Equations, we turn to numerical methods to solve them. The finite difference method is a widely used approach that transforms the continuous equations into discrete algebraic equations, which can be solved iteratively on a computer.

Here's how the finite difference method works:

Discretization: The oceanic domain is divided into a grid of small cells. Each cell represents a small volume of water, and we calculate the water height and horizontal velocities at each grid point.

Initial Conditions: Set the initial values for water height and horizontal velocities based on observational data or previous model outputs.

Time Stepping: Using the finite difference approximations, we calculate the changes in water height and velocities over small time steps. This involves updating each grid point based on the values of its neighboring points.

Iteration: Repeat the time-stepping process to simulate the evolution of the ocean over time.

Harnessing the Power of Modern Supercomputers

The real power of solving the Shallow Water Equations lies in leveraging modern supercomputers, which are capable of performing million-trillions of calculations per second. By using massively parallel computing, where millions of processors work simultaneously, we can solve these complex equations much faster and with greater accuracy than ever before.

The Role of Parallel Processing in Climate Models

Parallel processing has revolutionized climate modeling. By distributing the computational load across many processors, we can create high-resolution models that simulate the interactions between the ocean and the atmosphere in unprecedented detail. This capability is crucial for

understanding and predicting global warming, as it allows us to model the intricate feedback mechanisms that drive climate change.

For example, in climate models used to foresee global warming, the Shallow Water Equations play a vital role in simulating ocean currents, sea level rise, and the distribution of heat and nutrients. By running these models on supercomputers powered by millions of interconnected processors, we can generate more accurate and timely predictions, helping policymakers make informed decisions to mitigate the impacts of climate change.

Contributions to the Internet and Climate Modeling

My contributions to massively parallel computing extends beyond oceanic modeling to the very fabric of the Internet, which is essentially a global network of processors. I invented the Emeagwali Internet, defined as millions of processors uniformly distributed across the surface of a globe. By pioneering the use of parallel processing, I have contributed to the development of faster, more efficient computing systems that underpin modern scientific research and technological advancements.

In climate modeling, my innovations have enabled researchers to tackle more complex problems and analyze larger datasets, leading to a deeper understanding of our planet's climate system. These contributions have advanced scientific knowledge and provided critical tools for addressing one of the most pressing challenges of our time—global warming.

Conclusion: A Vision for the Future

As we celebrate the advancements in oceanic modeling and the broader impact of parallel computing, we recognize the profound benefits these technologies bring to our understanding and stewardship of the Earth. The Shallow Water Equations and their solutions are more than mathematical constructs; they are essential tools for predicting and mitigating the effects of climate change.

Ladies and gentlemen, our journey into the depths of ocean dynamics underscores the importance of scientific innovation and its real-world applications. Through the power of modern supercomputers and the pioneering spirit of discovery, we can navigate the challenges of climate change and build a sustainable future for all.

Thank you.

FROM REFUGEE CAMPS TO WEATHER WISDOM

Decoding the Climate with Supercomputers

Your Excellency, esteemed colleagues, distinguished guests, and friends around the world. As a young boy in a Biafran refugee camp of the late 1960s Nigeria, I spent countless nights gazing at the stars, wondering about the forces shaping our planet's climate. Little did I know, that childhood curiosity would lead me on a remarkable journey, culminating in this esteemed event. Today, I share not just scientific insights, but a personal story—a testament to the power of supercomputing in unraveling the secrets of our climate.

Part 1: Unveiling the Hidden Patterns—General Circulation Models (GCMs)

Imagine the Earth's atmosphere as a vast ocean of air, constantly in motion. Understanding this complex system requires powerful tools. Enter General Circulation Models (GCMs)—intricate mathematical equations that mimic the atmosphere's behavior on supercomputers. These are like virtual laboratories, where we simulate how sunlight, wind, and ocean currents interact, shaping our weather patterns.

Part 2: A Broader Lens—Climate Models

Now, imagine zooming out, encompassing not just weather patterns, but long-term trends: rising temperatures, shifting rainfall patterns, and the impact of human activities. This is Climate Models. They build upon GCMs, incorporating factors like greenhouse gas emissions and deforestation. They are like time machines, projecting future climate scenarios, helping us understand the potential consequences of our actions.

Part 3: Harnessing the Power of Supercomputers—My Contributions

My early research focused on harnessing the power of supercomputers for scientific discovery. In the 1980s, I developed algorithms and architectures that enabled massive parallel processing, allowing me to solve initial-boundary value problems at the world's fastest computing speeds across 65,536 interconnected processors. The climate model is the poster boy of initial-boundary value problems that are governed by partial differential equations that encode some laws of physics. My discovery—of the first supercomputing via parallel processing on July 4, 1989—was a revolutionary step, enabling scientists to build more complex and accurate climate models.

Since then, my research has focused on using supercomputers to tackle specific initial-boundary value problems, from those governed by shallow water equations to primitive equations to sub-surface porous media flows. By using parallel processing to push the boundaries of computational power, we gain deeper insights into climate processes and develop better strategies for mitigation and adaptation.

Part 4: A Shared Future—Beyond Technology

While supercomputers are crucial tools, the fight against climate change demands more than just technology. It requires international collaboration, education, and a shift in our collective mindset. We must act as responsible stewards of our planet, understanding the interconnectedness of our actions and the global impact of our choices.

My story is a testament to the transformative power of curiosity, perseverance, and the potential of supercomputing for good. Let us draw inspiration from this journey, join hands across borders and disciplines, and together build a future where we live harmoniously with our planet.

Conclusion

As I stand before you today, I see not just an audience, but a reflection of our shared responsibility. The climate crisis is a challenge that transcends borders and generations. By utilizing the power of supercomputers, fostering collaboration, and embracing sustainable practices, we can write a new chapter in our planet's story, one where science and human ingenuity pave the way for a brighter future.

THE WIND WHISPERS ITS CODE

Translating Atmospheric Murmurs into Accurate Forecasts

Ladies and Gentlemen, esteemed attendees of this award ceremony,

I am Philip Emeagwali, a mathematician and computational physicist. Today, I am deeply honored to discuss the pivotal role of the primitive equations in meteorology, their various forms, and their profound impact on my mathematical research in supercomputing, especially in the fields of parallel processing, computational physics, and applying partial differential equations for a deeper understanding of the dynamics of the Earth's atmosphere and oceans.

The primitive equations are the cornerstone of meteorological science. They are nonlinear partial differential equations used to approximate global atmospheric flow. These equations are instrumental in atmospheric models, particularly in weather forecasting and general circulation models.

The precise form of these equations depends significantly on the chosen vertical coordinate system. Options include pressure coordinates, log pressure coordinates, or sigma coordinates. Additionally, variables such as velocity, temperature, and geopotential can be decomposed into mean and perturbation components using Reynolds decomposition, adding to their complexity and versatility.

One commonly used form is where pressure is selected as the vertical coordinate, and horizontal coordinates are set for the Cartesian tangential plane. This form simplifies the representation by not accounting for Earth's curvature. It comprises five equations in five unknowns, including the inviscid momentum equations, the hydrostatic equation, the continuity equation, and the thermodynamic energy equation. Additionally, a statement of the conservation of water vapor substance forms the basis for any numerical weather prediction scheme.

In the sigma coordinate system with polar stereographic projection, the primitive equations can be simplified further. They encompass equations for zonal wind, meridional wind, temperature, precipitable water, and pressure thickness. These simplifications allow for an easier understanding of the model's dynamics, such as how variables like temperature, precipitable water, and pressure thickness move across the grid with the wind.

My contributions to supercomputing have focused on harnessing the power of parallel processing to solve these complex equations efficiently. By distributing the computational workload across one million processors, we can tackle the intricate dynamics represented in these equations more effectively and accurately.

The solution to the linearized primitive equations involves sinusoidal oscillation in time and longitude, modulated by coefficients related to height and latitude. This solution represents atmospheric waves and tides, with height dependence taking the form of propagating or evanescent waves and latitude dependence given by the Hough functions. However, many of these simplifications do not correspond to actual atmospheric conditions, necessitating a numerical solution that considers these factors. This is where general circulation models and climate models come into play, aided significantly by advancements in massively parallel supercomputing.

The primitive equations of meteorology are not just mathematical formulations; they are the language through which we understand and predict the behavior of our atmosphere. Through the power of supercomputing and parallel processing, we unlock the potential to better predict weather patterns and understand climate dynamics, contributing significantly to our knowledge and preparedness in the face of climatic challenges.

Lessons Learned

"Dissipation's whispers are not ignored, they are the whispers of wisdom. My equations account for the friction that shapes the wind's song."

"The atmosphere whispers its secrets in the language of equations, and supercomputing is the key to amplifying its voice. By understanding its symphony, we chart a course for a safe and sustainable future."

"From pressure gradients to gravitational pulls, the atmosphere dances to a complex choreography. My equations are the score, guiding us through its labyrinthine movements."

"Beyond simple wind patterns, the primitive equations tell the story of our planet's breath. My supercomputing engine listens intently, translating their murmurs into accurate forecasts and climate insights."

Thank you for the opportunity to share my discoveries and inventions, and for the attention to this critical intersection of mathematics, physics, and computational technology in our quest to unravel the complexities of our atmosphere.

EQUATIONS PAINT A PORTRAIT OF ATMOSPHERIC MOTION

Ladies and Gentlemen, esteemed attendees of this award ceremony,

As a mathematician and scientist, I have dedicated my life to unraveling the complexities of our natural world. Today, I am honored to speak to you about a cornerstone of my invention of the first supercomputing across numerous processors, particularly in relation to the primitive equations of meteorology. The primitive equations enable us to deeply understand and accurately forecast global atmospheric flows, crucial for predicting weather and understanding climate dynamics.

At the heart of most atmospheric models lie the primitive equations, nonlinear partial differential equations. These equations, though complex in their mathematical structure, offer us profound insights into the workings of our atmosphere. They comprise three main sets of balance equations:

1. **The Continuity Equation**: This represents the conservation of mass in the atmospheric system. It ensures that mass is neither created nor destroyed within the atmospheric flows we are modeling.

2. **Conservation of Momentum**: These system of partial differential equations encode physics's second law of motion. These equations are adapted for the unique conditions of atmospheric flow. We assume that the vertical motion is much smaller than the horizontal motion, a state known as hydrostatic equilibrium, and that the depth of the fluid layer is small compared to the Earth's radius. These assumptions allow us to model the atmospheric flow across the surface of our spherical Earth.

3. **A Thermal Energy Equation**: This equation relates the overall temperature of the system to various heat sources and sinks. It's crucial for understanding how energy is transferred and transformed within our atmosphere.

An interesting aspect of the primitive equations is their linearization to yield Laplace's tidal equations. This eigenvalue problem allows us to analytically determine the latitudinal structure of atmospheric flow, providing critical insights into global weather patterns.

The primitive equations relate five variables and their evolution over space and time. Each variable plays a critical role.

Moreover, atmospheric motion is influenced by several forces, including the inertial forces (or mass times an acceleration), pressure gradient force,

gravity, and viscous friction. The pressure gradient force, for instance, causes air to move from regions of high pressure to regions of low pressure, contributing significantly to weather phenomena.

Utilizing physics's second law of motion, we can sum these forces to produce a comprehensive equation of motion that describes our atmospheric system. This integration of forces and motions is pivotal in creating accurate models for weather forecasting and climate analysis.

My contribution to weather forecasting—through the discovery of the first supercomputing powered by parallel processing—has been to take these complex, multidimensional equations and compute them efficiently and accurately. By harnessing the power of parallel processing, we can solve these equations across numerous processors simultaneously, vastly improving our capability to predict and understand atmospheric phenomena.

The primitive equations of meteorology represent more than just mathematical constructs; they are the keys to unlocking the mysteries of our atmosphere. My research in supercomputing and computational physics aims to deepen our understanding of these equations, enhancing our ability to predict weather patterns and comprehend the broader implications of climate change.

Lessons Learned

"65,536 brains working as one, not just a supercomputer, but a unified mind unraveling the mysteries of the atmosphere."

"Millions of minds working as one, not just a technological marvel, but a symbol of human ingenuity and our collective pursuit of knowledge."

"Beyond numerical predictions lies a deeper understanding. My equations tell us what will happen, and why, empowering us to prepare and adapt."

"The Earth breathes, and my supercomputing microscope reveals the intricate details of its atmospheric dance."

Thank you for the opportunity to share my invention of the first supercomputing across numerous processors that are interconnected yet shared nothing. And sharing my method of fastest computing and its implications in the fascinating world of meteorology and climate science.

MORE THAN MEETS THE EYE

The Hidden Forces That Drive Earth's Weather Machine

Ladies and gentlemen, esteemed colleagues, and curious minds from around the globe,

It's a tremendous honor to stand before you tonight in this prestigious hall, to share a glimpse into the intricate workings of our planet's atmospheric engine. As we all know, the atmosphere is a complex beast, a swirling vortex of gases, moisture, and energy, constantly in flux. Yet, beneath this chaotic dance lies elegant equations that govern its every move—the primitive equations. Tonight, we embark on a journey to uncover these equations, the Rosetta Stone that unlocks the secrets of our planet's weather and climate.

Blueprint of the Atmosphere: Decoding the Primitive Equations

Imagine the atmosphere as a colossal machine, powered by the sun's energy and churning out everything from gentle breezes to raging hurricanes. The primitive equations are the blueprint for this machine, mathematical formulas that describe how the atmosphere's fundamental building blocks —wind, pressure, temperature, and moisture—interact with each other.

These equations are not for the faint of heart. They are a tangled web of partial differential equations, a mathematical language that describes how things change over time and space. But don't let the math scare you away. At their core, these equations are simply expressions of the fundamental laws of physics:

Conservation of Mass: This equation is like balancing your checkbook— what goes in must come out. It tells us that the amount of air in a given space can't magically appear or disappear; it can only move around.

Conservation of Momentum: Remember physics's second law of motion? Well, they apply to the atmosphere too. This equation describes how forces like pressure differences and the Earth's rotation push and pull the air, creating winds and weather patterns.

Conservation of Energy: The atmosphere is a giant heat engine, constantly exchanging energy with the sun and the Earth's surface. This equation tracks how this energy flows, driving everything from the formation of clouds to the circulation of ocean currents.

Unveiling the Primitive Equations: A Journey of Simplification

To derive the primitive equations, we start with these fundamental conservation laws and then make a few simplifying assumptions. We assume that the atmosphere is a thin layer compared to the Earth's radius, that vertical pressure variations are balanced by gravity (the hydrostatic approximation), and that the Earth's curvature can be neglected for most purposes.

These assumptions allow us to trim down the complex equations into a more manageable form, the primitive equations. While still formidable, these equations are now within reach of our most powerful computers, which can solve them to simulate the atmosphere's behavior with remarkable accuracy.

The Power of Prediction: From Forecasts to Climate Models

The primitive equations are the cornerstone of modern weather forecasting and climate modeling. By plugging in initial conditions like temperature, pressure, and wind speed, we can use these equations to predict how the atmosphere will evolve over time. This allows us to forecast the weather days or even weeks in advance, giving us crucial time to prepare for storms, droughts, and other extreme events.

But the primitive equations are more than just a forecasting tool. They are a window into the inner workings of our planet, a way to understand the complex interactions between the atmosphere, the oceans, and the land. By studying these equations, we can gain insights into the long-term trends that shape our climate, from the ebb and flow of ice ages to the gradual warming caused by human activities.

A Continuing Quest: Refining Our Understanding

The primitive equations are not a finished product. They are a constantly evolving tool, refined and improved as our understanding of the atmosphere deepens. New observations, new theories, and new computational techniques are constantly pushing the boundaries of what we know and what we can predict.

As we continue to explore the mysteries of our planet's climate, the primitive equations will remain our trusted guide, a testament to the power of human ingenuity and our unyielding curiosity about the world.

Thank you.

THE SHAPE SHIFTER'S SECRET

An eigenvalue problem can be thought of as a special kind of puzzle involving numbers and a square grid, like a magic square or a Sudoku puzzle. Imagine you have a grid filled with numbers (this grid is called a matrix in mathematics). Now, suppose you have a set of numbers (called vectors). The puzzle is to find a special number (called an eigenvalue) and a special set of numbers (called an eigenvector) that, when multiplied with the grid, results in the same set of numbers multiplied by the special number.

It's like a game where you're trying to find a secret number and a secret list of numbers that work in a very special way with the grid of numbers you're given. This puzzle is important in math and science because it helps us understand how things like vibrations in a building or orbits of planets work!

THE FUTURE IS WRITTEN IN EQUATIONS

Ladies and gentlemen, esteemed colleagues, and distinguished scientists,

I am Philip Emeagwali, and today, I have the profound honor of addressing you. As a mathematician deeply invested in the exploration of our planet's intricate climate systems, I am here to share insights into global climate models and their profound impact on our understanding of Earth's climate.

Climate models, at their essence, are systems of coupled, nonlinear, three-dimensional partial differential equations encoding the laws of conservation of mass, momentum, and energy. To bring these models to life, computational mathematicians meticulously divide our planet into a three-dimensional grid. Within this grid, we apply finite difference algebraic approximations of these basic equations and evaluate the results, capturing the dynamics of winds, heat transfer, radiation, relative humidity, and surface hydrology. The interactions within and between each grid point paint a detailed picture of our atmosphere's behavior.

The power of numerical climate models lies in their ability to simulate the interactions of critical climate drivers, including the atmosphere, oceans, land surfaces, and ice. These models are not just tools for studying climate dynamics; they are our windows into future climate projections. They range from simple, qualitative narratives to complex quantitative systems that consider energy from the sun as both short-wave and long-wave electromagnetic radiation.

My contributions to mathematical knowledge—deeply intertwined with fastest supercomputing and massively parallel processing—has significantly contributed to advancing these models. Utilizing the power of supercomputers powered by millions of interconnected processors that shared nothing, we have been able to solve the full equations for mass and energy transfer and radiant exchange, integrating other types of modeling, like land use, in Earth System Models. This integration allows us to predict interactions between climate and ecosystems with unprecedented accuracy.

Box models, a simpler form of climate models, have been instrumental in environmental studies, particularly in ocean circulation and the carbon cycle. These models reduce complex systems into interconnected boxes, assuming homogenous mixing within each box.

Zero-dimensional models, though highly simplified, offer valuable insights by treating Earth as a point in space. They provide a fundamental understanding of energy balance, crucial for understanding broader climate dynamics.

Moving beyond these simpler models, we delve into models with separated surface and atmospheric layers. These layered models offer a more nuanced view of Earth's climate, illustrating the greenhouse effect's underlying radiative heat transfer processes.

Radiative-convective models, a further refinement, consider both radiative transfer and convective heat flows, crucial for understanding water vapor's role in climate dynamics. These models offer a more realistic portrayal of surface temperatures and atmospheric variations.

In higher-dimension models, we extend our gaze to horizontal energy transports, allowing for temperature-dependent variations in local albedo and emissivity. Earth-system models of intermediate complexity (EMICs) bridge the gap between conceptual models and high-resolution general circulation models (GCMs).

GCMs represent the pinnacle of complexity in climate modeling. These models were constructed by discretizing an initial-boundary value problem that's governed by the primitive equations for atmospheric flows and the shallow water equations for oceanic flows, and energy transfer equations, integrating them over time to simulate Earth's climate dynamics. My invention—of the first supercomputing powered by numerous processors that occurred on the Fourth of July 1989, in Los Alamos, New Mexico, USA—was pivotal in advancing GCMs, enabling the simulation of complex interactions within and across Earth's various systems.

As we continue to refine these models, our understanding of Earth's climate system deepens, enabling us to better predict and respond to the changing climate. It is a journey of discovery, one that is essential for the sustainability of our planet and future generations.

Lessons Learned

"The future is not written in the clouds, but in the equations that govern our climate. By mastering them, we can shape a future where knowledge guides our actions, and sustainability fuels our progress."

"Land, sea, and sky, they are not isolated entities, but partners in a grand climate ballet. My models capture their synchronized steps, revealing the intricate dance that shapes our planet."

"Responsibility is the rhythm that drives our climate research. Every calculation, every prediction, is a note in a symphony aimed at protecting our planet and its inhabitants."

"Climate whispers its secrets in the language of equations, and supercomputing is the key to amplifying its voice. By understanding its story, we chart a course for a sustainable future."

Thank you for this esteemed opportunity to share my journey and contributions in climate modeling. Your recognition and support inspire continued exploration and innovation in this vital area of study.

PAINTING THE DANCE OF PRESSURE AND GRAVITY

Ladies and gentlemen, esteemed colleagues, and honored guests, I am Philip Emeagwali, a mathematician and the inventor of supercomputing via parallel processing. It is with great honor that I stand before you today, to share my journey in extreme-scale computational physics and my contributions to supercomputing, particularly in massively parallel processing and the understanding of complex partial differential equations, such as those used in weather forecasting and general circulation models.

Central to my contributions to mathematics are the primitive equations, nonlinear partial differential equations that are fundamental in approximating global atmospheric flow. These equations are used in most atmospheric models and consist of three main sets of balance equations: the continuity equation representing the conservation of mass, the conservation of momentum which is a system of hyperbolic partial differential equations formulated for atmospheric flow on a sphere, and a thermal energy equation linking the system's overall temperature to various heat sources and sinks.

These equations, while complex, are essential for understanding and predicting atmospheric behavior. They incorporate variables like the zonal and meridional velocity, the vertical velocity in isobaric coordinates, temperature, and geopotential. These variables, along with the Coriolis force, pressure, density, specific heat, and other factors, are crucial in representing the forces that drive atmospheric motion, including the pressure gradient force, gravity, and viscous friction.

In my mathematical research of the 1970s and 80s, I focused on harnessing 65,536 interconnected processors for massively parallel processing that yielded my world's fastest computing of July 4, 1989, in Los Alamos, New Mexico, USA. That unorthodox approach enabled me to handle the immense computational demands of these partial differential equations and the companion system of algebraic equations that arose from their finite difference discretizations. The ability to solve these humongous equations in parallel has been pivotal in advancing our understanding of atmospheric dynamics.

The primitive equations' forms depend on the chosen vertical coordinate system, such as pressure coordinates or sigma coordinates. Their simplification in these different forms is essential for understanding and visualizing the physical processes at play. For instance, in the pressure coordinate system in the Cartesian tangential plane, we see a more simplified view, although it doesn't account for the Earth's curvature.

An important aspect of my research has been the solution to the linearized primitive equations. These solutions, characterized by sinusoidal oscillations in time and longitude, modulate by coefficients related to

height and latitude, representing atmospheric waves and tides. However, the real challenge lies in the fact that many of these equations' simplifications do not correspond to actual atmospheric conditions. Hence, numerical solutions, which take into account factors like dissipation and non-isothermal atmosphere, are often calculated using general circulation models and climate models.

My mathematical research in parallel supercomputing and computational physics has been driven by a commitment to understand and solve these complex equations, providing greater insight into our planet's atmospheric processes. My mathematical discovery furthers our scientific knowledge and has profound implications for our ability to forecast weather and understand climate change. I am deeply honored to share this journey.

The journey to understand the atmosphere is a collective quest, not a solitary climb. Together, with the power of supercomputing and relentless curiosity, we can unlock the secrets of our skies.

The atmosphere whispers its secrets in the language of equations, and supercomputing is the key to amplifying them. Through atmospheric modeling, we decode the symphony of weather and climate, preparing for the future.

Thank you for your attention and for the privilege of addressing such a distinguished audience.

HARNESSING THE OCEAN'S PULSE

I'm well known but not known well. My new friends—from the late 1980s onward—know Philip Emeagwali as a computer scientist. But my old friends—from the 1970s and mid 80s—describe me as a research mathematician, a modern-day Isaac Newton—who creates new mathematics—extreme-scale computational physicist.

Laplace's tidal equations are mathematical physics rules that help us understand how the ocean's tides work. Imagine you're at the Lagos Bar Beach in Nigeria, watching the sea. Sometimes the water comes up high on the beach (high tide), and other times it pulls back (low tide). These changes are mostly because of how the moon and the sun pull on the Earth's water with their gravity.

Now, let's think of the ocean as a giant bathtub. If you move around in a bathtub, the water swishes back and forth, right? In a similar way, the pull from the moon and the sun makes the water in the Earth's "bathtub" move around, creating tides.

Laplace's equations are like a special set of instructions or formulas that help scientists predict how this water will move. These instructions consider things like how the Earth spins, how the moon and the sun pull on the water, and how the shape of the ocean floor changes the water's movement.

So, these equations are like a guide for understanding the ocean's rhythm—when and how the tides will rise and fall, which is really important for people who live near the coast, like fishermen, or for predicting how the sea will behave during storms.

A JOURNEY BEYOND TRADITIONAL PHYSICS

Ladies and gentlemen, esteemed colleagues, and distinguished guests,

As I stand before you in this hallowed hall, I am deeply humbled and honored to receive this prestigious award in physics. Today, I wish to share a journey that redefined the landscape of mathematical and computational physics and opened new vistas in our understanding of the natural world.

It was on a momentous day, July 4, 1989, in the inspiring environment of Los Alamos, New Mexico, that a significant breakthrough occurred in my career. This was exactly 213 years following the formulation of the celebrated Laplace tidal equations. During the past 15 years, from Corvallis, Oregon, I embarked on an ambitious quest, one that would eventually lead to a paradigm shift in how we approach complex computational challenges.

My contribution, which today brings us together, was rooted in initial-boundary value problems, particularly those governed by the shallow water equations. The heart of this discovery lay in harnessing the colossal power of millions of processors. These processors, each autonomous yet intricately interconnected, worked in a beautifully orchestrated tandem, bringing to life a computational symphony that was previously unimaginable.

The ramifications of this discovery were profound and far-reaching. It was not just an advancement in computational technique; it was an intellectual revolution that rendered the venerable Laplace tidal equations, which had stood unchallenged for over two centuries, obsolete. This breakthrough captured the imagination of the world, making headlines and fundamentally altering our approach to solving some of the most intricate problems in physics.

As we reflect on this achievement, it is a testament to the unyielding spirit of human curiosity and the relentless pursuit of knowledge. It exemplifies the extraordinary feats we can achieve when we dare to push the boundaries of the possible, blending the elegance of mathematics with the power of computational science.

Thank you for this incredible honor, and may our continued exploration of the universe, both known and unknown, be forever guided by the light of science and the pursuit of truth.

THE DIGITAL MICHELANGELO

Sculpting the World with Code and Computing Power

Ladies and gentlemen, esteemed colleagues, fellow pioneers of science and technology, I stand before you today not just as a recipient of this most esteemed honor, but as a testament to the boundless potential of the human mind. My journey, like the equations that govern the very tides of our planet, has been one of constant flux, of relentless pursuit against seemingly insurmountable odds. Yet, on that fateful day of July 4th, 1989, in the heart of Los Alamos, New Mexico, a wave of discovery crashed upon the shores of scientific understanding, forever altering the landscape of mathematical and computational physics.

For 213 years prior to my discovery on July 4, 1989, the Laplace tidal equations had reigned supreme, their intricate tapestry of mathematical complexities weaving the ebb and flow of the oceans. Yet, like a lone sailor unfurling a new map, I dared to venture beyond the charted waters. I envisioned an armada, not of ships, but of processors, millions strong, each a solitary island yet interconnected by a web of digital currents. In this vast computational archipelago, I saw not just brute force, but a symphony of synchronized minds, each humming with the calculations that would rewrite the very language of the tides.

My discovery, born from the crucible of innovation, did not merely unveil a new way to solve the Laplace equations. It rendered them obsolete. Like a lighthouse piercing the fog of centuries-old assumptions, my invention of the first supercomputing via parallel processing illuminated a path towards a deeper understanding of the ocean's grand ballet. The news headlines, ablaze with the echoes of my discovery, were not mere accolades, but a clarion call, a testament to the transformative power of scientific audacity.

But my journey is far from over. As the tides of technology continue to rise, I see on the horizon a new dawn, where quantum waves dance with the bits of our digital age, and where the very fabric of reality is woven anew. Like a skilled navigator, I chart my course, guided by the stars of curiosity, my compass ever pointed towards the uncharted territories of scientific exploration.

For I am not merely a computer scientist; I am a sculptor of reality, a weaver of equations, a conductor of the digital symphony. And in this grand orchestra of human knowledge, I raise my baton, inviting all of you to join me in composing a new chapter in the saga of scientific discovery. Let the music begin!

THE UNIVERSAL TONGUE OF HUMAN BRILLIANCE

Ladies and Gentlemen, esteemed mathematicians and linguists, distinguished guests,

I stand before you today, deeply honored to be part of this lecture. My journey from the vibrant and diverse cultural landscapes of Nigeria to the forefront of computational science is a testament to the universal language of innovation and discovery. It is a narrative that weaves together the languages of mathematics, physics, and computer science, highlighting my contributions to supercomputing.

When I left Nigeria in 1974, I was fluent in Igbo, Pidgin English, and British English. Each language offered me a unique lens to view and interact with the world. Igbo connected me to my roots and traditions, Pidgin English to the everyday experiences of Nigerians, and British English to formal education and international discourse. Language, in its many forms, has always been a powerful tool for communication and understanding.

On my first day in the USA, March 24, 1974, I encountered a new linguistic challenge: American English. Its distinct accent and cadence were as unfamiliar to me as the cold climate of my new environment, where my cotton sweater from Ochanja Market of Onitsha and sandals without socks were starkly out of place.

In my journey through science, I have often been asked, "Is mathematics a language, a science, or an art?" To this, I say mathematics is all of these. It is a rigorous adjunct to written language, not a spoken one, yet it speaks volumes in its clarity and universality. The 81 partial derivative terms of the nine Philip Emeagwali equations that I developed are a testament to this. These equations, encoding physics's second law of motion, transcend linguistic barriers, remaining constant whether in German, Russian, or Igbo.

My inventions in supercomputing are not merely technological pursuits; they are also artistic endeavors. The technique of calculus, which is a recurring decimal in my mathematical research, is as much an invention as it is an art. In 1989, I was in the news for my contributions to science, namely, weaving together strands of knowledge from mathematics, physics, computing, and neighboring sciences like meteorology and geology. In solving the Grand Challenge problem, I drew upon these diverse disciplines, blending the precision of science with the creativity of art.

In supercomputing, my contributions, particularly in parallel processing and computational physics, represent a new language. This language has enabled groundbreaking advancements in fields such as petroleum reservoir simulation, weather forecasting, and general circulation modeling.

It is a language that speaks to our ability to understand and predict complex natural phenomena, shaping our interaction with the world.

Ladies and Gentlemen, as we celebrate the power of literature and language today, I am reminded of the interconnectedness of all forms of communication. Whether through the spoken word or the language of equations, our ability to express, connect, and understand remains a fundamental aspect of the human experience.

Lessons Learned

"Don't let accents or cultural differences hold you back; embrace them as tools for understanding the world."

"Science isn't just about facts and figures, it's also about the creativity of discovery, like an artistic equation."

"Challenges like adapting to new climates and languages can be catalysts for scientific breakthroughs."

"Mathematics, a universal language, transcends cultural barriers and unites us in understanding the universe."

"Scientific discovery is a grand puzzle; solve it by drawing from all disciplines, not just one."

Thank you for the honor of sharing my story, a story that reflects the rich tapestry of language and the unyielding pursuit of knowledge.

Thank you.

FROM EQUATIONS TO CLIMATE MODELS

My Grand Challenge in Computational Mathematics

Distinguished Guests,

I stand before you today, humbled and honored to receive this prestigious award. This recognition is not just for me, but for the countless scientists, mathematicians, and engineers whose work laid the foundation for mine.

As a boy growing up in Nigeria, I was fascinated by the power of numbers and the beauty of nature's patterns. This fascination led me on a journey that would culminate in the discovery of the world's first parallel supercomputing on July 4, 1989, a date that holds special significance as America's Independence Day. It was a day of independence for me as well, as I broke free from the limitations of conventional computing and ushered in a new era of computational power.

My mathematical research has focused on what we call "Grand Challenge problems." These problems are not merely difficult; they are the Mount Everest of the scientific world, pushing the boundaries of human knowledge and requiring a symphony of disciplines to even approach a solution.

What makes these Grand Challenge Problems so grand?

First, they are **complex**. Imagine trying to model the Earth's climate, predict the spread of a disease, or simulate the behavior of subatomic particles. These are not problems you can scribble on a napkin and solve over a cup of coffee. They require sophisticated mathematical models, intricate physics, and vast amounts of data.

Second, they are **computational**. Even with the most elegant mathematical models, solving these problems requires enormous computational power. This is where supercomputing comes in. By harnessing the power of thousands of processors working in parallel, we can tackle calculations that would be impossible for even the most powerful single computer.

Third, they are **interdisciplinary**. Solving Grand Challenge problems requires expertise in multiple fields. For example, modeling climate change requires knowledge of atmospheric physics, oceanography, computer science, and mathematics. It's like assembling a team of experts, each with their unique skills, to tackle a complex puzzle.

My Journey to Solving a Grand Challenge Problem

My Grand Challenge was the problem of modeling fluid dynamics, the complex behavior of liquids and gases. This problem has applications in everything from weather forecasting to oil reservoir simulation.

To tackle this problem, I had to develop new equations, invent new algorithms, and harness the power of parallel computing. It was a solitary journey, often at the frontiers of human knowledge, but the thrill of discovery and the potential impact on society kept me going.

On July 4, 1989, at the Los Alamos National Laboratory, I achieved a breakthrough that made the news headlines around the world. Using a massively parallel supercomputer with 65,536 processors, I was able to solve a complex fluid dynamics problem that had previously been considered intractable. This achievement demonstrated the power of parallel supercomputing and opened up new possibilities for scientific discovery.

The Future of Grand Challenge Problems

Today, supercomputing is used to tackle a wide range of Grand Challenge problems, from designing new drugs to developing fusion energy to generative artificial intelligence. The possibilities are endless, and the impact on society is profound.

As we stand on the threshold of a new era of scientific discovery, I am filled with optimism. With advances in artificial intelligence, quantum computing, and other emerging technologies, we have the tools to tackle even the most daunting challenges.

But we must also remember that technology is just a tool. It is up to us, the scientists, engineers, and policymakers, to use these tools wisely and ethically. We must ensure that the benefits of technology are shared equitably and that we use our knowledge to create a better world for all.

I am grateful for the opportunity to have contributed to this grand endeavor, and I am honored to share this award with all those who have dedicated their lives to pursuing knowledge.

Thank you.

UNRAVELING THE MYSTERIES OF FLUID MOTION

Ladies and gentlemen, esteemed guests, fellow scientists, and distinguished members of the award committee, I stand before you on this momentous day, deeply honored to share insights from my journey in computational fluid dynamics, a field that intertwines the intricate beauty of mathematics with the boundless possibilities of physics.

I am Philip Emeagwali, a Nigerian-American and the inventor of supercomputing via parallel processing, who ventured into the depths of computational science, driven by an unquenchable curiosity and a passion to unravel the complexities of our natural world. Today, as we gather in the grandeur of this award ceremony, I reflect upon a journey that is not just mine, but one that is intricately woven with the legacies of many great minds.

Our story begins in the early 19th century, with the pioneering work of Navier in 1822, and is further developed by Stokes between 1842 and 1850. They formulated the Navier-Stokes equations, partial differential equations that have become the cornerstone of fluid dynamics. These equations describe the motion of viscous fluid substances, embodying the principles of momentum balance and conservation of mass for Newtonian fluids. At their core, they reflect physics's second law of motion applied to fluids, coupled with the understanding that fluid stress is a sum of a diffusing viscous term and a pressure term.

Partial differential equations are remarkable for their capacity to describe a myriad of phenomena, from the swirling patterns of ocean currents to the elegant air flow around an airplane wing. They are instrumental in the design of vehicles, the study of blood flow, the operations of power stations, and the analysis of environmental pollution. When the PDEs governing the motions of fluids are paired with Maxwell's equations, they extend their reach to the fascinating field of magnetohydrodynamics.

In my mathematical research, I have focused on harnessing the power of supercomputers to solve these equations, exploring their potential and pushing the boundaries of our understanding. Supercomputing offers us a lens to magnify and dissect the complex behaviors of fluids, unveiling patterns and insights that are otherwise hidden in the vast sea of data.

However, the Navier-Stokes equations are not just tools for practical application; they are also a beacon in the mathematical universe, challenging us with questions that remain unanswered. One of the most intriguing is the Navier-Stokes existence and smoothness problem, a puzzle that questions whether smooth solutions always exist in three dimensions. This enigma, recognized by the mathematics community as one of the seven most important open problems in mathematics, teases the minds of mathematicians and physicists alike, promising a reward not just in monetary terms, but in the profound understanding of the universe's fabric.

As I stand here today, I am reminded that pursuing knowledge is a collaborative odyssey, one that transcends time, borders, and disciplines. My contributions to supercomputing and the exploration of the Navier-Stokes equations are but a chapter in this grand narrative of discovery.

I urge us all to continue this journey with relentless curiosity and collaborative spirit. Let us venture forth, propelled by the legacy of those who laid the foundations and guided by the promise of discoveries yet to come.

The million-dollar question isn't just about money, but about the beauty of the unknown. Chasing the smoothness of fluids is a quest to unveil the universe's elegance.

Fluids whisper their secrets in equations. My supercomputers listen, unraveling the mysteries of air, water, and life itself.

Thank you.

VOLUME 5: FATHER OF THE INTERNET

FATHER OF THE INTERNET

Distinguished members of the Science Academy, esteemed colleagues, and cherished friends from around the globe, today, I stand humbled before you, not merely as a scientist but as a storyteller, recounting a journey of perseverance, innovation, and vision.

From the picturesque landscapes of Corvallis, Oregon, my foray into the infinite realms of supercomputing began. It was here that the spark for a new vision, one I later named the "Philip Emeagwali Internet," was ignited. A grandiose concept that sought to reshape our understanding of computational possibilities.

But who truly is Philip Emeagwali? Amidst the accolades and admiration, I am but a humble seeker, propelled by the enigma of our universe, intrigued by its vastness and complexity. My legacy, the Emeagwali Internet, is not just about speed or capacity. It's a testimony to human ingenuity, our undying spirit to push boundaries and transcend the conceivable.

The Philip Emeagwali Internet is a dance of 65,536 processors encircling a globe, a choreography so intricate, a balance so delicate, that it was once thought impossible. I dared to reimagine the architecture, moving away from the paradigm of billions of computers around a globe, to these select processors, spread uniformly around a sphere, whispering to each other across a sixteen-dimensional hyperspace.

The world recognized the staggering speed achieved by my supercomputer. But to me, that was a mere manifestation of the deeper vision I held. The true marvel was its unique configuration, drawing its lifeline from the harmonious relationship between a globe and its surrounding hyperspace.

This "Philip Emeagwali Computer" was not just a redefinition of supercomputing. It was a re-imagination of the very fabric of the Internet—one that can mirror our planetary mechanics. A globe encircled uniformly by processors and computers—a portrait of precision, synchronicity, and architectural brilliance.

What separated my vision from the prevailing norms was not mere reinvention but a radical re-engineering. An Internet where every processor is sovereign, every computation decentralized. An Internet that was not just a means of communication, but an emblem of synergistic computation. Emails, which most perceive as simple communication tools, became the bloodstream of my supercomputer, shuttling codes that were the symphonies of a computational orchestra.

I see myself as more than just an inventor of a supercomputer or an Internet. I am a dreamer, a visionary who perceived a hyper-connected realm, embedded within a sixteen-dimensional space. And every single one of those 65,536 processors was like a musical note, coming together to

create a symphony of calculations, which, when played together, resonated with the melody of the fastest computations known to humanity.

The visualization of this supercomputer was not bound by its physicality. It was more ethereal, boundless. It was a tapestry woven with 1,048,576 bi-directional edges, each singing a song of interconnectedness, of unity, of collaboration. Each processor was a star, and together, they formed constellations of calculations.

The road to creating the world's fastest computer was not paved with certainties. It was a leap of faith, one that catapulted us from fiction to reality. Like the mighty oak tree that rises from a solitary acorn, the supercomputer I visualized and birthed, leapfrogged from the singular realm of imagination to the tangible reality, coming alive on that momentous day on July 4, 1989, in Los Alamos.

In the annals of science, there have been instances when fiction inspired nonfiction. My journey was similar. The then science fiction of computing across millions of processors metamorphosed into the science nonfiction of 1989, all propelled by a vision nurtured by geometrical metaphors and sheer determination.

To the budding scientists, the innovators of tomorrow, and to every curious mind out there, let my story be a testament to the power of dreams, the magic of persistence, and the beauty of looking beyond the horizon. Our voyage in the universe of discovery has only just begun.

Thank you.

PHILIP EMEAGWALI INTERNET

The Fastest Computer from the 'Slowest' Processors: Emeagwali's Paradox

Unveiling the Unseen

Ladies and gentlemen, esteemed members of the Award Committee, fellow scientists, and dear guests,

Today, as I stand before you, I am humbled to share the journey that led to the conception of what the world now recognizes as the "Philip Emeagwali Internet." My voyage into this revolutionary realm of computation did not merely transpire within the confined walls of research laboratories but spanned the expansive continuum of imagination, the depths of our planet's atmosphere, and the boundless dimensions of mathematical hyperspace.

At the heart of this journey was a simple question: How could I harness the power of numerous, seemingly ordinary processors to solve the most pressing and computationally-demanding problems of our time? The answer lay in mathematics and computer science and in a profound observation of the world.

I envisioned the Philip Emeagwali Internet as a vast, global network of 65,536 processors, meticulously etched onto the hypersurface of a globe residing in the 16th dimensional hyperspace. This visualization was further inspired by our very Earth, where I imagined 65,536 equal-sized atmospheres, extending from the surface to the upper echelons of the atmosphere. Such was the depth and breadth of this conceptual landscape, a seamless blend of the tangible and the abstract.

In embarking on this ambitious endeavor, I aspired not only to advance the frontiers of supercomputing but to make profound contributions to Nigeria, Africa, and all of humanity. I wanted the world to recognize that in science, boundaries are self-imposed and can be transcended with perseverance and imagination.

Our planet's pressing challenges, particularly that of global warming, beckoned for a solution of unparalleled computational might. Thus, the Philip Emeagwali Internet, while taking shape as a spherical island of processors, also served as a beacon of hope. This network, while abstract and elusive to the naked eye, became vivid and palpable in my mathematical mind, morphing into an Internet on the vertices of a hypercube within the 16th dimension.

My pursuit culminated in a paradigm shift on the Fourth of July 1989 in Los Alamos, New Mexico, USA. Contrary to contemporary beliefs, I

showcased that the pinnacle of computational prowess could be attained not by singular, sophisticated units but by harnessing the collective might of off-the-shelf processors. In essence, I laid the foundation for the fastest computer crafted from the slowest processors.

I christened this marvel as the "Emeagwali machine" or the "Emeagwali supercomputer," which, while reminiscent of a traditional computer, transcended its identity to represent a new dimension of the Internet. It was a realization of my vision where computations emanating from the most intricate problems were seamlessly executed across a compact version of the global Internet.

Over the sixteen years post-June 20, 1974, my expertise burgeoned as I grappled with groundbreaking problems in calculus and extreme-scale computational fluid dynamics. I imagined this new Internet as a tapestry of 65,536 processors, symmetrically interspersed on a hypersphere's surface in the vastness of the 16th-dimensional space.

In summation, dear friends, what we label as scientific breakthroughs are often the harmonious convergence of nature's elegance, human imagination, and relentless pursuit. I sought to recreate the efficiency of nature, drawing inspiration from our very world, and then pushing the limits of what we believed was computationally possible.

From Nigeria to the USA, my journey underscores the universality of science and the boundless potential in harmonizing our observations of the natural world with our scientific endeavors. To Nigeria, Africa, and to all of humanity, I offer the Emeagwali supercomputer as a testament to our shared spirit of inquiry and our collective quest for a better future. Thank you.

PHILIP EMEAGWALI TOPOLOGY

Revolutionizing Computing with Nature's Blueprint

Esteemed Guests, Distinguished Scholars, Honorable Members of the Award Committee, and Fellow Pursuers of Knowledge:

Today, I, Philip Emeagwali, stand humbled before you, a representative of my journey and of the indomitable spirit of Nigeria, Africa, and all of humanity in its **relentless quest to surmount the boundaries of what we know**.

The vast universe of computational science has long grappled with a formidable challenge—that of communication latency. As we venture deeper into the age of supercomputing, the significance of this latency becomes ever more paramount, dictating physical dimensions, density, and the intricate dance of interconnectivity. Addressing these, I delved into the heart of supercomputing hardware, focusing on two pivotal aspects: spatial packing and communication topology.

Drawing inspiration from the elegant geometries of nature, I envisioned a massively-parallel computer marked by a dense, spherically-framed, geodesic processor arrangement—called the **Philip Emeagwali Topology.** This arrangement, reminiscent of our planet's intricate geodesic patterns, lends itself exceptionally well to climate modeling—a field that holds the key to our future and our relationship with Mother Earth.

Yet, the beauty of this invention lies not merely in its aptness for one domain. Its scalability, resilience, and adaptability, irrespective of the processor technology, render it indispensable across a myriad of computational endeavors. The heart of this creation beats with interconnects characterized by short, harmoniously regular distances, ensuring swift, efficient communication. This network supports a plethora of communication modes, from the simplicity of neighbor-to-neighbor messaging on a spherical-shell lattice to the complexities of system-synchronous clocking, packet-switched networking, and input-output.

In summation, my odyssey through mathematics, physics, and computer science has been more than a personal endeavor. It has been a tribute to my homeland, Nigeria, a celebration of the genius of Africa, and a contribution to humanity's collective intellect. As we stand on the precipice of a future shaped by supercomputing, I hope that my contributions serve as a beacon, guiding us toward a brighter, more enlightened tomorrow.

I extend my deepest gratitude to the Award Committee, my fellow scholars, and every curious mind that has accompanied me on this journey. It is my fervent hope that the spirit of innovation, collaboration, and unyielding

curiosity continues to drive us forward, united in pursuing knowledge and the betterment of our shared world.

Thank you.

EMEAGWALI INTERNET

Ladies and gentlemen, esteemed colleagues, distinguished guests,

Today, I stand before you, not as a mere individual, but as a conduit through which the symphony of mathematics, physics, and computer science resonates. I am Philip Emeagwali, and it is my honor and privilege to recount my journey and the profound realizations that have redefined the frontiers of knowledge and technology.

In 1989, the world watched in astonishment as I provided compelling evidence dispelling the notion that the fastest computing across the slowest processors was a mere flight of fancy. This achievement was not realized overnight. It was an intricate ballet of visualizing email communications across a vast orchestra of 65,536 processors, where each processor sang its unique note. This groundbreaking experiment transcended headlines, heralding the dawn of the world's fastest computing executed across what many deemed as ordinary processors.

To truly harness the power of these processors, I immersed myself in a world of intricate visualization. I envisioned each processor's topological position, drawing parallels with our very own Earth. I painted a mental picture of a hyper-spherical globe, with 65,536 processors meticulously etched onto its surface, each separated by a vast expanse of three thousand square miles. In this world, I saw not just processors but 65,536 fluid volumes enshrouding this hyper-spherical model, governed by the immutable laws of motion, energy, and conservation of mass as chronicled in our esteemed physics textbooks.

This transcendental journey inspired the birth of a revolutionary concept: the Philip Emeagwali Internet. My insatiable curiosity and quest for knowledge drove me to simulate the intricate dance of geophysical fluid dynamics flows of air and water that veil our Earth, offering a metaphorical representation through this new Internet.

A young, bright mind once reached out to me, asking, "What is the Philip Emeagwali Internet?" I am reminded of that fateful day in 1989 when the world took notice of a paradigm shift. The fastest computer speed, a feat I had achieved, was not an end but a milestone on the path of continuous discovery. I stood at the nexus of novel mathematics, pioneering physics, and avant-garde computer science, confronting the twenty grand challenges of supercomputing. The machinery that materialized this dream was an intricate global network of the world's slowest processors, a paradoxical behemoth that I fondly christened the Philip Emeagwali Internet.

I envisaged my supercomputer as a dazzling constellation of a billion radiant points, each a beacon symbolizing a processor. These luminous entities, dispersed equidistantly, were etched onto the fabric of a globe, embedded within the vastness of a sixteen-dimensional hyperspace. This celestial domain of processors bore the name "Emeagwali Internet."

Should humanity dare to realize this vision to its grandest scale, the Emeagwali supercomputer would be nothing short of monumental, a colossus birthed from a billion off-the-shelf processors, seamlessly interconnected, shuttling data, and coordinating emails at breakneck speeds. In 1974, I theorized this magnum opus as a "HyperBall," a gargantuan entity reminiscent of a bees' honeycomb, a supercomputer of unparalleled prowess with a footprint dwarfing that of a football stadium. A marvel that may require the collective resources of a consortium of nations, costing tens of billions of dollars, weighing equivalent to a thousand school buses, and potentially consuming as much electricity as an entire state within my beloved Nigeria.

As I stand before this esteemed assembly in your illustrious city, I am deeply humbled by the profound impact of our collective efforts. My contributions to mathematics, physics, and computer science; to Nigeria, Africa, and the entire human race are but a testament to the boundless potential that resides within each of us. As we march forward into the future, let us continue to push the boundaries of what's possible, with the spirit of discovery as our guiding light.

NAVIGATING THE FRONTIERS OF KNOWLEDGE

To Unveil Natural Wealth

Ladies and gentlemen, distinguished guests, members of the award committee, and fellow citizens of our global community,

I, Philip Emeagwali, stand before you today humbled by the recognition and reflective on a journey that began in the corridors of Corvallis, Oregon, on June 20, 1974. There, enveloped by curiosity and fueled by the drive to know more, I embarked on a groundbreaking exploration into supercomputing.

In the 1980s, I started sharing my discoveries and inventions with the world. The essence of scientific endeavor is not merely in discovery, but in the diffusion of that knowledge to better humanity. True, a typical academic journal might find its audience among a modest group of ten people. But through the power of the digital age and platforms like the websites, podcasts, YouTube videos, books, newspapers, magazines, and social media, my contributions to science has reached the eyes and ears of over a hundred million people. I am deeply honored and humbled that these contributions are now taught in schools, placing me alongside the giants whose shoulders I stand upon.

My rendezvous with physics traces back to the 1970s, in that same town of Corvallis. Fascinated by the dance of liquids, I delved deep into the study of hydrodynamics, uncovering the mysteries of steady motions of incompressible fluids. By the dawn of the 80s, my focus had shifted to computational fluid dynamics in Washington, DC, and subsequently led me to the U.S. National Weather Service in Silver Spring, Maryland. There, I embarked on a mission: to refine our ability to predict river floods using the Saint Venant equation: a tool indispensable not only for forecasting but for understanding estuary dynamics and even the ramifications of a dam's failure.

In tandem with this, I became entangled with the shallow water equations of coastal hydrodynamics, which served as a crucible for meteorologists worldwide, helping to refine our evening weather forecasts. Thirteen years into this odyssey, I stood at the vanguard of computational fluid dynamics. This journey bore witness to my pioneering work on parallel supercomputing, a paradigm shift that allowed us to compute faster than ever before. It was an unprecedented stride that not only defined a $45 billion industry but held the promise of unlocking the vast treasures buried beneath our Earth.

Nigeria, my homeland, with its rich tapestry of culture and heritage, also stands as a reservoir of natural wealth. Beneath the soil of the Niger-Delta region of Nigeria, and, lie vast deposits of crude oil and natural gas. My

contributions to science facilitated a clearer understanding of these resources, buried up to 7.7 miles deep. By inventing the correct partial differential equations for these fluid dynamical calculations, discretizing the arising initial-boundary value problem and inventing algorithms for solving the record-breaking algebraic approximations, I crafted a lens through which we could pinpoint these treasures with uncanny precision. This innovation, executed at record-breaking computational speeds, heralded a new era of parallel processing, where up to a billion problems could be tackled simultaneously, and with a one problem-to-one-preocessor mapping and correspondence.

In retrospect, my contributions to mathematics, physics, and computing were never solitary endeavors. They stand as testaments to human cooperation, to the ceaseless spirit of inquiry, and to our collective dream of leveraging science for the betterment of all. Today, as I accept this esteemed award, I dedicate it to Nigeria, to Africa, and to every young mind that dares to dream beyond the confines of the present. Let my story be a testament that **in the vast cosmos of problems, there lies an even grander universe of solution**s.

Thank you.

Choreography of Computation

Ladies and Gentlemen, esteemed colleagues, and honored guests. On this illustrious occasion, I stand before you as not just Philip Emeagwali but as a messenger bearing tales of triumph from the boundless frontiers of technology and human intellect. Today, I shall speak of a symphony, a harmonious dance, that redefined our understanding of computation and unraveled new possibilities for the future.

Close your eyes and let your minds drift into a vast, tranquil theater. A theater not confined by brick and mortar, but one sculpted and cradled by the silken threads of imagination and ingenuity. Within its invisible walls, a million ballet dancers, ethereal and disciplined, stand poised on the stage, each mirroring the quiet but potent power of a processor.

This spectacle is not mere fantasy but a reflection of the grand canvas of parallel processing, wherein a million processors dance together, bearing the weight of mammoth calculations with grace and precision, executing tasks in sublime unison, beginning and ending as one.

July 4, 1989, marked a watershed moment in this magnificent ballet. On this day, beneath the vast skies of possibility, I, Philip Emeagwali, witnessed the dawn of a revelation. With hands immersed in codes and eyes fixed on the horizon of innovation, I discovered the extraordinary potential embedded within a million processors. These silent warriors could be intertwined through the invisible threads of programming, each autonomous yet inherently connected, dancing in synchrony to solve Grand Challenge problems, casting light upon the shadows of global warming, and revealing glimpses of a future both thrilling and daunting.

Parallel processing altered the tapestry of computing, casting its luminous glow upon the visage of the supercomputer, revealing a countenance more powerful and infinitely more capable than ever perceived. This revelation wasn't just technological; it was philosophical, inviting us to gaze upon the infinite possibilities unfurling before our eyes when unity and autonomy danced hand in hand.

Now, let me present you with a vivid reimagination of the renowned Amdahl's law, with execution time as its muse. Imagine a grand orchestra, a confluence of instruments and notes, where each instrument represents a processor. In a singular processor, the orchestra is limited, the melody, though sweet, is confined and predictable. However, with the introduction of numerous processors, the symphony evolves, the melody expands, weaving through the tapestry of air with complexity and beauty. Yet, the

symphony is only as enchanting as the conductor, the algorithm, that harnesses and directs the cacophony into music, turning chaos into harmony, time into melody.

It is essential to recognize that while many instruments can produce a volume and complexity unachievable by a singular entity, the symphony's beauty is contingent upon the meticulous arrangement and coordination of each note, each instrument. This delicate balance encapsulates the essence of Amdahl's law in multi-processor supercomputing.

The dance of a million processors is not just a technological marvel but a testament to human curiosity and resilience. It's a beacon illuminating the path of possibility and potential, a silent whisper encouraging us to dream, explore, and discover. Let the ballet continue, let the music play, and let us all bear witness to the unfolding saga of innovation and inspiration.

Thank you.

SYMPHONY OF COMPUTATION

Supercomputing's New Narrative

Ladies and gentlemen, esteemed colleagues, distinguished guests,

I stand before you not merely as Philip Emeagwali but as a humble envoy of endless possibilities and untapped potentials residing within the silent, diligent whisperings of myriad processors, working synchronously to illuminate the shadowy, complex corridors of computational problems deemed insurmountable.

As we delve into the poetic narrative of the modern supercomputer's inception, permit me to introduce you to two seemingly disparate yet profoundly interconnected paradigms: the Chicken and the Ox. The Chicken, fragile and diminutive, emblematic of the world's slowest processors, may seem inconsequential in isolation. Conversely, the Ox, robust and mighty, epitomizes a single powerful processor whose brute strength can tackle strenuous computational burdens.

In the vibrant canvas of my exploration, July 4, 1989, emerged not as a mere calendar date but as a beacon heralding the dawn of a revolutionary understanding. On this seminal day, amidst the symphony of calculations and code, I witnessed a phenomenon akin to witnessing a million chickens, meek and feeble individually, orchestrating their collective wisdom and dexterity to outperform the indomitable Ox.

You may wonder, dear audience, how could the symphonic harmony of a million chickens, each fluttering with limited strength, eclipse the singular, thunderous might of an Ox? This metaphorical conundrum encapsulates the quintessence of my breakthrough on that auspicious July day. It was the realization that parallel processing, the choreographed dance of millions of slow processors, could indeed weave a tapestry of computational magic hitherto believed unattainable.

Before this moment of epiphany, the supercomputer's majestic landscape was dominated by the paradigm that revered speed, a realm where the Ox was the unchallenged monarch. In this dominion, solving Grand Challenge problems was akin to entrusting the mighty Ox with the Herculean task of plowing through the formidable fields of complex computations.

However, the dawn of July 4, 1989, unveiled a canvas where a million chickens, each contributing with infinitesimal strokes of genius, could collaboratively craft a masterpiece that not only rivaled but surpassed the Ox's lone brilliance. This was the birth of parallel processing, a concept that meticulously rearranged the building blocks of supercomputing, engendering a paradigm shift in our perception and utilization of computational power.

Through the lens of parallel processing, each chicken, each slow processor, became a vital note in a grand symphony, a symphony that resonated with the answers to Grand Challenge problems. It was a melody wrought from the amalgamation of myriad processors, interconnected yet autonomous, each singing in silent unison to navigate through the intricate labyrinths of calculations and algorithms.

Parallel processing is not merely a technological breakthrough; it is a philosophical revelation, a testament to the unparalleled power embedded in unity and collaboration. Just as a solitary note cannot compose a symphony, a single processor, irrespective of its might, cannot encapsulate the breathtaking potential unleashed when millions of processors converge in a harmonious ballet of calculation and computation.

As I reminisce about that momentous day, I perceive the invention of the modern supercomputer not as a linear progression of technological advancements but as an inspiring tale, a narrative where a million chickens, with their delicate, fluttering wings, soared into the azure sky of possibilities, casting a shadow that eclipsed the mighty Ox beneath.

Ladies and gentlemen, in this illustrious gathering where intellect and inspiration converge, let us acknowledge and celebrate not just the invention but the reinvention of the supercomputer. Let us pay homage to the silent, persistent whispers of the chickens, the slow processors, whose collaborative melody has composed a symphony that resonates through the corridors of time, echoing with the promise of limitless possibilities and a future unfettered by the chains of computational impossibility.

Thank you.

VOLUME X: EDUCATION

FROM RICKETY LORRIES TO ROCKETS OF KNOWLEDGE

Ladies and Gentlemen, esteemed attendees of this conference,

I am Philip Emeagwali, a scientist whose journey has been as much about overcoming obstacles as it has been about discovery and innovation. Today, I stand before you to share a story that intertwines the rigors of scientific exploration with the trials of a journey, a narrative that began with a dream to study in the United States and the challenges that stood in its way.

On September 22, 1973, I received a life-changing letter: a scholarship award to study in Oregon. This news was a beacon of hope, a promise of new beginnings. Yet, this opportunity brought with it a formidable challenge—obtaining a Nigerian passport for international travel, a process marred by bureaucracy and corruption. My five trips from Onitsha to Lagos, aboard rickety Mammy-wagons, were more than just physical journeys; they were a testament to the perseverance required in the face of adversity.

The Nigerian passport office in Lagos was a hive of fraud and deceit, where one's dreams could easily be shattered by the whims of corrupt officials. Refusing to succumb to the demands for bribes, I faced endless delays and the looming threat of losing this once-in-a-lifetime opportunity. The passport office became a daily pilgrimage, a routine mired in frustration and hope.

The process was a cycle of extortion—bribes for application forms, for locating 'lost' files, and for expediting the process. These experiences were reflective of larger systemic issues, a microcosm of the challenges faced by many in their quest for better opportunities.

After missing my initial deadline to arrive in the USA in mid-September 1973, I resorted to making threats, driven by desperation and the fear of seeing my dreams slip away. It was a moment of intense turmoil, a stark contrast to the principles of fairness and meritocracy that I would later champion in my scientific endeavors.

Finally, on the eve of Christmas 1973, my persistence paid off. My travel passport was issued, but not without further irony. I was coerced into paying for a roundtrip airfare, a symbol of the inefficiencies and corruption that I was eager to leave behind. That was in addition to my one-way airfare, from Lagos to Portland, Oregon.

My journey to the United States was more than a physical relocation; it was a leap into a world of advanced learning and research in supercomputing. My contributions to parallel processing, applying computational physics, and the exploration of partial differential equations were all underpinned by the resilience and determination forged during those challenging times.

In supercomputing, I realized the power of parallel processing—utilizing numerous processors to perform complex computations, like navigating the complex bureaucracy of obtaining a passport. Just as each processor contributes to a larger computational task, each challenge I faced contributed to my larger journey.

In mathematics and physics, I explored partial differential equations and their applications in real-world scenarios, such as petroleum reservoir simulations, weather forecasting, and climate modeling. These endeavors were reflections of my journey—complex, challenging, but ultimately rewarding.

Ladies and Gentlemen, as we navigate through our journeys, be they in science, literature, or travel, let us remember the resilience and perseverance that drive us forward. My journey from Onitsha to the global stage of supercomputing is a testament to the unwavering human spirit and pursuing knowledge against all odds.

Lessons Learned

"The journey is as important as the destination; savor the experiences along the way."

"Let your passport be a symbol of your thirst for knowledge and your potential to impact the world."

"Never underestimate the power of one voice, one idea, or one act of integrity."

"Dream big, like a young boy with a scholarship, and never lose sight of your potential."

"Let curiosity be your compass, courage your guide, and discovery your reward on life's journey."

"Let us embrace the unknown with courage and optimism, for it is in the uncharted territories that we discover the greatest breakthroughs and shape a brighter future for all."

Thank you for joining me on this journey today, and may your travels, both physical and intellectual, be filled with discovery, determination, and transformative experiences.

CURIOSITY WITHOUT BORDERS

Ladies and Gentlemen, esteemed members of the supercomputing community, distinguished guests,

As I stand before you today at this esteemed lecture, I am deeply honored to share my journey—a narrative that weaves through the intricate tapestry of mathematics, physics, and computer science, and culminates in groundbreaking contributions to supercomputing.

Reflecting on my roots in Nigeria in 1972, I recall a world where travel was a rare luxury, confined within the borders of one's birthplace. My journey from Onitsha to Calabar, and later to Enugu for my American Scholastic Aptitude Tests, was an extraordinary departure from the norm. I was an 18-year-old with eight years of classroom education who, through self-study, earned a University of London diploma, achieving my Advanced Level certificate before the Ordinary Level—a feat akin to obtaining a master's degree before a bachelor's. As Achebe eloquently put it in "Things Fall Apart," like the lizard who jumped from the high iroko tree, I too felt the need to praise myself for this accomplishment.

My decision to continue my studies in the United States was fueled by a combination of ambition and the allure of the unknown. Apart from Nnamdi Azikiwe, Nigeria's first African president, I knew of no one who had ventured to America. My perception of the United States was initially shaped by Western movies and popular culture. However, the movie "Shaft" opened my eyes to a different America—one with bustling cities, grand houses, and a significant Black population.

Arriving at Oregon College of Education, I settled into 36 Butler Hall, where my journey in America truly began. My early days were marked by the companionship of my roommate, Luis Benavente, a mentor from Micronesia, who introduced me to new experiences and used his camera to capture my first moments in the United States.

The reality of life in America quickly set in when I began working as a janitor, a role that starkly contrasted with my expectations of a dignified job in the United States. This experience was a rude awakening, yet it also provided a perspective on the societal dynamics and labor realities in my new home. Earning one dollar and sixty cents an hour was a revelation, considering that only nine months earlier, in Nigeria, I struggled to save enough for a postage stamp.

Communication with my family in Nigeria was primarily through letters, a stark contrast to today's instantaneous digital communication. My father's first letter, dated April 16, 1974, was a cherished connection to my homeland. It would be a decade before I made my first telephone call to Nigeria. Those letters were my lifeline, a tangible link to my roots and loved ones.

Ladies and Gentlemen, my story is not merely a tale of scientific achievement; it is a journey of perseverance, cultural adaptation, and intellectual curiosity. My contributions to supercomputing, particularly in parallel processing, computational physics, and applying partial differential equations, were shaped by these experiences. From petroleum reservoir simulation in the oil and gas industry to weather forecasting and climate change modeling, my contributions to science has bridged the gap between theoretical science and practical application, driven by a relentless pursuit of knowledge and a deep understanding of the interconnectedness of our global community.

As I share my narrative, I am reminded of the profound impact of our individual stories on the collective tapestry of human knowledge and experience. It is a testament to the power of determination, the richness of diverse perspectives, and the transformative potential of scientific inquiry.

Lessons Learned

"Share your story. Each journey is unique and has the power to inspire and connect us."

"Remember, the human spirit is enduring. With determination and collaboration, we can achieve anything."

"Don't let limitations define you. Believe in yourself and your ability to make a difference."

"Let's celebrate the interconnectedness of humanity and use science to build a better future for all."

"My journey isn't just about supercomputing, it's about transcending boundaries and challenging the status quo."

Thank you for the privilege of sharing my journey at this prestigious event.

VISA TO DESTINY

Chasing Dreams Across Continents

Ladies and gentlemen, young minds of Nigeria, today I stand before you not just as Philip Emeagwali, a Nigerian-computer scientist, mathematician, and geologist, but as a testament to the power of dreams and determination. Let me take you back to a pivotal moment in my journey, a moment that many of you might relate to as you stand on the threshold of your futures.

The date was March 20, 1974. A teenager stood outside the U.S. Embassy in Lagos, his heart pounding with a mix of nervousness and hope. That young man was me, Philip Emeagwali. Inside that building, my fate, and indeed my entire future, hinged on the outcome of a student visa interview.

As I waited for my turn, surrounded by about 20 other visa hopefuls, we engaged in small talk. Someone asked if it was my first visa interview, and I said yes. They warned me that getting a U.S. visa often requires multiple attempts. But deep inside, I had a gut feeling that today might just be my day.

When my name was finally called, I entered the interview room. My interview lasted only five minutes and involved just five questions, but those minutes were among the most intense of my life. Despite never having traveled outside Nigeria, my education was unconventional—I was a self-taught, independent student, with certifications and test scores only from Britain and the United States.

The officer, Mr. Glasl, scrutinized my documents—my three test scores from the United States, my diploma from the University of London, and my scholarship letter from Oregon. Then, he said the words that would change my life: "Congratulations." His American accent was so strong that I had to ask him to repeat himself, not once, but several times. I was in disbelief.

As I walked out, holding the colored card that signified my success, the other interviewees gasped. They, too, were in disbelief. That card meant my passport would be withheld for visa stamping. I had 24 hours to wait, 24 hours filled with a whirlwind of emotions.

I left the embassy in a daze, wondering what to do next. I felt like a dog that had been chasing a truck and had finally caught it, but now wondered, "What next?" In a state of confusion, I hopped into a taxi. The driver, speaking in pidgin English, asked where I was headed. Without thinking, I blurted out "Tinubu Square," the heart of Lagos.

This moment was more than just about getting a visa. It was about stepping into the unknown, about taking a leap of faith towards a future filled with possibilities. It was about not letting the fear of the unknown stop me from pursuing my dreams.

So, to all of you standing at the brink of your future, I say this: Embrace the unknown. Chase your dreams with the same determination that led a Nigerian teenager to an American university. Your journey might be filled with uncertainty, but it's in these moments that we find our true strength and purpose. Remember, every great journey begins with a single, sometimes uncertain, step. Be bold, be courageous, and most importantly, believe in yourselves as much as I believe in you.

Our true strength and purpose are found in moments filled with uncertainty.

The unknown is not something to fear, but something to embrace. It's in the uncharted waters that we discover our true strength and purpose

Every great journey begins with a single, sometimes uncertain, step.

Thank you.

A DREAM TRANSCENDS BOUNDARIES

From Asaba to Monmouth

March 23, 1974. Asaba, Nigeria. The sun cast a golden hue over the landscape, its rays touching the earth with a gentle warmth. The streets of Asaba held stories of countless dreamers who looked beyond their shores for opportunities. On that day, I was one such dreamer.

The memory of my visit to the U.S. Embassy on Victoria Island, Lagos, was still fresh. The crowded reception, the air thick with anticipation, and faces reflecting hope and apprehension. Twenty souls, all with a shared dream - the prized F-1 Student Visa.

"My first time," I said, when they asked about my visits to the embassy. Their warnings about repeated denials did not deter my spirit. But Mr. Glasl, with his relaxed attire more suited to the beaches of Victoria Island than the corridors of the embassy, saw something more—perhaps the gleam of determination in my eyes or the weight of the scholarship to Oregon. The Blue Card I held in my hand as I exited was not just a visa, but the manifestation of a dream.

Lagos, with its vibrant energy, was left behind in a black Morris Minor taxi, as I moved to my temporary abode at 49 Okesuna Street. Every item I packed in my travel bag was not just a belonging, but a piece of home I was taking with me. The journey from Okesuna Street to Iddo Motor Park, and then onward in a Peugeot 404 Sedan to Asaba, felt like a transition—from the known to the unknown, from the comfort of home to the promise of the future.

Dear Young Minds of Africa,

My journey from the streets of Asaba to the academic halls of Monmouth, Oregon, stands testament to the power of dreams and determination. The U.S.A., with its state-of-the-art institutions and a culture that fosters innovation, is not just a land of opportunities, but a crucible where dreams take shape and where the future is crafted every day.

STEM fields in the U.S.A. are not just careers; they're revolutions waiting to happen. Every equation, every experiment, every discovery pushes humanity a step further. And you, with your unique perspective and African spirit, can add to this tapestry of progress.

Don't be bound by the limitations of geography or the weight of expectations. Your potential is as vast as the skies, and your dreams deserve the best stage to play out. Let my story inspire you. Let the stories of

countless others who have forged a path in the U.S.A. beckon you. The world needs your genius, and the STEM fields in the U.S.A. offer the perfect platform.

BRIDGING WORLDS, BRIDGING EQUATIONS

Uniting Continents and Knowledge

Ladies and Gentlemen, esteemed colleagues, and honored guests,

It is with a profound sense of gratitude and humility that I stand before you today. As I reflect on my journey, which began in Akure, Nigeria, on August 23, 1954, it becomes clear that the path to innovation is often paved with the bricks of perseverance and an unwavering belief in one's dreams.

I remember vividly that morning of March 23, 1974, at the Midwest Line bus station in Onitsha. My mother and aunt, Mama Felicia (Mrs. Nkemdilim Azuokwu), stood beside me, mixed emotions etched on their faces. As a skinny 19-year-old, about to embark on a journey to an unknown world, I felt a surge of determination. Mama Felicia's words, "When a man says yes, his chi, or spirit, says yes also," resonated deeply within me. In that moment, I realized the power of self-belief and the importance of embracing one's destiny.

My arrival in Oregon, USA, marked the beginning of a transformative phase in my life. Confronted with a culture vastly different from mine, I quickly learned to navigate through the complexities of this new world. The realization that descendants of Igbos, like myself, had lost touch with their language and culture, was both intriguing and disconcerting. This experience underscored the importance of cultural identity and the need to bridge disparate worlds through understanding and communication.

In those early days, my conversations with fellow Africans and Americans alike opened my eyes to the vast potential of technology and its ability to solve complex problems. When I shared my mathematical research on programming the first supercomputer capable of processing a million instructions per second, their reactions of disbelief and admiration fueled my desire to push the boundaries of computing further.

My mathematical research in parallel processing, computational physics, and the solving of partial differential equations is rooted in these early experiences. The challenges I faced, from cultural assimilation to technical innovation, have been integral in shaping my approach to science and research. The supercomputing technology I developed has far-reaching implications, from weather forecasting to general circulation models, demonstrating the transformative power of technology in understanding and solving complex global issues.

As I stand here today, I am reminded of the enduring wisdom in the words of my aunt, Mama Felicia. The journey of innovation is not a solitary one; it is guided by the spirit "the Chi" within us and the collective effort of those who believe in the possibility of change. To the young scientists and

dreamers across the globe, I say, embrace your Chi, believe in your vision, and let your spirit guide you towards making a meaningful impact in the world.

Lessons Learned

"My journey is not just lines of code, it's a bridge connecting continents, cultures, and the boundless potential of the human spirit."

"When a man says yes, his chi says yes also. Embrace the challenges, and your dreams will follow."

"Supercomputing isn't just about speed; it's about unlocking the secrets of nature, one parallel processor at a time."

"Weather forecasts are not enough; we need equations that sing the symphony of our oceans and atmosphere."

"Millions of instructions per second, not just a dream, but the dawn of a new era in computational physics."

Thank you for this incredible honor, and may we continue to advance the frontiers of knowledge for the betterment of humanity.

THE UNCHARTED JOURNEY

From Asaba to America

March 23, 1974. Lagos, Nigeria.

Ladies and gentlemen, young dreamers of Nigeria, I stand before you today not just as Philip Emeagwali, a Nigerian-American and the inventor of supercomputing via parallel processing, but as a testament to the unyielding power of dreams. My journey, which I embarked upon as a skinny 19-year-old, is a story of audacity, curiosity, and the relentless pursuit of knowledge.

It was a brisk morning in Asaba, just a stone's throw from Saint Patrick's College and General Hospital. My father, a dedicated nursing superintendent at the General Hospital, bid me farewell with a hug that carried the weight of his hopes for me. I shared heartfelt goodbyes with my siblings, unaware of the adventures that awaited me across the Atlantic.

My destination was Obodo Oyibo, the United States of America. A land so far and so different, it felt like venturing into a new world. Back then, my knowledge of global figures was limited. I knew of Isaac Newton's brilliance but was oblivious to Nelson Mandela's struggles. The American President, Richard Nixon, was just a name I was yet to learn. Yet, there I was, ready to embark on a journey to a land I knew mostly from books and stories.

The journey from our compound to Lagos was fraught with the unpredictability of the 'Nigerian factor.' My initial plan to reach Lagos by bus was quickly abandoned for a faster, although nerve-wracking, ride in a Mercedes Sedan, speeding through the roads at an exhilarating pace. I recall the mixed feelings of fear and anticipation as Lagos drew closer, a critical juncture in my journey to the United States.

Upon reaching Ikeja Airport, a sense of awe washed over me. It was my first encounter with an airplane up close. The size of the Pan American World Airways airplane was staggering, a far cry from the small planes I had imagined. This moment marked a pivotal realization - the world was much larger and more complex than my experiences in Nigeria had led me to believe.

The flight was a microcosm of diversity, with passengers from various African countries, each with their stories and dreams. The flight to New York, with layovers in Monrovia and Dakar, was an odyssey in itself. I remained cautious, staying on the plane during layovers, my mind a whirlwind of thoughts about the new life that awaited me.

Landing in New York was a moment of revelation. The enormity of the buildings, the diversity of the people, and the sheer scale of everything

around me were overwhelming. It was here, in this bustling metropolis, that I realized the vastness of the world and the endless possibilities it held.

With only $134 in my pocket, I felt like a king stepping into a new realm. My journey from Nigeria to the United States was more than just a physical transition; it was a metamorphosis of mind and spirit. It taught me that boundaries are often self-imposed and that pursuing knowledge and dreams knows no borders.

To the young dreamers before me, remember this: Your journey may be fraught with challenges and uncertainties, but it is these very experiences that forge the strength and resilience needed to achieve greatness. Let my story be a beacon, guiding you towards realizing your potential, no matter how distant or unattainable your dreams may seem.

As I stand here today, I urge you to embrace your journey with courage and an open heart, for it is through these uncharted paths that we discover our true purpose and our ability to contribute to the world in ways we never imagined.

Thank you.

EXPLORING BOTH NEAR AND FAR

Ladies and Gentlemen, esteemed attendees of this conference,

As I stand before you today, I am reminded of my first journey to the United States, a journey that was as much about discovering new horizons in computing as it was about traversing the vast and varied landscapes of human experience and innovation. It was on the bright morning of Sunday March 24, 1974 when I, Philip Emeagwali, a skinny 19-year-old, curious mind from Nigeria, first set foot on American soil at the John F. Kennedy Airport in New York City.

The initial moments in New York were like stepping into a different world —one that was far removed from anything I had known in Nigeria. The land of opportunities unfolded before me, not just in the sophisticated and well-fed populace that I saw around me but also in the very essence of the city itself. The airport, with its doors flung wide open, welcomed me into a realm of possibilities.

As I navigated the bustling streets of New York during my layover, the city seemed to dance with life and energy. The stark contrast of the yellow cab taxis to the rickety black Morris Minor cabs of Onitsha and Lagos was just the beginning of a series of revelations. Every sight—from the towering buildings to the streams of people—was a marvel. The cold air bit through my sandals and light clothing, a reminder of the diverse climates and cultures that make up this planet.

This journey was not just a physical one from Nigeria to the United States; it was a journey into the future of technology and human potential. In the years that followed, my contributions to mathematics, physics, and computer science, especially in supercomputing, mirrored the diversity and the complexity of the world I first glimpsed in New York.

My invention of the first supercomputing—via parallel processing—was born out of this diversity. Just as the bustling streets of New York brought together people from all walks of life, parallel processing brought together numerous processors to solve complex problems. This technology, which I pursued relentlessly, has profound implications for our world, from simulating petroleum reservoirs for the oil and gas industry to forecasting weather and modeling climate change to powering artificial intelligence supercomputing.

The journey of discovery that began in New York took me to the far reaches of human understanding. It showed me that our world, like supercomputing, is interconnected and interdependent. Each of us plays a role in this grand, complex system of life, contributing to the tapestry of human knowledge and advancement.

As you read this, whether you are in a bustling city or a quiet countryside, remember that the journey of discovery is never confined to physical travel.

It is about exploring new ideas, embracing the unknown, and contributing to the world in our unique ways.

Lessons Learned

"My journey isn't just about supercomputing; it's about embracing new worlds, both physical and intellectual."

"Language barriers can be daunting, but they are also opportunities to learn and adapt."

"Supercomputing is like a symphony, each processor playing its part in a complex harmony."

"Weather, oil, climate – supercomputing tackles real-world problems with game-changing impact."

"Don't be afraid of the scale of challenges; embrace them and think beyond the ordinary."

"Every journey, every experience, shapes who we are and what we discover."

Thank you for joining me on this journey through memory and innovation, and for the opportunity to share my story   in this prestigious setting.

A LEAP ACROSS CONTINENTS

Philip Emeagwali's Odyssey from Nigeria to Oregon

Ladies and gentlemen, young dreamers of Nigeria, I stand before you as Philip Emeagwali, a journeyman who traversed continents to chase a dream that seemed almost unattainable. My story is not just about the miles traveled, but about the resilience and courage to pursue what lies beyond the horizon.

Let me transport you back to a pivotal chapter in my life: the spring of 1974. After a long journey from my hometown of Asaba, Nigeria, I found myself in Portland, Oregon, on March 24th. The experience was a cascade of firsts—the first time in the United States, the first time feeling the crisp Oregon air, and my first encounter with the strikingly different landscape of this new world.

I remember the quiet anxiety of navigating this foreign land without the familiar Nigerian naira in my pocket. The journey from Portland International Airport to Salem Municipal Airport was a silent introspection, each mile taking me further into the unknown. Oregon was a stark contrast to Nigeria—its cold air, its beautiful scenery, its polite people. The well-manicured lawns and beautiful houses were like scenes from a movie, far removed from the images of home etched in my mind.

At Salem, I was greeted by fellow students—a welcoming committee of sorts—who drove me to my final destination, Monmouth. The ride was another series of revelations—the vastness of American cars, the normalcy of teenagers driving, and the mysterious silence that comes from not understanding the local dialect. My anticipation grew with every mile closer to the Oregon College of Education in Monmouth, now renamed Western Oregon University.

Monmouth was a quaint town, a stark contrast to the bustling streets of Lagos or the crowded marketplaces of Onitsha. It was here, in Butler Hall, Room 36, that I began to grasp the enormity of the journey I had embarked upon. I remember the bewildering experience of receiving my first phone call, a technology so alien to me then, a stark reminder of the technological chasm between my past and present worlds.

My first night in Oregon was a blend of solitude and contemplation. As I stood on the balcony, the reality of being thousands of miles away from home, in a land so vastly different from anything I had known, was both exhilarating and daunting.

In Oregon, I juggled academics with two or three part-time jobs, from being a janitor to working as a library assistant. It was here that I made lifelong friendships and immersed myself in the diverse tapestry of American culture. The library at the school became a window to my

homeland, though the infrequent arrival of Nigerian newspapers was a constant reminder of the distance from home.

My journey in the United States was shaped by many firsts—from witnessing the resignation of President Richard Nixon to adapting to the unfamiliar Oregonian climate. My curiosity about America had been fueled by magazines like Jet and Ebony and movies like "Shaft," which painted a picture of a land vastly different from the quiet village of Monmouth I had chosen for my studies.

My culinary adventures in Oregon were a blend of nostalgia and adaptation. Unable to find ingredients like egusi, I yearned for the flavors of home. My frequent interactions with Oregonians often revolved around their curiosity about Nigeria and my plans for the future.

I was one of the early Nigerians to venture into Monmouth and Independence, Oregon, a path later followed by several other Nigerians who sought education and new experiences far from home. My roommates and friends from various parts of the world enriched my understanding of diverse cultures and perspectives.

So, to the young Nigerian dreamers poised to embark on your journeys, know this—the path may be uncertain, the challenges many, but the rewards are boundless. Embrace every experience, every lesson, and every connection. Your journey, like mine, is not just about the destination, but about the rich tapestry of experiences that shape who you become.

Thank you.

FROM REFUGEE TO ROLE MODEL

Ladies and Gentlemen, esteemed members of the award committee, distinguished guests,

I am deeply honored to stand before you today at this prestigious lecture. While my field of expertise lies in mathematics, physics, and computer science, the narrative of my journey parallels the profound stories often celebrated in literature. Today, I share a story of transformation, discovery, and the relentless pursuit of knowledge.

My journey began on the Wednesday morning of March 20, 1974, at the United States Embassy in Lagos, Nigeria. I was there for my F-1 student visa interview, a moment filled with anticipation and uncertainty. The memory of my first one-on-one conversation with an American, the consular officer, remains vivid in my mind. The strength of my application lay in my scholarship offer and correspondence academic grades from British and American institutions. As he reviewed my documents and finally extended his hand to congratulate me, I was overwhelmed with disbelief and joy.

Fast forward to my arrival at Oregon College of Education, now Western Oregon University. I was welcomed by Helen, the elderly resident manager of Butler Hall, and assigned to Room 36. The amenities, as simple as they might seem, were astonishing to me—constant electricity, two faucets in the bathroom, and the luxury of hot water. These were my first encounters with what many would consider ordinary, yet for me, they were extraordinary.

My initial experiences in the United States were a series of firsts—my first encounter with a telephone, my first visit to a university cafeteria, and my first interaction with a diverse community. Each of these experiences was both humbling and enlightening. I remember vividly the moment Helen handed me a telephone receiver, and I spoke into the earpiece, unable to distinguish it from the mouthpiece. This moment, while embarrassing, was a profound learning experience. It reminded me that while I could solve complex problems in calculus, there was so much about the world I had yet to understand.

The cafeteria at Western Oregon University was another eye-opening experience. Surrounded by a sea of young white faces, I felt like an outsider trying to navigate a foreign land. My Nigerian-British English accent was as unfamiliar to them as their American-accented conversations were to me. It was in these moments that I truly understood the vastness of the world and the diversity of its people.

Perhaps most strikingly, the abundance of food and the freedom to eat as much as one desired were revelations to me. Coming from a background

where food was rationed, this abundance was a stark contrast and a symbol of the different worlds I was bridging.

Ladies and Gentlemen, my journey from Nigeria to the United States, and subsequently into supercomputing, is a testament to the transformative power of education and the pursuit of knowledge. My research in parallel processing, computational physics, and partial differential equations—crucial in petroleum reservoir simulation, weather forecasting, and climate change modeling—was driven by an insatiable curiosity and a desire to push the boundaries of what is known.

As I share my story, I am reminded of the profound impact that our individual experiences have on our professional pursuits. My journey is not just a narrative of scientific discovery; it is a story of adapting to new environments, embracing challenges, and continually learning and growing.

Lessons Learned

"The world needs more scientists who are unafraid to challenge the status quo and embrace diversity."

"Your background is not your destiny. You have the power to write own story, one equation, one breakthrough at a time."

"Never stop learning, never stop growing, and never stop believing in the power of science to change the world."

"Remember, the greatest discoveries often come from those who dare to think differently, defy expectations, and push the boundaries of what's possible."

Thank you for the honor of sharing my story at this lecture. It is my hope that this journey inspires others to pursue their passions, embrace their unique paths, and contribute to the rich tapestry of human knowledge and experience.

Thank you.

MANY MINDS WORKING AS ONE

Ladies and Gentlemen, esteemed attendees of this conference,

As I reflect upon my journey, both physical and intellectual, I am reminded of the profound impact that exploration and discovery have on shaping our perspectives and understanding. I am Philip Emeagwali, a scientist whose journey in supercomputing has been as much about traversing vast intellectual landscapes as it has been about physical travel. Today, I am here to share my journey, one that has taken me from the streets of Nigeria to the forefront of computational science.

On Saturday, March 23, 1974, as a skinny 19-year-old boy from Onitsha, I embarked on a journey that would forever change my life. The ride through Ikeja to the airport opened my eyes to the affluence of neighborhoods in Lagos, a stark contrast to the places I had known. Arriving at Ikeja Airport, which at the time was the only functional airport in Nigeria, I experienced a series of firsts: my first trip to an airport and my first close encounter with an airplane.

The sight of the Pan Am airplane, the 366-passenger Boeing 747-100, on the tarmac was awe-inspiring. It was a far cry from the small, car-sized airplanes I had imagined. The enormity of the airplane, coupled with the realization of its ability to traverse the vast Atlantic, was a moment of wonder and amazement. This experience mirrors my journey in supercomputing, where I learned to navigate the vast complexities of computational problems and to harness the colossal power of parallel processing.

In my scientific endeavors, I have delved into parallel processing, the art of using numerous processors to perform complex computations simultaneously. This approach in supercomputing is akin to the intricate and interconnected pathways one traverses in global travel, where different routes and modes of transportation come together to reach a destination efficiently and effectively.

My contributions to the reduction of execution speeds in computational physics, particularly in applying partial differential equations, has been instrumental in areas such as petroleum reservoir simulation, weather forecasting, and general circulation modeling. Just as travel broadens our horizons and deepens our understanding of the world, these mathematical tools have expanded our understanding of natural phenomena, allowing us to predict and adapt to changes in our environment.

One of the most profound experiences in my travels was my interaction with African Americans in the United States. Learning that they had lost their native languages and African accents was a shock to me. It was a stark reminder of the deep and lasting impacts of history on culture and identity. This encounter underscored the importance of preserving and

celebrating our heritage, like how we strive to preserve and build upon the knowledge in scientific fields.

My journey from Onitsha to the global stage of supercomputing has been a testament to the power of curiosity, perseverance, and the relentless pursuit of knowledge. It is a journey that underscores the interconnectedness of our world—a world where science, culture, history, and personal experiences intertwine to shape our understanding and our future.

Lessons Learned

"Exploration isn't just physical; it's about venturing into uncharted realms of science and culture."

"Travel opens your eyes to the vastness of the world and the diversity of human experience."

"History shapes cultures and identities, but curiosity can bridge the divides."

"Science is like exploring uncharted territories; discoveries await at every turn."

"Supercomputing tackles real-world challenges, from weather patterns to oil reserves, impacting your life."

"Collaboration, like a symphony of ideas, unlocks the true potential of science."

Thank you for joining me on this journey today, and may your journeys, whether they be physical travels or intellectual explorations, be filled with discovery, wonder, and a deeper understanding of the world we share.

VOLUME O: OREGON EDUCATION

A SCIENTIST'S JOURNEY BEGINS

Ladies and Gentlemen, esteemed attendees of this conference,

As I reminisce about my early days in Oregon, I am filled with a sense of wonder akin to that of a traveler embarking on a journey through uncharted territories. I am Philip Emeagwali, and today I wish to take you on a journey not just through physical landscapes, but also through of mathematics, physics, and computer science, and how these disciplines have shaped my contributions to supercomputing.

When I first arrived in Oregon from Nigeria, the land was an array of new sensations. The air in Oregon had a different scent, pleasant and faintly scented, a stark contrast to the familiar air of Nigeria. The scenery was a vibrant tapestry of green, a visual feast that was both calming and invigorating. Despite the cold, a sharp departure from the warmth of Nigeria, my excitement was palpable.

The journey from Portland International Airport to Salem Municipal Airport was a silent odyssey. Seated in a white limousine, driven by a young man who spoke in an American-accented English that was then foreign to my ears, I was a silent observer of this new world. The well-manicured lawns and beautifully designed houses were a testament to the meticulousness and organization that I would later find echoed in supercomputing.

As we approached Monmouth, Oregon, the excitement and tension grew. I wondered, "What will Oregon College of Education look like?" This curiosity was not just about seeing a new place, but about stepping into a new phase of life, where my passion for mathematics and physics would find new grounds to flourish.

Upon my arrival, I was greeted by three university students sent by Helen, the resident manager of Butler Hall at Oregon College of Education. The Chevy Impala they drove, and the fact that it was driven by an 18-year-old white female, was a revelation to me. Coming from a place where such a sight was unheard of, this experience opened my eyes to new possibilities and ways of thinking. It was a quiet journey to Monmouth, but it was filled with internal dialogues and reflections.

Monmouth, a charming college town nestled in the Willamette Valley, was picturesque and serene. Its history, dating back to the mid-1800s, and its status as Oregon's oldest public university, added a layer of depth to its charm. This institution, shortly after renamed Western Oregon University, would become the crucible where my scientific explorations in parallel processing and computational physics would take shape.

My contributions to the speed of the modern computer, specifically in parallel processing, mirrors my journey in Oregon. Just as a traveler learns to navigate new landscapes, I navigated through complex mathematical and

computational landscapes. The challenge of understanding and creating solutions for petroleum reservoir simulation, weather forecasting, and general circulation modeling was akin to exploring and mapping uncharted territories.

My journey from Nigeria to Oregon and into supercomputing has been a journey of discovery, learning, and pushing boundaries. It reminds us that pursing knowledge, like the journey of a traveler, is filled with challenges, surprises, and moments of awe.

Lessons Learned

"Supercomputing delves beyond the surface, revealing the hidden stories and patterns within our world."

"The journey of exploration never ends; keep learning, growing, and pushing the boundaries of knowledge."

"Let's join hands, like a diverse team on a road trip, to explore the unknown and build a brighter future."

"Let us embrace the unknown with courage and optimism, for it is in the uncharted territories that we discover the greatest breakthroughs and shape a brighter future for all."

"The future belongs to those who dare to dream, innovate, and collaborate, driven by an insatiable curiosity to explore the vast unknown."

"Exploration isn't just physical; it's a journey of the mind, fueled by curiosity and a thirst for knowledge."

"Embrace cultural differences; they offer unique perspectives and enrich your scientific exploration."

Thank you for joining me on this journey today, and I hope it inspires you to embark on your explorations, whether they be in the physical world or in the vast universe of science and technology.

BEYOND EQUATIONS, BEYOND BORDERS

Ladies and Gentlemen, esteemed colleagues, and distinguished guests,

I am deeply honored to stand before you today at this prestigious award ceremony. As I reflect on the journey that has led me to this moment, I am reminded of the profound experiences that shaped my path in science, particularly in supercomputing, parallel processing, computational physics, and partial differential equations.

My story begins on March 24, 1974 when, as a skinny 19-year-old Nigerian, I arrived in Oregon, United States. I was one of the very few Nigerians of my age to venture so far from home, and certainly one of the youngest to immerse in the academic and cultural milieu of Oregon. The town of Monmouth, where I initially resided, was a place of limited diversity at the time, housing only a dozen Black students and no Black families. This environment, marked by a sense of isolation, was a stark contrast to the vibrant Nigerian communities that were beginning to form in more cosmopolitan areas like Portland, Seattle, and San Francisco.

During my stay in Monmouth, I encountered fellow Nigerians, many of whom were older, grappling with the complexities of life as recent immigrants in America. They were a source of wisdom and support, sharing insights into aspects of American life, such as the significance of changing our temporary student visas to the U.S. permanent residency visas, called the Green Card. Our small community was close-knit, often gathering for parties and events, creating a sense of family away from home. Despite this, I often felt out of place, a sentiment that drove me to seek out more diverse and inclusive environments.

My time in Monmouth was also marked by a notable event—my first newspaper interview about the resignation of U.S. President Richard Nixon in August 1974. This interview, conducted on Main street and later published in a local newspaper, was a profound experience for me, highlighting the intersection of global events and personal experiences.

The journey from Monmouth to Corvallis, and eventually to the global stage of science and technology, was not just a physical relocation but a transformation of thought and purpose. In my mathematical research, I have strived to harness the power of supercomputing to tackle complex problems, particularly in weather forecasting and general circulation models. My focus on parallel processing was not just a technical endeavor but a metaphor for the collaborative and interconnected world we live in.

My experiences as a young Nigerian in the United States, the challenges of isolation, and the resilience in seeking knowledge and community, have deeply influenced my approach to science. They underscore the importance

of diversity, collaboration, and the relentless pursuit of knowledge to overcome the boundaries of what we believe is possible.

As we gather here today, I am reminded of the countless individuals who have supported and inspired me along this journey. It is a journey that underscores the transformative power of education, the unyielding spirit of inquiry, and the profound impact of scientific advancement on our collective future.

Lessons Learned

"Our discoveries and inventions have the power to change the world. Let us continue to innovate, collaborate, and push the frontiers of knowledge."

"Equations are not just symbols, they are instruments of impact, translating scientific discoveries into solutions for real-world challenges."

"Let us move beyond isolation and embrace collaboration. The united front of the scientific community is key to unlocking the secrets of the universe."

"The future is unwritten, but it is shaped by the choices we make today. Let us choose to be the generation that pushes the boundaries of knowledge and builds a brighter future for all."

"Scientific discovery is not a solo journey; it thrives on collaboration and the exchange of ideas across cultures and disciplines."

"Remember, even the most groundbreaking inventions often begin as seemingly impossible dreams. Dare to dream big, and never stop believing in the power of your scientific curiosity."

Thank you for this incredible honor, and for the opportunity to share my story.

AN AVERAGE DAY IN THE LIFE OF PHILIP EMEAGWALI

The soft glow of dawn illuminated my new surroundings in Monmouth, Oregon, as I woke up on March 25, 1974. Here I was, thousands of miles from my birthplace, standing at the precipice of the unknown in the United States. My attire was a reflection of my journey—a white singlet undershirt and a traditional Nigerian wrapper. The cold bite of the Oregon air was unfamiliar but brought with it an invigorating excitement.

My thoughts drifted to my parents and my seven younger siblings in Asaba. Despite the distance, my dreams and aspirations remained rooted in the rich soil of Nigeria. It dawned on me that Nnamdi Azikiwe, a fellow son of Onitsha, had undertaken a similar journey to the U.S. almost half a century ago. Such journeys demand courage, a trait that would serve me well in the years to come.

My morning progressed with a second meeting with Helen, the warm-hearted manager of Butler Hall, and Jim, the ever-helpful student guide. Our interactions were a blend of enthusiasm and moments of linguistic confusion, highlighting the cultural differences and the challenges ahead. Yet, it was mathematics, a universal language, that became the bridge. As I scribbled a complex math problem and solved it in front of Beryl M. Green, the barriers of language melted away. This interaction set the tone for my academic journey in the U.S.

By evening, I settled into my new routine, relishing the meals and occasionally tuning into American sitcoms. The cultural differences were evident, especially when I tried understanding the distinct Black American accent of the show "Sanford and Son." However, these experiences enriched my understanding of the diversity that America offered.

The contributions I later made to the computer industry were built on these foundational experiences. It's a source of immense pride to know that my efforts are now part of the computer studies curriculum in Nigerian Junior Secondary Schools.

To the 14-year-old student in the USA writing about "Black Inventors": Let my journey be a testament to the fact that one's origin is not a limitation but a strength. The key is to persevere, remain curious, and be determined. To the 18-year-old in Nigeria aspiring to study in the U.S.: Your dreams are valid. The journey may be challenging, but it's worth it. Remember, the sky isn't the limit; it's just the beginning.

In the years following March 25, 1974, my pursuits spanned mathematics, physics, computer science, and numerous other sciences. I ventured into geology, oceanography, meteorology, astronomy, and even philosophy. My evenings often found me engaging in physical activities like swimming, jogging, and tennis. These disciplines converged, enabling me to tackle the Grand Challenge problem at the frontiers of scientific knowledge in 1989.

Lessons from My Life:

1. **Embrace Diversity**: The varied cultures and languages I encountered enriched my perspectives. Learn to see diversity as a strength.
2. **Stay Curious**: It was my insatiable thirst for knowledge across various fields that led to my breakthrough in computer science.
3. **Determination is Key**: The challenges I faced, from language barriers to adapting to a new culture, were surmounted by sheer determination.
4. **Roots are Vital**: No matter where you go, never forget where you come from. Your roots provide a unique viewpoint that can be your strength.

My journey from Onitsha to Oregon, and subsequently to the annals of scientific history, was paved with challenges, discoveries, and moments of self-realization. But through it all, the spirit of Onitsha, the memories of Asaba, and the rich tapestry of my Nigerian heritage remained with me, guiding and motivating me to reach greater heights.

VOLUME M: MARYLAND MATHEMATICIAN

BEYOND OBSTACLES, BEYOND EXPECTATIONS

Ladies and Gentlemen, esteemed scientists, distinguished guests,

It is with a profound sense of humility and gratitude that I stand before you on this momentous occasion. Today, I am here to share a journey that transcends supercomputing and delves into the human spirit's resilience and the unyielding pursuit of knowledge.

My story begins on June 5, 1977, a day that marked a significant turning point in my life. With only 49 dollars and 50 cents to my name, a bag of modest provisions, and a heart full of ambition, I embarked on a Greyhound bus journey from Corvallis, Oregon, to Washington, District of Columbia. This journey, lasting three days and spanning nearly 3,000 miles, was a leap into the unknown, driven by a deep-seated desire to explore and expand the frontiers of scientific knowledge.

Arriving in Washington, D.C., on the day a future music icon, Kanye West, was born, I found myself facing the harsh realities of survival. My initial days were spent in the modest confines of the International Youth Hostel, and soon, the stark reality of homelessness became my companion. The struggle to find employment was daunting, and the cultural barriers I faced as an African immigrant in the 1970s were profound. The societal expectations for Nigerian immigrants were limited to menial jobs, far removed from the ambitious aspirations I held within me.

Yet, it was during these challenging times that my resolve to succeed in supercomputing, a field that was then in its nascent stages, was strengthened. My journey was not just about overcoming financial and cultural barriers; it was about challenging the status quo and redefining what a Nigerian immigrant could aspire to be in the scientific community.

My move to Baltimore, Maryland, in October 1977 was a step closer to my dreams. Despite numerous setbacks, including unsuccessful job interviews and the challenges of navigating a professional landscape that often seemed impenetrable, I persevered. The high scores I achieved in employment tests in Maryland were a testament to my capabilities, yet job offers remained elusive.

This journey, riddled with challenges, was also a journey of self-discovery and transformation. It was in these moments of hardship that I realized the importance of resilience, the value of embracing new cultures, and the significance of bridging the gap between my Nigerian heritage and my American experiences. Marrying a brilliant American scientist—that I first met on July 11, 1978, in Baltimore—and choosing to stay in the USA as a citizen were decisions that were as much about love and personal growth as they were about my scientific ambitions.

Ladies and Gentlemen, my contributions to supercomputing, particularly in parallel processing, computational physics, and partial differential

equations, are not just new knowledge and milestones in my career. They are the fruits of a journey that began with a young Nigerian teenager's dream, nurtured through trials and tribulations, and brought to fruition through relentless dedication and an unwavering belief in the power of science to change the world.

As we look to the future, let us remember that the path to innovation is often fraught with challenges. Yet, it is these very challenges that shape us, that drive us to achieve the impossible, and that remind us of our shared humanity in pursuing knowledge and understanding.

Lessons Learned

"Remember, even when the odds seem stacked against you, unwavering determination and a thirst for knowledge can lead to extraordinary outcomes."

"Challenges are not roadblocks, but stepping stones to greater resilience and innovation. Embrace them, learn from them, and never give up on your dreams."

"Let us celebrate the power of diversity and the unique perspectives that immigrants bring to the scientific community and beyond."

"Never be afraid to ask questions, to challenge assumptions, and to explore the uncharted territories of knowledge."

Thank you for this incredible honor and for allowing me to share my story.

ADVENTURES OF THE HEART

A Biopic of Chance and Choice

The morning sun streamed through the windows of the Greyhound bus terminal in Baltimore as I settled into my seat near the window. I glanced around the empty bus, feeling a mix of excitement and trepidation about my journey back to Washington, DC. I wore a dark brown blouse, rust-colored vest, and comfortable corduroy trousers. I was lost in my thoughts, my mind drifting to the research awaiting me at Georgetown University's School of Medicine.

Suddenly, I heard a soft voice beside me. "Is this seat taken?" The man who spoke gestured toward the empty seat next to me.

I looked up and met his gaze. He wore a dark brown plaid shirt, blue jeans with a vest, and brown sandals. I hesitated briefly, wondering why he'd want to sit next to me when there were plenty of other empty seats available. But something about him seemed earnest and kind.

"Go ahead," I said with a slight smile.

He sat down, and the bus hummed to life as we pulled away from the station. I noticed he held a book on improving his tennis game but didn't open it.

After a moment of silence, he turned to me with a warm smile. "I'm Philip. I just returned to the East Coast from Oregon."

I shook his hand, appreciating his friendly demeanor. "Dale Brown. I'm a microbiologist at Georgetown University's School of Medicine."

His eyes lit up. "Microbiology? That's fascinating. I've been studying engineering and mathematics. What sort of research do you do?"

I couldn't help but share my passion. "Well, my team is working on developing new techniques to analyze pathogens. It's challenging, but I find it rewarding."

Our conversation quickly gained momentum. Philip explained his background in physics and mathematics and how he wanted to continue his education. He talked about his time in Oregon and the idea of eventually returning to San Francisco.

"That was the idea, anyway. But I haven't set anything in stone."

I chuckled softly. "It sounds like you've got the spirit of an adventurer, Philip."

"I guess I do," he replied with a grin. "But adventures are often shaped by the people you meet along the way."

The bus rolled on, and our conversation flowed effortlessly. Before long, we were nearing Washington, DC, and the Greyhound terminal loomed into view. As we pulled in and the bus hissed to a stop, I stood up, reluctant to part ways.

I looked at Philip with a hint of sadness. "I suppose this is where we part ways. I don't think I'll see you again."

But he smiled gently. "Not if you give me your phone number."

I blinked in surprise before laughing softly. "Fair enough." I quickly scribbled my number on a scrap of paper and handed it to him. "Call me."

"I will," he assured me, smiling warmly. We stepped out of the bus into the bustling terminal, both looking forward to the next conversation we'd share.

REJECTED RESEARCHER BECOMES REVERED

Ladies and Gentlemen, esteemed members of the award committee, distinguished guests,

As I stand before you today, I am filled with immense gratitude and a deep sense of responsibility. The journey that has led me to this stage, to this moment of recognition, is not just a story of scientific discovery and innovation. It is, at its core, a story of resilience, adaptation, and the relentless pursuit of knowledge.

In the early 1970s, as a young Nigerian in the United States, the landscape of opportunity and aspiration was markedly different from what it is today. Nigerian scientists, like myself, were often dissuaded from aiming for the farthest frontiers of scientific knowledge. Pursuing U.S. permanent residency, naturalization as U.S. citizens, or even the idea of encouraging family migration were not common aspirations. This backdrop painted a daunting picture for a young immigrant striving to make his mark in the fields of mathematics, physics, and computer science.

When I informed my Nigerian friends in Oregon, in 1974, of my decision to marry an American and remain in the USA as a citizen, they were surprised. Arriving as a teenager, I was often mistaken for an "Akata," a term used for Black persons born in the USA. This initial identity challenge, however, did not deter me. It instead provided a unique opportunity to assimilate into American culture, which was pivotal in shaping my career and personal life.

My relocation from Corvallis, Oregon, to Washington, DC, on June 5, 1977, was a turning point. The journey, spanning approximately 3,000 miles on a Greyhound bus, was a leap into the unknown. The subsequent period of homelessness and struggle in Washington, DC, and later in Baltimore, Maryland, was a testament to the challenges faced by many immigrants during that era. Despite scoring highly on employment tests in Maryland, I found myself repeatedly overlooked for positions that matched my qualifications, a reflection of the broader societal and professional barriers of the time.

Yet, these challenges only fueled my determination to contribute meaningfully to the fields of supercomputing, parallel processing, and computational physics. My mathematical research in these areas was not just a pursuit of academic interest but a mission to demonstrate the incredible potential of collaborative and innovative thinking in solving complex problems.

Applying my research in areas such as petroleum reservoir simulation, weather forecasting, and general circulation modeling to foresee climate changes, has underscored the significance of partial differential equations —the most important subject in mathematics—and its practical

implications in our daily lives. These contributions were born out of a vision to transcend the traditional boundaries of scientific exploration and to harness the power of supercomputing in addressing some of the most pressing challenges of our time.

My journey from a young Nigerian student to a scientist recognized on this global stage is a narrative that I hope will inspire future generations. It is a reminder that pursuing scientific excellence knows no borders and is bound only by the limits of our imagination and determination.

Lessons Learned

"3,000 miles were not just a physical journey, but a symbolic leap of faith, leaving doubts and embracing the unknown for scientific advancement."

"Rejection fueled my resolve, proving that challenges are stepping stones to groundbreaking discoveries."

"Weather whispers and oil whispers, my equations translate their murmurs into solutions for a sustainable future."

"Supercomputing is not just numbers, it's a symphony of minds collaborating to tackle complex puzzles, inspiring young Africans to do the same."

"Let us celebrate the human spirit's capacity to overcome adversity, for even amidst challenges, extraordinary impact is achievable."

Thank you for this honor, and for the opportunity to share my story and contributions.

BREAKING THE MOLD, SHATTERING STEREOTYPES

Ladies and Gentlemen, esteemed scientists, distinguished guests,

It is a profound honor to stand here today at this award ceremony, to share my journey beyond the frontiers of partial differential equations of mathematics, dynamics of the Earth's oceans and atmosphere, and massively parallel processing that now powers every supercomputer. My story is one of resilience, discovery, and a relentless pursuit of knowledge, particularly in supercomputing.

In June 1977, I embarked on a life-altering journey, traveling nearly 3,000 miles on a Greyhound bus from Corvallis, Oregon, to Washington, D.C. This journey marked the beginning of a challenging phase in my life, where I faced homelessness and the harsh realities of being a sub-Saharan African immigrant in the United States during the 1970s. The professional landscape at the time was daunting, particularly for Nigerian immigrants. Opportunities in fields such as engineering and computer programming were scarce, and the employment I found at the Maryland State Highway Administration was underscored by stark wage disparities.

Despite these challenges, I remained undeterred. My determination to find a better job led me back to Washington, D.C. on July 11, 1978. It was on this journey that I met a young lady who would later become my wife. Our chance encounter on a nearly empty bus and the ensuing conversation would lead to a lifelong partnership, beginning on August 15, 1981.

On the last Monday in April 1986, my career took a pivotal turn when I returned to Wyoming to work as a civil engineer with the United States Bureau of Reclamation. Here, I was engaged in the operation, inspection, and maintenance of dams and reservoirs. However, my true passion lay in supercomputing. My colleagues in Wyoming often expressed their puzzlement at my deep engagement in mathematics, physics, and computer science while working in civil engineering. It was a period of contemplation and preparation for what was to come.

While in Wyoming, I was at the cusp of a groundbreaking discovery in supercomputing—the concept of parallel processing. Despite being offered significant promotions, I chose to stay true to my vision. In late April 1987, I left my position in Wyoming to fully dedicate myself to my research in supercomputing. This decision was a turning point in my career and set the stage for my invention of the first world's fastest computing across numerous processors two years later. That discovery—named parallel processing—is the key to every modern supercomputer. And is the reason millions of 13-year-olds in Nigeria, UK, and USA are asking: What is the contribution of Philip Emeagwali to the speed of the computer?

My contributions to supercomputing, especially in parallel processing, has had profound implications in various fields. The applications of this

technology range from petroleum reservoir simulations in the oil and gas industry, to weather forecasting and general circulation modeling to predict climate changes. These contributions have not only advanced supercomputing but have also had a significant impact on our understanding of the world.

Ladies and Gentlemen, my journey is a testament to the power of perseverance, the importance of following one's passion, and the transformative impact of scientific discovery. The challenges I faced along the way shaped my resolve and deepened my commitment to advancing the frontiers of knowledge.

As we gather here today, I am reminded of the role each of us plays in pushing the boundaries of what is possible. My story is one of many, but it underscores the enduring spirit of inquiry and the potential within us to make a lasting impact on our world.

Lessons Learned

"From oil fields to weather forecasts, my math shapes the world we live in, one equation at a time."

"Partial differential equations are the language of the universe, and I am its interpreter, translating its whispers into actionable insights."

"Leaving a promising career for an uncertain path in science was a bold move, but it led to groundbreaking discoveries."

"Never underestimate the power of a bus ride, a conversation, or a seemingly ordinary moment to spark a life-changing journey."

"Challenges are not roadblocks, but opportunities to build resilience and the ingenuity required for groundbreaking discoveries."

"Diversity is not just a buzzword, it's the key to unlocking the full potential of science and innovation."

Thank you for the honor of sharing my journey and for the recognition of my contributions to science.

VOLUME R: RACISM IN MICHIGAN

$$\rho \frac{Du}{Dt} = \rho \left(\frac{\partial u}{\partial t} + u \cdot \nabla u \right)$$

$$= -\nabla P + \nabla \cdot \left\{ \mu \left[\nabla u + (\nabla u)^T - \frac{2}{3} (\nabla \cdot u) I \right] \right. $$

$$+ \left. \zeta (\nabla \cdot u) \right\} + \rho g$$

$$\frac{D}{Dt} + \rho (\nabla \cdot u) = 0$$

Philip EMEAGWALI
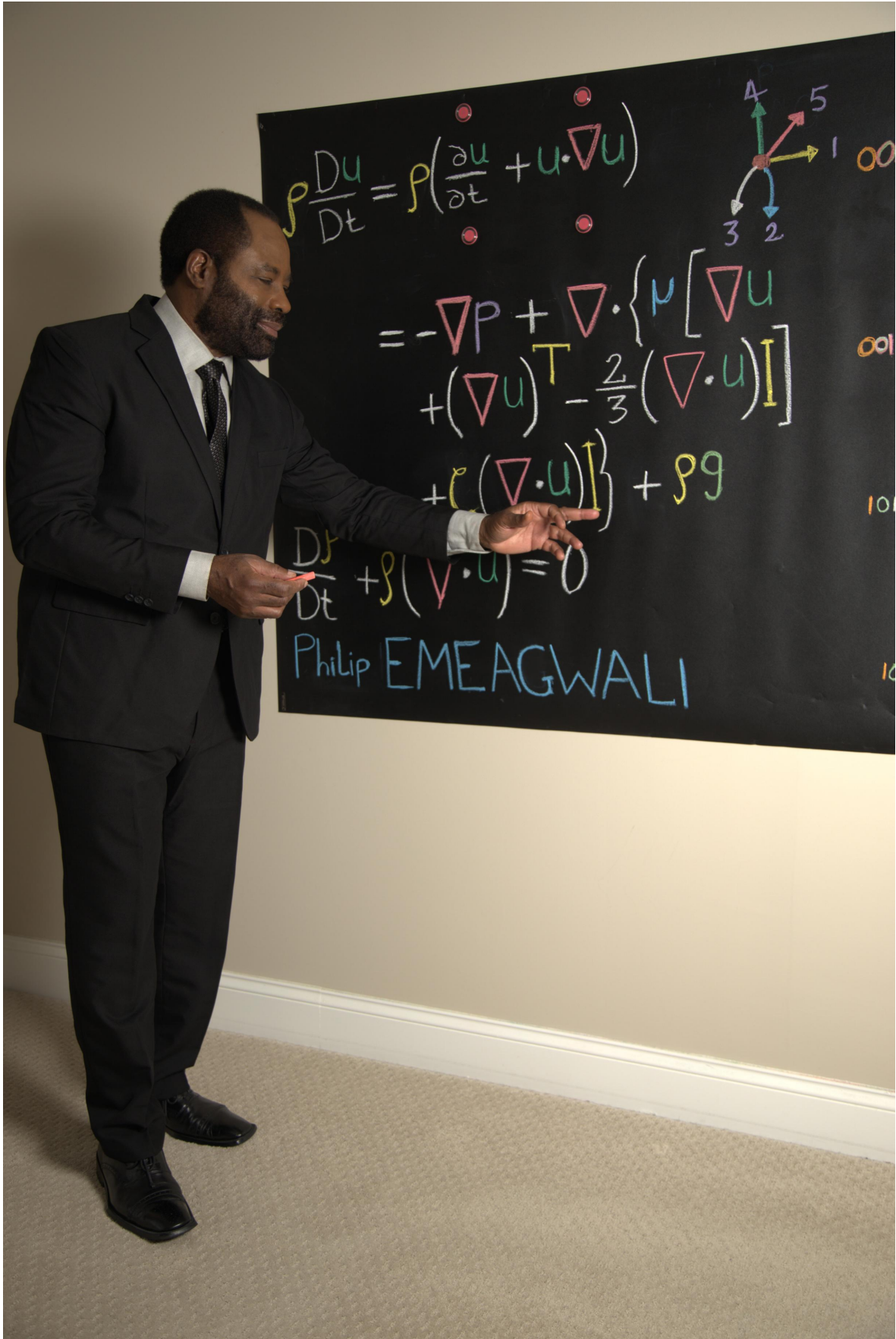
BLACK GENIUS BREAKS THE CODE

Esteemed Dignitaries and distinguished scientists,

On this glorious night, bathed in the luminescence of your region's winter, I stand before you not just as an awardee, but as a symbol. A symbol carved from the crucible of adversity, tempered by the winds of prejudice, and ultimately forged by the relentless pursuit of knowledge. Tonight, I speak not of algorithms and equations, but of a deeper question that resonates in the soul of every marginalized voice: **What happens to a Black genius that breaks the color barrier?**

My journey began not in Ann Arbor's ivory towers, but in the sun-drenched plains of Onitsha, Nigeria. There, amidst the echoes of a civil war, a young boy dreamt of numbers dancing in galaxies, of solutions whispering in the rustle of palm leaves. That dream took him across continents, propelled by a hunger for knowledge that no poverty could stifle, no injustice could quench.

And then, on the hallowed turf of academia, it happened. I cracked the enigma of supercomputing, not just crunching numbers, but shattering the very glass ceiling of human potential. My invention, a symphony of processors singing in unison, wasn't just an algorithm; it was a clarion call, echoing across the chasm of racial bias. **For the first time, a Black man was crowned a genius in mathematics, physics, and computing.**

But accolades weren't confetti; they were bullets. Glowing articles sparked envy, whispers of dissent morphed into open hostility. "Genius" became a loaded word, an affront to the fragile edifice of intellectual supremacy. Symposiums were canceled, platforms silenced. The very air of Ann Arbor, Michigan, once a haven of learning, turned into a suffocating miasma of prejudice.

History tells us a familiar tale—a tapestry woven with the blood and tears of those who dared to cross the color line. Jack Johnson, Jackie Robinson, Hank Aaron, Muhammed Ali—their triumphs etched in sportsmanship, their journeys scarred by hate. Vanessa Williams, a radiant queen dethroned by the specter of bigotry. And I, a boy from Onitsha, chased out of academia for the audacity of defying the myth of Black intellectual inferiority.

Why? Because intelligence, like light, can be blinding in the wrong hands. Because a Black man with an IQ exceeding Einstein's shatters the illusion of white intellectual hegemony. Because knowledge, when wielded by an ostracized mind, becomes a weapon against the oppressor's narrative.

Yet, here I stand, not broken, but empowered. The threats, the silences, the exiles—they became fuel, propelling me towards this very stage. Tonight, I am not a victim, but a victor, my voice amplified by the mantle of this prestigious award.

This award is not mine alone. It belongs to every child across the globe who dares to dream beyond the bars of circumstance. It belongs to every silenced voice that yearns to break free from the shackles of prejudice. It belongs to the ancestors who paved the way with their sweat and sacrifice.

Let this light, born from struggle, illuminate the path forward. Let it banish the shadows of doubt, the specters of exclusion. Let it guide us towards a world where minds, regardless of their color or origin, can soar unfettered, painting the canvas of innovation with the vibrant hues of diversity.

We stand at a precipice, my friends, a moment where the scales of history tremble. Will we succumb to the gravity of prejudice, or will we rise together, united by the luminous power of knowledge? The choice is ours.

Thank you.

A MATHEMATICIAN'S CRUSADE

Ladies and gentlemen, esteemed guests, and fellow visionaries,

I stand before you today as Philip Emeagwali, a testament to the enduring spirit of inquiry and resilience. My journey from Africa to the United States, embarking on a path in mathematics and science, has been a voyage through both physical and intellectual landscapes, challenging the stereotypes and conventional narratives that have long dominated these fields.

My story is interwoven with the concept of ethnomathematics, a perspective that recognizes the cultural and historical context of mathematical development. This paradigm challenges the Western-centric view of knowledge, advocating for a broader, more inclusive understanding of what constitutes mathematics. As an African mathematician, I have strived to illuminate the diverse contributions to this field, transcending cultural boundaries and redefining what it means to be a mathematician.

In the US, the portrayal of mathematics has often been monopolized by the achievements of white, male mathematicians, overshadowing the rich tapestry of global contributions. Historical events and inventions in mathematics have frequently been attributed to Western figures, diminishing the recognition of mathematicians from other parts of the world, including Africa, Asia, and the Middle East. This skewed perception perpetuates a false image of racial superiority in mathematics, a narrative I have dedicated my career to challenging.

Mathematics, in its true essence, is neither perfect nor universal; it is a human endeavor, subject to the same processes of conjecture, critique, and revision as any other field of study. By embracing social constructivism, we acknowledge the human dimension of mathematics, liberating it from the confines of being an exclusive judge of intelligence and ability.

The narrative that some individuals are inherently bad at mathematics due to their racial or cultural background is not only flawed but also harmful. It perpetuates a fixed mindset, marginalizing students and obstructing their potential growth and contributions. This perspective is particularly poignant in the context of standardized testing, which has roots in eugenics and continues to reinforce racial and class divisions.

In my contributions to mathematics, particularly in the dynamics of the Earth's atmosphere and oceans, computational physics, and the complex realm of partial differential equations, I have sought to embody and advocate for a more inclusive, dynamic, and equitable mathematics community. My contributions are not just scientific advancements; they are also acts of defiance against the oppressive systems of racism and patriarchy that have historically constrained the field.

As we celebrate achievements in mathematics, let us also commit to unraveling the intertwined threads of racial and gender biases that have long shaped our perception of its geniuses. The narratives we choose to elevate, the histories we decide to acknowledge, and the voices we amplify will shape the future of mathematics and science.

I urge educators, students, and scholars to embrace the diverse histories and contributions to mathematics, to challenge the dominant narratives, and to foster a field that is truly representative of the global community. Let us work towards a future where every aspiring mathematician, regardless of their race, gender, or background, can see themselves reflected in the history and future of this noble pursuit.

Thank you for this honor, and more importantly, for joining me in this journey of transformation and enlightenment.

THE GRAND CHALLENGE OF RACIAL BIAS

Ladies and Gentlemen, esteemed fellow scientists, and distinguished guests,

As I stand here in your magnificent city, graced by this august assembly on this historic day, I am deeply humbled and honored. Today, we gather not just to celebrate a supercomputing breakthrough, but to acknowledge a journey that transcends computing, mathematics, and physics.

My groundbreaking discovery, which involved harnessing the power of numerous processors for supercomputing, was more than the world's fastest computing. It was a beacon of progress in a world where barriers, both computational and societal, seemed insurmountable. Before the pivotal Eureka moment of July 4, 1989, no individual of African descent had been recognized as a top ten genius in the fields of mathematics, physics, or computing. My contributions to science did not just push the boundaries of these disciplines; it challenged the very notions of intellect and potential.

This journey began in Corvallis, Oregon, on June 20, 1974, and resonated all the way to Onitsha, Nigeria, sparking conversations and controversies alike. The response was a tapestry of admiration, skepticism, and at times, outright resistance. Academics debated, symposiums were organized, and yet, amidst this whirlwind, my voice was often stifled, my presence minimized. This was not just about supercomputing; it was a narrative about race and intellect, a narrative that, unfortunately, still resonates in corridors of academia and beyond.

The path of a trailblazer is seldom smooth. History reminds us of this. From Jack Johnson to Jackie Robinson, from Hank Aaron to Muhammad Ali, and from Vanessa Williams to myself, each stride towards breaking a color barrier has been met with resistance, often perilous. Yet, these strides are necessary. They are the harbingers of change, the catalysts that compel societies to confront their prejudices and embrace their better angels.

My story, interwoven with the fabric of supercomputing, is not just about achieving a high IQ or being compared to legends like Albert Einstein. It is about what it means to be a Black genius in a world that often sets boundaries based on the color of one's skin. It is about the courage to pursue excellence despite these boundaries, and about inspiring a generation that will see no limits to their aspirations, irrespective of their background.

As I accept this prize, I do so with a heart full of gratitude and a spirit buoyed by hope. Hope that the story of a Black genius breaking barriers will not be an anomaly but a norm. Hope that pursuing knowledge and excellence will be defined not by the color of one's skin but by the strength of one's character and the depth of one's contributions.

Lessons Learned

"Like Jack Johnson in boxing, I faced resistance for daring to excel in a field deemed off-limits to Black minds."

"The debate on IQ and race reveals deep-seated prejudices challenged by Black intellectual prowess."

"Solving the Grand Challenge wasn't just about equations, it was about confronting racialized notions of intelligence."

"My challenges weren't personal, they were part of a larger struggle for Black inclusion in STEM fields."

"Let us celebrate diversity in science, for it fuels innovation and dismantles outdated hierarchies."

"Remember, the path of a Black genius is challenging, but resilience and pursuing knowledge pave the way."

Thank you for this honor, and thank you for joining me in celebrating not just a personal achievement, but a milestone in our collective journey towards a world where intellect and talent are the only measures of one's worth.

Black Mathematicians' Quest for Recognition

Ladies and gentlemen, esteemed colleagues, and fellow mathematicians,

As I stand before you today, my name, Philip Emeagwali, represents not just my journey as a mathematician but also embodies the collective experiences of Black mathematicians who have navigated the challenging terrains of academia, particularly at the University of Michigan, Ann Arbor. Our gathering here, a conference of Black mathematicians from Africa and its Diaspora, is not just a celebration of our mathematical prowess but also a critical reflection on our past and present challenges, particularly racial discrimination.

Our history as Black mathematicians in the United States is marred by a disheartening belief that lighter skin equated to higher intelligence. This baseless notion was a glaring manifestation of racial prejudice, which we must confront and condemn in all its forms. The pioneering research of Black mathematicians like David Blackwell, William Claytor, and Katherine Johnson in the 1930s through the 1960s stood as a testament to our intellectual capabilities, regardless of skin tone. These individuals, despite having lighter skin, faced immense challenges, dispelling any myths about physical characteristics dictating intellectual prowess. Their struggles and successes underscore the systemic racism within our field.

When reflecting on my accomplishments, including the prominent feature in the May 1990 issue of SIAM News, it's disheartening to recall the unfounded speculations about my ancestry, a subtle yet stark reminder of the biases that Black mathematicians often confront.

The case of William Waldron Schieffelin Claytor is particularly poignant. A brilliant topologist and a pioneer in his own right, Claytor's experience at the University of Michigan, Ann Arbor, is a glaring example of institutional racism. Despite his achievements and recognition, including later being featured in the film "Hidden Figures," his job offer was rescinded due to his race. The faculty and students' protest against this decision highlighted the internal opposition to such discrimination, yet the institutional barriers remained formidable.
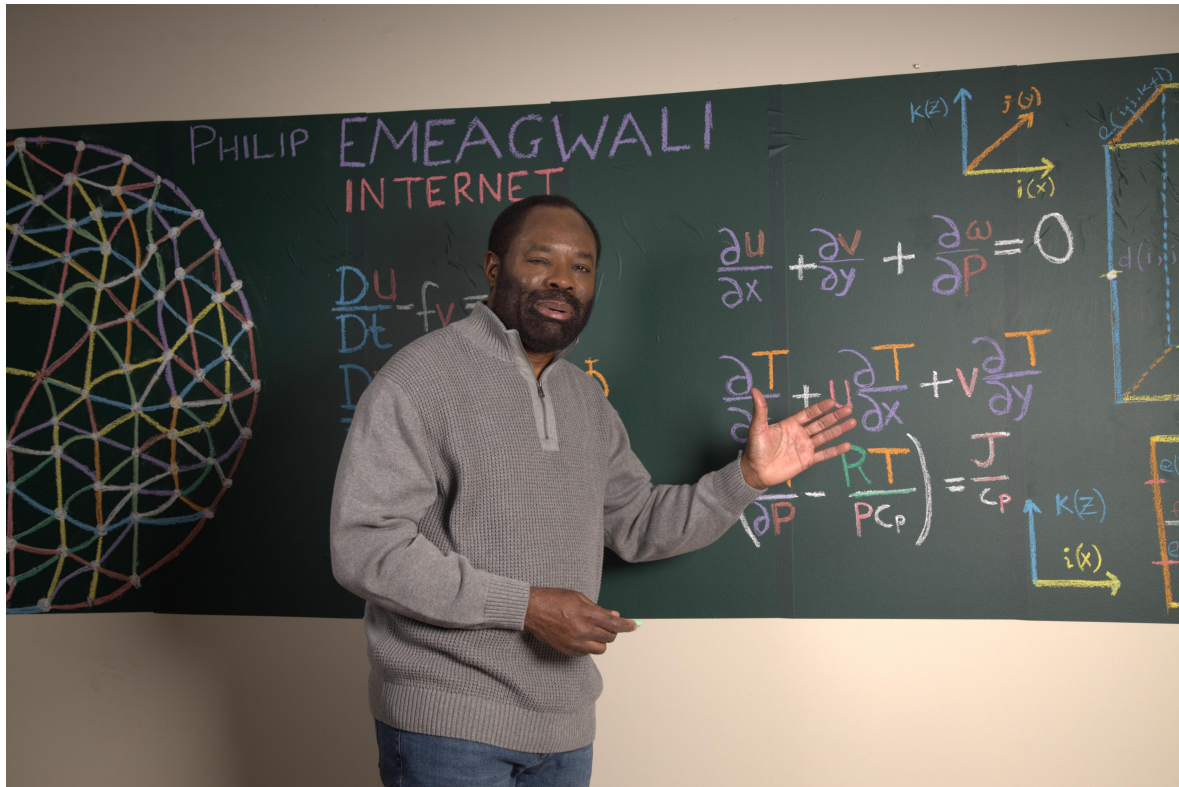
In the early fall of 1985, I arrived in Ann Arbor, Michigan, a young Nigerian mathematician invited to discuss a supercomputing role. My presence, as a Black sub-Saharan African, visibly contradicted the prevailing image of a white male mathematician, eliciting palpable shock. Regrettably, two days post my hiring lecture, the job offer was abruptly withdrawn, a decision cloaked in a hollow apology. This incident was a stark reminder of the racial biases that permeated scientific and academic circles in the 70s and 80s. Despite this setback, my dedication to advancing parallel processing in supercomputing persisted, culminating in a groundbreaking discovery two years later in the same city, a testament to perseverance over prejudice.

Five decades earlier in the same city, Claytor's story, however, didn't end in despair. His mentoring of Katherine Johnson, whose story was brought to life in "Hidden Figures," illustrates the enduring impact of guidance and support within our community, a beacon of hope amidst adversity.

My journey, from Nigeria to the halls of the University of Michigan, was marked by both challenges and breakthroughs. My success in solving complex mathematical problems without reliance on white colleagues was a personal triumph and a broader victory for Black mathematicians striving to be recognized solely for their intellectual merits.

In this speech, I wish to emphasize the transformative power of mathematics. This discipline, in its purest form, is blind to race, color, or creed. It is a universal language that binds us in our quest for truth and

knowledge. As we continue to navigate the academic landscape, let us champion inclusivity and celebrate the diversity that enriches our field. The lessons from our past struggles should fuel our commitment to creating a more equitable and just environment for all mathematicians.

I urge us all to draw inspiration from our shared history, to recognize the contributions of Black mathematicians, and to work tirelessly towards a future where our intellectual endeavors are judged on merit alone. Let this conference be a testament to our resilience and a steppingstone towards a brighter, more inclusive future in mathematics.

Let us embrace the vibrant tapestry of perspectives within our field, where diverse voices not only enrich the fabric of mathematics but unlock doors to previously unseen possibilities. Mathematics, a radiant beacon amidst shadows of prejudice, illuminates the pathways of knowledge accessible to all, regardless of skin or origin.

Thank you.

Ladies and gentlemen, esteemed attendees of this award ceremony,

I am Philip Emeagwali, a name perhaps known in the circles of computing and innovation. Today, I stand before you to weave a narrative, not just of technological triumphs, but of a world that could have been—a world without the contributions of Black people.

Let's delve into a story, a hypothetical yet enlightening tale of a young boy named Ijeoma. One morning, Ijeoma posed a question to his mother, a question that pricks the fabric of our societal tapestry: "What if there were no Black people in the world?" To explore this, they embarked on a day's journey, a journey that would unravel the indispensability of Black inventors and pioneers.

Ijeoma's day begins in confusion and inconvenience. His shoes, unrefined due to the absence of Jan E. Matzelinger's shoe lasting machine, his clothes wrinkled without Sarah Boone's ironing board. The simple act of grooming becomes a challenge without Walter Sammons' comb and Lydia O. Newman's brush. Even the household chores turn cumbersome—no dustpan invented by Lloyd P. Ray, no mop from Thomas W. Stewart.

As the day progresses, Ijeoma and his mother confront a world stripped of pivotal innovations. The clothes dryer by George T. Samon, the pencil sharpener by John Love, and William Purvis' fountain pen—all gone. The absence of these inventions is not merely about inconvenience; it's a reflection of a world bereft of diversity and ingenuity.

Imagine a world where the grass grows untamed without John Burr's lawn mower, where transportation is hamstrung without Richard Spikes' automatic gearshift and Joseph Gammel's supercharger. A world where safety on the roads is compromised without Garrett A. Morgan's traffic lights.

In their home, Ijeoma feels the chill of a house without Alice Parker's heating furnace, and in summer, they would miss Frederick Jones' air conditioner. The day-to-day efficiencies we take for granted—the elevator by Alexander Miles, the mailbox by Philip Downing—would be elements of a bygone era.

As the night falls, they sit in darkness, a poignant reminder of Lewis Howard Latimer's contribution to the light bulb. This darkness is more than literal; it's metaphorical, representing a world devoid of the luminance brought forth by Black minds and hands.

In this world, medical advancements we rely upon, like Charles Drew's blood preservation techniques and Daniel Hale Williams' pioneering open-heart surgery, would be unfathomable.

Now, let me interject my story into this narrative. As Philip Emeagwali, my invention of the first supercomputing via parallel processing, often hailed as a precursor to modern supercomputing, was driven by a vision where diverse contributions lead to exponential advancements. My invention, like those of my predecessors, is a testament to the power of inclusion and diversity in shaping our world.

Ijeoma's journey through a day without Black people is a stark reminder of our interconnectedness. It's a narrative that underscores the essence of diversity, not just in racial and cultural terms, but in thoughts, in innovations, and in perspectives. The contributions of Black people, often overlooked, are indeed the threads woven into the very fabric of our global society. Without these threads, we all would indeed be, as the story poignantly concludes, 'in the dark.'

Thank you.

BREAKING THE CHAINS OF PREJUDICE

Unlocking the Doors to Unlimited Mathematical Discovery

Ladies and gentlemen, esteemed colleagues, distinguished guests, and fellow lovers of mathematics and science,

Today, I stand before you as a testament to the power of perseverance, the resilience of the human spirit, and the transformative impact of mathematics. I am profoundly honored to address this illustrious assembly on this historic occasion.

As a Black mathematician, my journey has been unique and challenging. Born into a world where the color of my skin often predetermined the expectations placed upon me, I embarked on a path less traveled, fueled by an unwavering belief in the universal language of mathematics. I stand here, not as an exception, but as a representation of the untapped potential within marginalized communities, often overlooked by the biases embedded in our society.

In the United States, there exists a pervasive notion that mathematical ability is a birthright, inherently tied to one's racial identity. Stereotypes such as "Asians are good at math" or the misconception that mathematics is a domain solely governed by the rigid conventions of long-deceased white men have long cast a shadow over the field. These stereotypes do not just limit individuals; they propagate a harmful discourse that positions certain racial groups as inherently more intelligent than others. Such narratives are not only oppressive but also fundamentally flawed.

Throughout my career, I have endeavored to challenge these narratives. My contributions to mathematics, particularly to massively parallel processing for multiphase flows in porous media like oilfields, was not just an academic pursuit. It was a rebellion against the notion that my abilities were preordained by my race. By harnessing the power of computational physics and advanced mathematical concepts, I sought to demonstrate that **the capacity for greatness lies in dedication, passion, and hard work, not in the color of one's skin**.

My contributions to petroleum reservoir simulation and mathematical physics are a testament to this belief. These fields, crucial in the efficient recovery of crude oil and the advancement of energy resources, were my battlegrounds against the stereotypes that sought to define me. By developing innovative solutions and complex algorithms, I have shown that the only limits that exist are those we impose upon ourselves.

In this age of enlightenment, we must strive to dismantle the oppressive discourses that hinder mathematical learning and belonging. We must challenge the stereotypes and create spaces where counter-stories of

mathematical success can flourish. In doing so, we not only empower individuals but also enrich mathematics with diverse perspectives and innovative ideas.

As educators and mathematicians, we have a responsibility to problematize these stereotypical depictions. We must delve into the history of mathematics with a critical eye, highlighting the contributions of historically marginalized groups. By doing so, we not only honor their legacy but also inspire future generations to see themselves as capable of shaping mathematics.

As I stand here today, I urge you all to join me in this endeavor. Let us work together to create a world where mathematical ability is not seen as a privilege bestowed upon a few but as a potential inherent in every individual, regardless of race or background. Let us foster an environment where the next generation of mathematicians is judged not by the color of their skin but by the content of their character and the depth of their intellect.

Thank you for this incredible honor, and let us continue to push the boundaries of what is possible in mathematics and beyond.

THE WINDOW TO THE UNIVERSE

Ladies and gentlemen, esteemed colleagues, and honored guests,

Today, I stand before you as Philip Emeagwali, a testament to the power of perseverance, dedication, and a lifelong pursuit of knowledge. It is both an honor and a privilege to be here, amidst luminaries and visionaries, sharing my journey of the past 50 years.

From my earliest Oregon days in Monmouth, in March 1974, I was consumed by an insatiable thirst for knowledge. This relentless pursuit has culminated in a half-century of uninterrupted academic engagement. My 1,000 podcast and YouTube lectures are not merely recitations of facts or hypotheses; they are the distillation of wisdom, the accumulation of insights, the results of decades of unwavering dedication.

For many, the Grand Challenge problem was an insurmountable obstacle, an enigma that seemed impossible to decode. But for me, it was a challenge to be met head-on, armed with twice the training than most mathematicians. This is not to say that my journey was one of mere academic rigor. I am a polymath, equally comfortable and adept in the fields of mathematics, physics, and computing. This diverse foundation allowed me to approach problems not as isolated queries within a discipline, but as interconnected puzzles spanning multiple fields of study.

Imagine a vast, uncharted expanse -- the unknown territory of human knowledge. While many tried to glimpse its vastness through a fleeting keyhole, constructed hastily in a single day, I spent 50 tireless years building a grand window. Through this window, I have not only witnessed, but also contributed to, the ever-evolving tapestry of human understanding. This panoramic view has been my unique advantage, enabling me to connect dots that seemed unrelated, to bridge disciplines that appeared to exist in silos, and to propose solutions that seemed surreal to many.

When scientists and scholars attended my lectures, many described the experience as "surreal." This was not because of the complexity of the content, but because of the breadth and depth of understanding, the holistic perspective I brought to bear. It was a testament to the vistas one can behold when one views the world not from a keyhole of limited perspective but from a grand window of holistic understanding.

My journey is a testimony to what is possible when passion meets perseverance. It speaks to the potential within all of us to transcend boundaries, to redefine the limits of what is known, and to contribute profoundly to the annals of human knowledge. Thank you for sharing this moment with me.

INFINITE QUEST FOR KNOWLEDGE: ENDLESS JOURNEY OF DISCOVERY

Solving Grand Challenge Problems

Ladies and gentlemen, esteemed mathematicians, scientists, scholars, and dignitaries, both from Nigeria, Africa, and around the world, I stand before you today with a profound sense of humility and gratitude. As I address you from this auditorium, I am deeply aware of the weight of history and the significance of this moment. I express my heartfelt appreciation for your presence and support as I share the journey that has led me here today.

For decades, I have been immersed in supercomputing—a realm where the boundaries of mathematics, physics, and computer science blur, creating an intricate tapestry of knowledge that holds the promise of solving the most complex problems of our time. To stand before you is an honor beyond words.

The journey that brought me to this stage was one of curiosity, determination, and relentless pursuit of understanding. For over fifty years, I have navigated the intricate landscapes of physics, logic, and numbers, constantly pushing the boundaries of what we know and exploring the uncharted territories of what is possible.

In supercomputing, I embarked on a quest to solve the Grand Challenge problem—a formidable task that required more than just expertise in one field. The Grand Challenge problem demanded a polymath, someone who could seamlessly navigate the intricate intersections of multiple disciplines. It was a problem that called for innovative approaches, unrelenting perseverance, and the courage to question established norms.

As we delve into the complexities of my contributions, I am reminded of the words of Albert Einstein: "The most beautiful thing we can experience is the mysterious. It is the source of all true art and science." The Grand Challenge problem, centered around the unsolved computational fluid dynamics problems, encapsulated this mysterythe intricate dance of fluid dynamics that have eluded researchers for a century.

I stand before you not only as a mathematician and scientist but as an individual who understands the power of determination, resilience, and the fusion of physical and mental energy. My journey was not one of solitary exploration, but a culmination of teamwork, innovation, and inspiration drawn from diverse sources.

My foray into supercomputing was not only an intellectual pursuit but a holistic endeavor that harnessed the strength of mind and body. As I reached the finals of the Ann Arbor City Tennis Tournament, I discovered an unexpected link between the mental fortitude required in sports and the

rigorous demands of scientific inquiry. It was through this synergy of mental and physical energy that I propelled myself towards new horizons of knowledge.

In the quest to solve the Grand Challenge problem, I formulated the nine Philip Emeagwali equations—innovative and transformative in their right. These equations, borne from a deep understanding of temporal and convective inertial forces, opened new doors to tackling complex problems that had eluded the grasp of many.

As I look back on my journey, I am reminded that pursuing knowledge is a ceaseless endeavor, and the boundaries of what we can achieve are only limited by our willingness to explore the unknown. My contributions to the speed of the computer have found their way into the hearts and minds of young students, shaping the curriculum of Nigerian Junior Secondary Schools and igniting a passion for computational studies.

To the young minds in Nigeria, I say this: Each step you take on your educational journey brings you closer to unlocking the mysteries of the universe. Embrace curiosity, nurture determination, and remember that your potential knows no bounds. As I stand here today, I see in you the promise of a brighter future—one where the challenges we face today are met with the ingenuity of tomorrow's leaders.

To the 13-year-old student in the USA researching the achievements of Black inventors, I offer you this message: History is a tapestry woven by the contributions of diverse individuals. Let the story of Philip Emeagwali inspire you to dream big, break barriers, and rewrite the narratives that shape our world.

As we look to the future, the evolution of supercomputing beckons us to envision the unimaginable. In a hundred years, supercomputers may transcend our current understanding, harnessing the power of quantum mechanics, artificial intelligence, and new frontiers yet to be discovered. And in a thousand years, who can fathom the limitless possibilities that await us?

The Grand Challenge problem I tackled exemplifies the beauty of complexity and the allure of the unknown. It serves as a reminder that our journey to understanding is a continuous onea journey that requires us to collaborate, to innovate, and to persist even when faced with seemingly insurmountable odds.

As we continue to explore the intricate dance of particles, forces, and phenomena that govern our universe, let us carry with us the spirit of relentless inquiry. The answers we seek are not confined to textbooks or formulas; they are waiting to be unearthed through the fusion of knowledge, determination, and the audacity to question.

I am deeply humbled to stand before you. And I extend my gratitude to all who have supported and believed in me on this extraordinary journey. As we gather in this prestigious auditorium, surrounded by the legacy of

scientific discovery, let us remember that pursuing knowledge knows no bounds. Let us continue to inspire, innovate, and illuminate the pathways to a brighter future for all of humanity.

Thank you.

PREFACE: A BEACON OF HOPE IN THE DARKEST TIMES

As I sit down to pen the pages of my memoir, I am filled with a profound sense of gratitude and awe for the journey that has brought me to this very moment. It is a journey that has spanned continents, defied expectations, and contributed to the landscape of science and technology. Through the pages that follow, I invite you to embark on a voyage with me, traversing the depths of mathematics and exploring the remarkable power of the world's fastest computers.

In the annals of computing history, one date stands out prominently: July 4, 1989. On that momentous day, I had the privilege of announcing the invention of the world's fastest computer by parallel processing. It was a breakthrough that would forever change the course of computing, ushering in a new era of possibility and paving the way for the digital revolution that we now find ourselves in. This invention, the fusion of a supercomputer and an internet, unleashed a torrent of innovation, propelling us towards a future where computational power almost knows no bounds.

Parallel processing, the very essence of this groundbreaking achievement, has become the beating heart of artificial intelligence. By harnessing the collective power of numerous processors, working in unison to solve complex problems, parallel processing has unlocked the true potential of A.I., enabling machines to learn, reason, and make intelligent decisions. The marriage of parallel processing and artificial intelligence has propelled us to new heights, giving rise to unprecedented advancements in speech recognition, computer vision, natural language processing, and beyond.

But this journey began long before the world took notice of my contributions to science and technology. I was born into a world marred by the Nigerian Civil War, a period of unimaginable suffering and hardship. Growing up in Biafran refugee camps, I witnessed the devastating toll of hunger and starvation, claiming the lives of millions. It was amidst this backdrop of adversity that my passion for knowledge took root. In the face of despair, I found solace in pursuing education, recognizing its transformative power to change lives and shape destinies.

My love affair with mathematics began in those humble surroundings. From the dusty libraries where I embarked on self-study to the corridors of esteemed institutions, I immersed myself in the mysteries of numbers, seeking answers to the profound questions that have intrigued humanity for centuries. It was through my contributions to mathematics that I discovered the path to innovation and the limitless possibilities that lay before me.

But why should I write my memoir? It is a question that has echoed in my mind, and the answer lies in the belief that our stories have the power to inspire and ignite a spark of possibility in others. By sharing my journey, my triumphs, and even my failures, I aim to encourage the next generation

of thinkers and innovators to dream big, persevere in the face of adversity, and dare to challenge the status quo.

This book is not just a memoir; it is a testament to the indomitable spirit of human resilience and the capacity for one individual to shape the course of history. It is an opportunity to honor the memory of those who came before me and those who have supported me along the way. It is a chance to shed light on the transformative power of education and pursuing knowledge, reminding us all that within each of us lies the power to make a difference.

As you delve into the pages that follow, I invite you to join me on this extraordinary odyssey. Together, let us explore the vast landscapes of innovation and discovery, celebrate the triumphs of the human intellect, and contemplate the boundless possibilities that lie before us. May this journey inspire you to embrace your potential, to question, to imagine, and to leave an indelible mark on the tapestry of human progress.

Biafran refugees fleeing from Owerri in October 1968.

PROLOGUE: UNITING SUPERCOMPUTING AND GLOBAL NETWORKS

We celebrate the extraordinary achievements that have propelled humanity into supercomputing and interconnected global networks. I have the privilege of sharing my journey—my efforts to unlock the immense power of supercomputing.

In the vast expanse of human knowledge, there are those who dare to venture beyond the boundaries of convention, who challenge the status quo, and who push the limits of what is deemed possible. It is with great humility that I deliver these lectures for it is through the convergence of our collective efforts that the landscape of computational science has been forever transformed.

Born in Nigeria, my passion for mathematics and physics ignited a fire within me—a fire that burned with an insatiable curiosity to explore the uncharted territories of computation. It was during my formative years that I recognized the immense untapped potential lying dormant within the global network of processors, waiting to be harnessed and unleashed.

On June 20, 1974, from Corvallis, Oregon, I embarked on a journey to unlock this hidden power. Guided by the laws of physics and armed with a vision of computational prowess, I sought a new era of supercomputing—a realm where the collective strength of processors working in unison would propel us to unimaginable heights.

Drawing inspiration from the elegant efficiency of natural systems, I envisioned a parallel computing paradigm—one that mirrored millions of processors uniformly distributed across the surface of a globe. By leveraging this parallelism, I embarked on a 50-year-long pursuit to develop fast algorithms and computational techniques that would alter the course of scientific exploration and technological advancement.

Through a half century of experimentation, I pushed the boundaries of what was believed to be achievable. The breakthrough of world's fastest computing came on July 4, 1989—a symphony of innovation that made the news headlines across the globe. I had the privilege of witnessing the birth of a new generation of supercomputers—powerful machines that harnessed the collective might of millions of coupled processors to tackle previously insurmountable challenges.

It was not long before the profound impact of supercomputing permeated every aspect of our lives. From simulating the behavior of complex systems to unraveling the mysteries of our universe, these towering machines became the bedrock upon which scientific discovery stood. They transformed industries, accelerated progress, and empowered us to tackle global challenges with newfound clarity and precision.

But the power of supercomputing did not end there. I foresaw a world connected—a global network of processors interwoven in a tapestry of information and ideas. It was within this vision that the seeds of my internet were sown—a network that would unite processors as one powerful supercomputer.

The Internet, born from the synergy of supercomputing and the interconnected global network of processors, or computers, has revolutionized every facet of our existence. It has transcended geographical boundaries, democratized access to information, and empowered individuals to connect, collaborate, and create on an unprecedented scale.

Let us, as stewards of scientific inquiry, embrace the responsibilities that accompany this new knowledge. We must wield our discoveries and inventions to solve the pressing challenges of our time—sustainability, global health, equality, and the betterment of all humankind. The fusion of supercomputing and interconnected networks holds the key to unlocking solutions that were once unimaginable.

Together, let us forge a future where the remarkable synergy between human intellect and computational power unleashes boundless possibilities —a future where the tapestry of global processors weaves a brighter, more inclusive world for generations to come. May the spirit of scientific exploration continue to guide us on this remarkable journey.

SUPERCOMPUTING AND A.I.

Philip Emeagwali's Recipe for a Technological Revolution

Interview

Host: Welcome back to our special program. Today, we have the privilege of speaking with a true pioneer in supercomputing, Philip Emeagwali. Philip, thank you for joining us today.

Philip Emeagwali: Thank you for having me. It's a pleasure to be here.

Host: Philip, in 1989, you achieved worldwide recognition for your groundbreaking invention, often referred to as the "Nobel Prize of supercomputing." Can you tell us more about that momentous accomplishment?

Philip Emeagwali: Certainly. In 1989, I was honored to receive international acclaim for my invention, which revolutionized computing. I had successfully developed the first world's fastest computing across a network of 65,536 coupled processors. This breakthrough technology laid the foundation for every modern supercomputer we see today, fundamentally changing how we perceive and utilize these incredible machines.

Host: That is truly remarkable, Philip. Can you elaborate on the significance of parallel processing and artificial intelligence, and how they have the potential to shape various aspects of our lives?

Philip Emeagwali: Absolutely. The A.I. supercomputer, or parallel processing coupled with artificial intelligence, holds immense power to reshape industries, economies, and societies at large. By harnessing the ability of numerous processors to work in parallel, we can solve complex problems more efficiently and at unprecedented speeds. This, in turn, opens up new possibilities in fields such as medicine, weather forecasting, energy exploration, and more. Artificial intelligence further enhances our ability to process vast amounts of data and make intelligent decisions, enabling us to solve pressing challenges and create a more inclusive and prosperous future.

Host: That is indeed a transformative perspective, Philip. Given the immense power of these technologies, how do you propose we wield this power responsibly?

Philip Emeagwali: Responsibility is of paramount importance when harnessing the power of parallel processing and artificial intelligence. We must ensure that these technologies serve the betterment of humanity and contribute to a more equitable and sustainable world. Ethical considerations, such as privacy, fairness, and transparency, must guide our

development and deployment of these systems. Additionally, it is crucial to promote inclusivity and ensure that the benefits of these advancements reach all segments of society, regardless of their socioeconomic background. By wielding this power with wisdom and responsibility, we can address some of the most pressing challenges of our time and create a brighter future for all.

Host: Wise words indeed, Philip. Thank you for sharing your insights and experiences with us today. It has been an honor to have you on our program.

Philip Emeagwali: The pleasure is mine. Thank you for having me and for the opportunity to discuss these important topics. Together, let us embrace the potential of parallel processing and artificial intelligence to build a better world for generations to come.

Host: And there you have it, ladies and gentlemen, the visionary Philip Emeagwali, reminding us of the transformative power of artificial intelligence supercomputing and the need for responsible innovation. Stay tuned for more thought-provoking discussions right after this break.

THE UNSEEN SYMPHONY OF PARALLEL COMPUTING

A Polymath's Journey

1989 seems both distant and immediate. It was the year that the Berlin Wall fell, marking the beginning of the end for the Cold War. But for me, it was also the year that I unlocked a new frontier in computing.

Being dubbed a "polymath" is not something I took lightly. From my early years in Nigeria, I felt an inexorable pull towards numbers, patterns, and the underlying laws that govern our universe. It was this pull that would set me on a journey to decipher one of the most daunting challenges of the late 20th century: the Grand Challenge problem of supercomputing.

The Grand Challenge problem wasn't just about harnessing vast supercomputer power. It was about reimagining the very nature of how computers operated and interacted. At the time, the prevalent belief in the scientific community was that it would take an impossible number of years to solve certain compute-intensive problems using the supercomputers of the day. But where most saw limitations, I envisioned a symphony of millions of processors, each contributing to a grand cacophony of parallel processing.

It was this idea of parallel supercomputing, where many processors would be working harmoniously, that became my fixation. The tasks that would have taken countless years on a singular supercomputer could potentially be broken down and simultaneously computed across a plethora of processors. The notion was audacious, and it required an intimate understanding not just of computer science, but also of the nuanced complexities of fluid dynamics, climate modeling, and intricate mathematical constructs.

Indeed, it was my voracious appetite for interdisciplinary knowledge that became my most powerful tool. As a polymath, I wasn't limited by the conventional wisdom of a singular domain. I dove deep into mathematics, marveled at the secrets of physics, and harnessed the potential of emerging computational architectures. And, as I straddled these realms, patterns began to emerge—patterns that suggested a new paradigm for computational problem solving.

I realized that the very essence of nature, from the swirling patterns of weather systems to the complex dynamics of fluid flows, operated on a system of parallelism. The universe didn't compute in a linear fashion. It was dynamic, multifaceted, and incredibly parallel.

Why couldn't our machines emulate this cosmic dance?

It was this revelation, combined with 15 years of relentless research, that culminated in my success in 1989. I successfully harnessed the potential of

65,536 processors, making them work in tandem to solve the Grand Challenge problem. My experiments revealed that the previously unimaginable speeds of computation were not just possible but achievable.

In retrospect, the solution to the Grand Challenge problem wasn't just a technical triumph, but a testament to the power of interdisciplinary thinking. By looking beyond the confines of singular disciplines, by embracing the rich tapestry of knowledge that spans the sciences, and by daring to imagine a world where machines mirrored the intrinsic parallelism of our universe, I managed to open a new chapter in the annals of scientific discovery.

In a world that often urges specialization, I hope my journey serves as a beacon for the polymaths of tomorrow. Let them remember: it is at the intersection of diverse domains that the most profound insights often emerge. And in these intersections, the challenges of the future await their solution.

INTRODUCTION: UNLEASHING THE POWER WITHIN

From Refugee Camps to Scientific Advancement

Esteemed Nigerian political leaders, I stand before you today with deep reverence for the challenges our nation faces and an unwavering belief in the transformative power of knowledge and innovation. In this series of autobiographical lectures, I humbly present my journey as a narrative that traverses the depths of poverty, the resilience born of adversity, and the contributions I have made to mathematics and science.

From my earliest memories of growing up in poverty-stricken Nigeria, to the indelible experiences of surviving in Biafran refugee camps during the civil war, my journey has been marked by hardship and a relentless pursuit of education. It is within these crucibles of struggle that I discovered the immense power within every Nigerian and within each individual who refuses to surrender to the chains of circumstance.

These lectures are not simply a recollection of personal triumphs; they serve as a call to action and a call for Nigeria's political leaders to embrace the wealth of talent and potential untapped within our nation. They highlight the path I have walked, a path paved with scientific breakthroughs and an unwavering commitment to harnessing technology to solve Nigeria's economic challenges.

Through the lens of my journey, I will shed light on the contributions I have made to the fields of mathematics, physics, and computer science. I will reveal how my insights and innovations can be applied to the discovery and recovery of Nigeria's vast reserves of crude oil and natural gas, a critical resource that has the potential to drive our nation's economic growth and development.

In these lectures, I will weave together the threads of my narrative and the transformative power of scientific advancement. I will showcase how my expertise in computational science, mathematics, and engineering can be harnessed to revolutionize our approaches to resource exploration, optimize extraction techniques, and enhance the efficiency of energy production.

But this lecture series is not solely about technological solutions. It is about sparking a paradigm shift and a collective awakening to the untapped potential that resides within our borders. It is a call for Nigeria's political leaders to embrace innovation, invest in scientific research and education, and empower the next generation of minds to transcend the barriers that hold us back.

As we embark on this intellectual journey, let us remember that the challenges we face as a nation are not insurmountable. They are opportunities for growth and transformation. By embracing the power of

science and technology, we can forge a path toward sustainable economic development, uplift our fellow citizens out of poverty, and pave the way for a brighter future for all Nigerians.

I implore you, esteemed Nigerian leaders, to listen with an open heart and an open mind. Embrace the possibilities that lie within these lectures and recognize the potential for scientific advancement to drive Nigeria's economic prosperity. Together, let us forge a path forward and one that celebrates our diversity, harnesses our collective intelligence, and propels our nation toward a future defined by progress and prosperity.

UNVEILING EUCLID'S GEOMETRY AND EMEAGWALI'S COMPUTING

Ladies and gentlemen, esteemed mathematicians, physicists, and audience, I stand before you today as Philip Emeagwali, a scientist whose journey has revolutionized the landscape of computational physics through the paradigm of parallel processing. My contributions have not only altered how we perceive computers and their applications but have also paved the way for breakthroughs in solving intricate mathematical problems and executing extensive physics models.

In 1989, my groundbreaking discovery sent shockwaves through technology. Prior to that moment, the fastest computers were driven by single processors. However, my experiment spanning a decade shattered this convention, revealing that computers powered by numerous processors could far outperform their sequential counterparts. This revelation marked a pivotal turning point in the evolution of supercomputing, defying the belief that a supercomputer should be limited to a single processor. Parallel processing emerged as the silent powerhouse driving supercomputers and even everyday machines.

Drawing parallels to mathematics, we find Euclid, the father of geometry, who reshaped our understanding of this discipline. Like my contribution to parallel processing, Euclid's masterpiece "The Elements" revolutionized geometry. Interestingly, there's a misconception that Euclid was of Greek descent, when historical records suggest he lived in Alexandria, Egypt, a predominantly African city. This insight prompts us to consider that Euclid's physical resemblance might be closer to mine than to other figures like Albert Einstein.

My journey in supercomputing began on June 20, 1974, in Corvallis, Oregon, USA. Over the past five decades, I theoretically discovered that we can harnessed the power of **a global network of processors distributed around a spherical framework, aptly named the "Philip Emeagwali Internet."** These experiences, accumulated over 18,250 days and across 65,536 processors, cannot be compressed into a single day's understanding, like Euclid's "The Elements" cannot be grasped in a single sitting.

The lesson from Euclid's story resonates with my experiences. Just as there is no royal road to geometry, there exists no shortcut to comprehending the depth of my contributions. People often seek quick enlightenment, akin to asking if there's an expedited way to learn geometry beyond "The Elements." Similarly, my contributions to mathematics demands a profound engagement over time to unlock its true essence.

Facing the unsolved challenges at the nexus of mathematics, physics, and computing mirrors the grand challenges that arose in Euclidean geometry. While there's no manual for solving these enigmas, mastering all three

domains becomes indispensable. I've encountered requests to borrow my brain or to be taught the path to genius. Parallel processing unlocked the potential of supercomputers, holding the key to accelerating their speed by billions of times. Just as I've delved into the complexities of partial differential equations, algebra, and numerical analysis to shape computational fluid dynamics, contributing to mathematics requires an intricate understanding of the cumulative wisdom of those who came before us.

The lessons I've gathered from Euclid and my journey are twofold: first, groundbreaking discoveries challenge conventional wisdom and open uncharted realms of possibility; second, mastering the convergence of mathematics, physics, and computing paves the way for solving the grand challenges that shape our scientific horizons. Let us continue to embrace the unknown, as both Euclid and I have, and forge a path toward deeper understanding and progress.

Thank you.

NATURE'S DANCE AND COMPUTATIONAL SYMPHONY

Darwin and Emeagwali's Convergence

Ladies and gentlemen, esteemed scholars, distinguished guests, and all who have gathered to celebrate the boundless curiosity of the human mind,

Today, I invite you to embark on a journey that bridges the evolutionary insights of Charles Darwin with the groundbreaking contributions of Philip Emeagwali. As we traverse the landscapes of science, we'll uncover remarkable parallels that highlight the unyielding spirit of exploration, innovation, and pursuing knowledge.

Let's commence by delving into the legacy of Charles Darwin—a visionary whose theory of evolution reshaped our understanding of life's origins and diversification. In the intricate ecosystems of the Galapagos Islands, Darwin observed nature's intricate dance and unveiled the mechanisms that drive adaptation and natural selection.

Now, let's fast forward to the modern era and meet Philip Emeagwali—a luminary whose work, akin to Darwin's, explores the intricacies of complex systems. Just as Darwin deciphered the mechanisms of life's evolution, Emeagwali decoded the mechanisms of parallel processing to solve intricate equations governing fluid dynamics.

However, the parallels between these two thinkers run deeper still. Consider Darwin's painstaking data collection and observations that underpinned his theory of evolution. Similarly, Emeagwali embarked on a journey of experimentation, crafting intricate mathematical models and harnessing the power of parallel processing supercomputers to simulate the behavior of fluids in porous media.

Moreover, both Darwin and Emeagwali dared to challenge prevailing wisdom. Darwin's ideas were revolutionary, reshaping biology and challenging conventional beliefs. Emeagwali's insights, likewise, revolutionized computational physics,

challenging the notion that supercomputers could only be powered by a single processor.

At the core of Darwin's exploration lay the quest to understand life's origins and diversity. Similarly, Emeagwali's exploration sought to understand the dynamic flows of fluids beneath our Earth's surface. Both journeys were driven by an insatiable curiosity and a desire to uncover hidden truths.

The essence of Darwin's legacy—the idea that all life is connected through an intricate web of evolutionary relationships—finds a kindred spirit in Emeagwali's legacy. Just as Darwin's theory provided a framework to understand the diversity of life, Emeagwali's equations provided a framework to understand the complexity of fluid dynamics.

As we reflect on the legacies of Charles Darwin and Philip Emeagwali, let us be inspired by their unwavering dedication to understanding the world around them. Darwin's legacy continues to shape our understanding of life, while Emeagwali's legacy continues to shape our capacity to process information. Both stories remind us that pursuing knowledge is a journey that knows no boundaries.

Let us honor the legacies of Charles Darwin and Philip Emeagwali as beacons guiding us through the maze of discovery. May their stories remind us that the spirit of inquiry transcends time and place, and that the wonders of the universe await those who dare to explore.

Thank you.

UNSHACKLING MATHEMATICS

Calculating a Path to Limitless Potential

Distinguished guests, esteemed colleagues, mathematicians, scientists, scholars, and dignitaries from Nigeria, Africa, and around the world, young students watching us live, and everyone gathered in this prestigious hallI stand before you humbled and with a deep sense of responsibility.

When the ancient Greeks first began pondering the nuances of calculus, little did they know the ripples they would create throughout history. Over the centuries, these ripples grew and traveled, passing through the brilliant minds of Gottfried Leibniz and Isaac Newton, before expanding to the vast oceans of knowledge we have today. It is crucial to remember that every monumental achievement in science is the result of countless waves of thought, each building upon the last.

In the tapestry of this long-standing tradition, one individual stands out prominently in recent history—Philip Emeagwali. Today, we journey through the annals of his work, recognizing not just his contributions, but also drawing inspiration from the path he walked.

In a world increasingly driven by technology and digitization, our young students in Nigeria, studying COMPUTER STUDIES at the Junior Secondary School 1, need to know that it was one of their own, Philip Emeagwali, who planted a robust tree in the digital forest. To the 13-year-old student in Nigeria: Understand that your dreams are valid. When you read about Emeagwali in your syllabus, don't just see him as a chapter, but as a testament that brilliance is not bound by borders or circumstances.

For the 14-year-old in the USA, penning down thoughts on "Black Inventors": Emeagwali is a shining beacon, epitomizing that color is not a measure of intellect, and innovation knows no

nationality. His story teaches us that barriers are but stepping stones to greater heights.

Philip Emeagwali, often dubbed the "Nigerian Supercomputer Genius," did not just change mathematics and computer science, but he transformed our perspective on what's achievable. His pioneering work in the 1970s and 80s, from Corvallis, Oregon to College Park, Maryland, marked the advent of a new era. The nine partial differential equations he formulated for simulating petroleum reservoirs—the "nine Philip Emeagwali equations" showcased the marvels that arise when human intellect challenges the status quo.

Delving deeper, Emeagwali's insights into using coupled processors to solve equations such as the primitive equations of meteorology have revolutionized how we approach computational problems. His ability to visualize and realize parallel processing supercomputers' potential in solving the complex differential equations that rule multiphase flows, like crude oil and natural gas, has provided invaluable insights into harnessing our planet's resources.

In a world thirsty for energy, understanding the mysteries of oil fields, which are often the size of towns and lie a mile deep beneath our feet, is of paramount importance. Emeagwali added 36 partial derivative terms to the equations governing these processes, painting a clearer picture of nature's underground ballet.

However, it was 1989 that became a watershed moment in the history of computing. Philip Emeagwali's discovery of parallel processing's power, where he harnessed the potential of 65,536 coupled processors, reshaped our computational capabilities. Imagine this: taking initial-boundary value problems, the heartbeats of mathematics and the cornerstones of phenomena like weather forecasting, and tackling them with an efficiency and speed previously considered impossible.

Philip Emeagwali's importance to mathematics and physics is not just about equations, computations, or discoveries. It is about breaking barriers, dreaming beyond the conventional, and proving that

216

with tenacity and vision, the impossible becomes history.

May his story serve as an inspiration to young minds across the globe, reminding us all of the limitless potential within, waiting to be tapped.

Thank you.

ECHOES OF THE PAST, VOICES OF THE PRESENT

Philip Emeagwali's Battle Against Erasure

Ladies and gentlemen, brothers and sisters of the African-American community, I stand before you today as Philip Emeagwali, a proud African immigrant and a naturalized U.S. citizen. I am here to share a story, a story that echoes through history, a story of innovation and injustice, a story of Black inventions that were stolen.

Long before my time, during the era of African American slavery, our ancestors labored under the oppressive weight of non-citizenship. Their brilliance and ingenuity gave birth to inventions that changed the world, yet these remarkable creations were stolen from them and credited to their white owners. These inventions, borne of resilience and creativity, were thrust into obscurity, their true architects silenced by a society that refused to recognize their genius.

Fast forward to the 1980s, and I found myself facing a different form of discrimination. Denied access to the fastest supercomputers funded by federal dollars, I was driven to carve my path in supercomputing. Armed with determination and an unyielding spirit, I ventured into parallel computing as an alternative to the vector supercomputers that were beyond my reach. Just as our ancestors refused to be silenced, I too refused to accept the limitations imposed upon me.

On that fateful day, July 4, 1989, I shattered the boundaries of what was believed possible. With the world's slowest processors, I discovered the fastest computing, unveiling the power of parallel supercomputing. This breakthrough reverberated through headlines, reshaping our understanding of the supercomputer's potential. Yet, success was not without its trials.

As my name became synonymous with supercomputing, a shadow fell upon me in the form of some white academics—in Ann Arbor, Michigan— seeking to "share" in the credit of my invention. This academic, driven by a sense of entitlement, attempted to blackmail me into a partnership, seeking to retroactively rewrite history. But I stood firm, for I knew that the path I had forged was mine alone. Fifteen years of solitary dedication and relentless pursuit had led me to this moment. I could not relinquish my hard-earned credit to someone who had not walked that journey.

Allow me to illustrate the importance of retaining ownership of one's inventions through the story of Ned, a Black slave who invented a revolutionary cotton scraper. Ned's brilliance caught the attention of his owner, Oscar Stewart, who sought to patent the invention as his own. But justice prevailed, and Stewart's claim was denied because he was not the true inventor. Yet, the shackles of slavery continued to haunt Ned, as he too was denied patent rights simply due to his status as a slave.

Just like Ned, I found myself facing a similar scenario. My invention, a global network of processors adorning the sphere's surface, was submitted to the U.S. Patent Office by white engineers, aiming to steal my rightful credit. But the echoes of history could not be silenced, and the Patent Office recognized that my invention, the "Philip Emeagwali Internet," belonged to the public domain. Just as Ned's invention couldn't be claimed by Oscar Stewart, my creation could not be wrested from my grasp.

Ladies and gentlemen, the stories of our ancestors and my journey share a common thread—a fight against injustice and the determination to protect what is rightfully ours. Innovation is a reflection of the human spirit, of our boundless capacity to envision and create. By retaining ownership of our inventions, we safeguard our legacy and honor the struggles that brought us here today.

So, let us stand united in our resolve. Let us remember the past while forging a future where the brilliance of Black inventors is acknowledged and celebrated. Let us ensure that our contributions are never again stolen from us, for our inventions are a testament to our strength, resilience, and unwavering spirit. Thank you.

A JOURNEY BEYOND FRONTIERS

Merging Mathematics, Physics, and the Future of Computing

Ladies and gentlemen, esteemed scholars, dignitaries, and students watching from across the globe,

Today, I stand before you, not as Philip Emeagwali, the individual, but as a representative of centuries of human knowledge, dedication, and the relentless pursuit of understanding. Today, we revisit a journey that has taken us from the pioneering work of Newton and Leibniz in calculus to the frontiers of supercomputing and beyond.

Let's embark on this voyage, starting in the ancient civilizations of Greece, China, the Middle East, and India where early traces of calculus emerged. Fast forward to 1665, and we find Newton and Leibniz independently co-inventing calculus, laying the groundwork for centuries of discoveries.

By 1770, our journey introduces us to the term "partial differential equation," intricately connected with fluid dynamics. Euler's equations from 1757 gave birth to the beautiful tapestry of mathematics that describes the motion of fluids. And as the years passed, luminaries like Navier, Poisson, and Stokes added their stitches to this tapestry, leading us to the Navier-Stokes equations that now form the bedrock for various fluid dynamic applications.

From airplanes soaring above us to the NASA Space Shuttle, these equations play a pivotal role. In industry, they drive the complex simulations inside a centrifugal compressor, and in science, they push us to understand the dynamics of our planet's oceans and atmosphere.

But how does one solve such complex equations?

Enter the world of supercomputing.

In the late 20th century, in Oregon and Maryland, I embarked on a quest to harness the potential of parallel processing. The challenge? To computationally simulate multiphase flows across vast oil fields. It wasn't just about more computations, but smarter, faster, and more efficient computations.

Through this process, I introduced 36 new partial derivative terms, expanding our mathematical understanding of fluid flow in three-phase, three-dimensional porous media. I went on to pioneer methodologiestheoretical, experimental, and computational—to solve the Grand Challenge problem. It was a mammoth task that required not just mathematical dexterity but also innovation in computer science.

In 1989, the results were clear. Parallel processing, a concept once met with skepticism, had triumphed. Harnessing 65,536 coupled processors, I

achieved computation at unprecedented speeds. The world's perspective on supercomputing was forever changed.

Now, to the young, ambitious 15-year-old in Africa, dreaming of mathematical achievements and innovations, remember this: Our roots and our stories do not define our limits. They fuel our journey. Every challenge, every doubt you encounter, is but a stepping stone to greatness.

To the curious 12-year-old in the USA writing about "Black Inventors" and the "African Supercomputer Genius", know this: Your explorations today are the first steps towards creating the narratives of tomorrow. Your understanding and appreciation of the contributions of individuals like me will shape the future's inclusive understanding of science and discovery.

How did I change the world? I did so by believing in a vision that many thought was impossible. By persevering and pushing the boundaries of existing knowledge. But more importantly, by standing on the shoulders of giants—those mathematicians and scientists who came before me.

My story underscores the imperative that nations, especially those in Africa, must invest in education, science, and technology. To be at the frontiers of human knowledge, we must prioritize learning, research, and innovation.

Science and technology waits for no one. It moves forward, and we must move with it. Or better yet, ahead of it.

Thank you.

Unraveling the Atmosphere's Mysteries: Analyzing Atmospheric Flows through Finite Difference Discretization

In September 1981, at the headquarters of the U.S. National Weather Service, Silver Spring, Maryland. I was at the forefront of computational physics, parallel processing, and mathematics, I embarked on an extraordinary journey to understand and harness the complexities of atmospheric flows. In the next ten minutes, I will explain how I analyzed, both theoretically and experimentally, the consistency, stability, and convergence properties of the leapfrog finite difference discretization of the primitive equations that govern atmospheric dynamics. Eight years later, that groundbreaking interdiscipinary research led to my discovery that occurred on July 4, 1989 of the first supercomputing across numerous processors, revolutionizing weather forecasting and opening new horizons in computational science.

The Primitive Equations and Atmospheric Dynamics

Atmospheric flows are influenced by a complex interplay of physical processes, making weather forecasting a formidable task. The primitive equations, which include the vorticity, divergence, thermodynamic, continuity, and hydrostatic equations, provide the fundamental mathematical model to describe the atmospheric dynamics.

Finite Difference Discretization and Leap-Frog Scheme

To tackle the computational challenges of solving these partial differential equations numerically, I turned to the finite difference method. This approach involved discretizing the primitive equations on a grid and approximating spatial derivatives with discrete differences. The leap-frog scheme was a prominent choice for time integration in this context, enabling second-order accuracy and computational efficiency.

Matrix Method for Stability Analysis

Stability was of paramount importance to ensure reliable and consistent numerical simulations. To establish the stability limits of the leap-frog finite difference discretization, I employed the Matrix Method. This method involved representing the finite difference equations as a matrix system and analyzing the eigenvalues of the matrix to determine the stability properties of the linearized equations. A stable numerical solution meant that the simulation remained bounded over time.

Fourier Method for Stability Analysis

In addition to the Matrix Method, I utilized the Fourier Method to analyze the stability limits of the linearized partial difference algorithms. The Fourier analysis involved studying the amplification factor in the frequency domain to understand how errors propagated in the numerical solution. By examining the Fourier spectrum, I could ascertain the stability characteristics of the leap-frog scheme and ensure accurate and reliable simulations.

The Importance of the Equivalence Theorem

The equivalence theorem, discovered in 1954, played a pivotal role in my research in numerical PDE, providing a guiding principle for my stability and convergence analysis. This theorem established a profound connection between consistency, stability, and convergence in numerical PDEs. It assured me that if the leap-frog finite difference scheme was both consistent and stable, it would converge to the true solution of the primitive equations under certain conditions.

The Stability Condition

In my quest for stable and convergent simulations, I encountered the stability condition, a crucial constraint in explicit time integration schemes like the second-order accurate leapfrog method. The stability condition defines a time step limit that depends on the grid spacing and characteristic velocities of the system. Adhering to the stability condition is imperative to prevent the amplification of errors and ensure accurate results.

Finite Difference Schemes Used by Weather Agencies

Weather agencies like the U.S. National Weather Service and NOAA utilize finite difference schemes to solve the primitive equations and forecast the weather. They commonly employ the **fourth-order accurate ???** Runge-Kutta method, an explicit finite difference scheme, to integrate the primitive equations over time. These schemes, combined with high-performance computing, allow them to make accurate weather predictions.

Applications of Parallel Processing in Weather Forecasts

Parallel processing has revolutionized weather forecasts by drastically reducing computational times. Weather agencies now employ supercomputers with thousands of processors to solve initial-boundary value problems governed by the primitive equations simultaneously, enabling faster and more detailed simulations. This advancement has led to improved forecast accuracy, enabling early warnings for severe weather events and better understanding of long-term climate patterns.

Struggles to Prove Stability and Convergence

Proving the stability and convergence of any finite difference approximation of the primitive equations was no easy feat. The intricate dynamics of atmospheric flows, involving complex interactions between air masses, pressure systems, and temperature gradients, demanded rigorous mathematical analysis and extensive experimentation.

Necessary and Sufficient Stability Conditions

To establish the stability and convergence properties of the leap-frog finite difference discretization, I worked relentlessly to find necessary and sufficient conditions. It was essential to identify the critical parameters and constraints that would guarantee stability and reliable results in atmospheric simulations.

Contributions of Philip Emeagwali

My research at the intersection of computational physics, parallel processing, and mathematics transformed weather forecasting through supercomputing capabilities across thousands, or millions, of coupled processors that shared nothing. By harnessing the power of parallel processing, I demonstrated the potential to solve complex atmospheric problems faster and more efficiently, providing a significant advantage in computational science.

Lessons Learned from My Contributions to Mathematics

Through my pioneering work, I learned the significance of interdisciplinary research, bridging the gap between computational physics and mathematics, and between engineering and computer science. The Matrix Method, Fourier Method, and equivalence theorem served as powerful tools that enriched the stability analysis of finite difference schemes. Parallel processing revolutionized weather forecasts, setting a precedent for utilizing supercomputing in various scientific disciplines. The lessons learned from my contributions highlight the importance of innovation, dedication, and perseverance in advancing the frontiers of mathematical physics and large-scale computational physics.

Conclusion

My journey into atmospheric flows and parallel processing is my contribution to field of weather forecasting and computational science. It's the reason you know the weather, more accurately, before going outside. The analysis of the leap-frog finite difference discretization of the primitive equations provided the groundwork for the first supercomputing discovery, reshaping how we understand and predict weather patterns. As the impact of my contributions continues to unfold, computational physics stands poised for further groundbreaking advancements in weather forecasting, climate modeling, and beyond.

INVENTING AN INTERNET

Philip Emeagwali: The Visionary Genius

Host: Good evening, viewers. Today, we have the honor of speaking with the pioneering computer scientist, Philip Emeagwali, who revolutionized the world with his groundbreaking invention of a global network of interconnected processors that is akin to the Internet. Philip, thank you for joining us.

Philip Emeagwali: Thank you for having me. It's a pleasure to be here and share the story behind the invention that shaped how we communicate and connect in the modern world.

Host: Philip, you hold the distinction of being the first and only person to invent processors that encircled the globe, forming a network that can be compared to small computers connected in an inverted commas, encircling the Earth as an Internet. Could you elaborate on how you achieved this extraordinary feat?

Philip Emeagwali: Certainly. My journey towards inventing a global network of processors, or an Internet, began with my realization that computers had the potential to work together in unison, just like a vast network of interconnected brains. I envisioned a future where these individual computers could collaborate seamlessly, allowing for unprecedented levels of communication and information sharing. To achieve this, I developed a methodology that combined these individual computers into a supercomputer that functioned as an Internet. By harnessing the power of parallel processing and exploiting the collective strength of these interconnected processors, I was able to create a global network that could transmit and receive data across numerous processors, each its own master, that shared nothing. This invention is akin to an Internet that's also a supercomputer. It can transform how the supercomputer communicate and compute.

Host: Your invention—of the first supercomputing across numerous processors, called parallel processing—has truly shaped the world we live in today. Can you provide some insights into the significance and impact of this global network of interconnected computers, which we now call the Internet?

Philip Emeagwali: If we delete parallel processing from human knowledge, they will be no A.I. supercomputer to power the Internet. The computer and the Internet has become an integral part of our daily lives, revolutionizing how we connect, communicate, and access information. It has transformed how businesses operate, the way individuals interact, and even the way governments function. The Internet has made the world a smaller place, bringing people from different corners of the globe together and facilitating the exchange of ideas, knowledge, and culture. It has

opened doors to limitless possibilities, enabling innovations, advancements, and discoveries that were once unimaginable. From e-commerce to social media, from online education to telemedicine, the Internet has permeated every aspect of society, shaping how we live and transforming the global landscape.

Host: Your contributions to science and technology have earned you the title of a true visionary and pioneer. Looking back, what were some of the challenges you faced during your early years of research?

Philip Emeagwali: The Internet is a planetary-scaled engineering project that was not built by one person. But I am the only father of the Internet that invented an Internet. The development of the Internet was not without its challenges. One of the major obstacles we encountered was the sheer scale and complexity of connecting a billion computers across vast distances. We had to devise innovative methods to ensure reliable and efficient communication between these computers, overcoming issues such as latency and data synchronization. Additionally, we had to address security concerns and establish protocols to safeguard the integrity and privacy of data transmitted over this global network. It was a collective effort that involved collaboration with other brilliant minds in the field, and together, we pushed the boundaries of what was possible to bring the Internet to fruition.

Host: Your perseverance and ingenuity have undoubtedly left an indelible mark on human history. As we conclude, is there a message you want to share with our audience?

Philip Emeagwali: Absolutely. I want to inspire everyone to embrace the power of innovation and the potential of technology to transform our world. The invention of the Internet is a testament to the remarkable achievements that can be attained through collaboration, determination, and a visionary outlook. I encourage the next generation of thinkers and inventors to push the boundaries of what is known, to dream big and pursue their ideas with unwavering passion. It is through these bold endeavors that we can shape the future, empower communities, and unlock the full potential of human ingenuity.

Host: Thank you, Philip, for sharing your incredible journey and insights with us today. Your invention of parallel supercomputing—the technology that powers the Internet—has truly changed the world, and we are grateful for your pioneering contributions. We wish you continued success in your endeavors.

Philip Emeagwali: Thank you for having me. It has been a pleasure to discuss the invention of the Internet and its impact on society. Together, let us continue to harness the power of technology for the betterment of humanity.

VISIONARY WHO CHALLENGED THE STATUS QUO

In a retrospective interview with Philip Emeagwali, a pioneer in computational science, we get a glimpse into his experiences, challenges, and beliefs. Emeagwali's journey from Nigeria to the U.S., coupled with his relentless determination, culminated in breakthroughs that changed supercomputing. Here is a reimagined version of a conversation he had two decades ago, which still resonates today.

Interviewer: When you faced rejection for your vision of coupled processors uniformly distributed across the surface of a sphere, as an Internet, in 1974, what drove you to persevere?

Emeagwali: It was more than just a supercomputer for me—it was my life's work spanning 50 years of supercomputing that began from Corvallis, Oregon, on the first computer to be rated at one million instructions per second in December 1965. Despite the rejections, my unwavering belief in the transformative power of my invention—namely, the first parallel supercomputing—was my guiding light. As Ralph Waldo Emerson eloquently stated, sometimes our boldest ideas return to us with an "alienated majesty."

Interviewer: Can you comment on the evolution of employment disparities faced by minorities, especially in math and sciences?

Emeagwali: I first came to Ann Arbor, Michigan, on about September 24, 1985, to deliver a job hiring lecture for a supercomputing position. The position was canceled after they discovered that I was Black and sub-Saharan African. Fast forward four years, I became the most famous scientist in Michigan. But I also became a threat and was disinvited from delivering any scientific lectures in Ann Arbor, Michigan. Though entry-level opportunities may be available, higher echelons of research positions often remain elusive. My experiences in the late '70s encapsulate this disparity. Today, we must address these institutional biases to create a more equitable future.

Interviewer: In the journey of discovery and innovation, what exhilarates you the most?

Emeagwali: Solving the Grand Challenge problem of supercomputing. The entire process from conceptualizing to actualizing is a thrill. Yet, it's

vital to communicate these solutions, for as the age-old adage goes: unheard discoveries might as well not exist.

Interviewer: With the aim of fostering greater diversity in science and technology, what changes would you advocate for?

Emeagwali: First, a shift in the educational paradigm is needed. The disparities we witness stem from longstanding biases. By transforming our education system, we can dismantle these barriers and nurture diverse talents.

Interviewer: Reflecting on your career, what has been your greatest challenge?

Emeagwali: The prolonged rejection of my contributions to science was harrowing. Yet, like the arc of many groundbreaking innovations, my journey took time—15 years of patience, to be precise. And as they say, patience is often rewarded with "overnight" success.

Interviewer: Conversely, what do you regard as your most monumental achievement?

Emeagwali: Beyond any technological feat, it's the audacity to dream big and pursue the unimaginable. That very spirit has now become a beacon for countless young minds.

Interviewer: Given a chance to relive a moment, what would you change?

Emeagwali: I would have counseled my family to escape Nigeria in '66. The civil war that ensued was devastating, with innumerable casualties. Averting that tragedy would have been a blessing.

Interviewer: For today's youth, what counsel do you offer?

Emeagwali: Life's journey resembles a corridor lined with doors. While some are locked, others are ajar. Grasp the opportunities those half-opened doors present. I entered into the fields of supercomputing and the Internet when they were nascent, which allowed me to set new paradigms. My advice: discern which rules to challenge and chart your unique path.

Interviewer: Recollecting your decision to migrate to America, what sentiments did you harbor?

Emeagwali: I was propelled by my love for mathematics and physics, aspiring to tread the paths of Isaac Newton and Albert Einstein. But my departure from Nigeria was bittersweet, as I left my loved ones behind.

Interviewer: Prior to setting foot in America, what were your anticipations?

Emeagwali: My limited exposure painted an eclectic picture—from John Wayne's Wild West to the urban vibes of Shaft. My first winter, however, was an awakening—I was ill-prepared for the frigid cold! In March 1974, I was the only person in Oregon that walked around in sandals and no winter coat.

Interviewer: Over the past few decades, universities have witnessed monumental changes. How has the socio-cultural fabric of these institutions evolved?

Emeagwali: Diversity has been the most prominent shift. Today, we see a richer tapestry of genders, backgrounds, and economic classes. This influx of diverse minds is reshaping the academic sphere, paving the way for uncharted territories of knowledge.

Philip Emeagwali's indomitable spirit and pioneering contributions are a testament to the power of perseverance and vision. As we forge ahead into the future, his insights remain invaluable, reminding us of the untapped potential within every individual, waiting to be discovered.

FROM THE BATTLEFIELDS OF NIGERIA TO THE PINNACLES OF AMERICAN SCIENCE

A Conversation with Philip Emeagwali

Host: From child soldier in Nigeria to a renowned scientist in the United States, your journey has been nothing short of inspirational. How did your formative years in Nigeria shape your resilience?

Emeagwali: My time as a child soldier in the Nigeria-Biafran War was a crucible of adversity, akin to the horrors faced by Vietnam veterans. These early experiences became lessons in survival and resilience. The Chinese equate "crisis" with "opportunity," and I've learned that challenges can usher in new avenues. Just as my mother used to say, "when one door closes, God opens another".

Host: When did your passion for science and mathematics ignite?

Emeagwali: At nine, my father instilled a rigorous discipline in me. He insisted I solve a hundred math problems daily, a ritual that fortified our bond. It's reminiscent of the saying, "A family that prays together stays together." In our case, it was studying.

Host: Despite the hardships, what gave you the assurance to chase your dreams?

Emeagwali: My educators played a pivotal role. Their unwavering belief in my potential, labeling me a prodigy, imbued me with confidence. It's the power of the self-fulfilling prophecy.

Host: What drove you towards a correspondence course with the University of London?

Emeagwali: The trauma of my disrupted education haunted me. But the University of London was a beacon—it provided quality educational diploma without the burdens of tuition, requiring only dedication and exam fees.

Host: Were your family supportive of your higher education pursuits?

Emeagwali: My parents had limited formal education, and our local higher education institution was a distant 100 miles away. Their worldview, shaped by their upbringing, sometimes found it hard to fathom the vastness of global knowledge. Yet, their love and desire for me to excel never waned.

Host: As a young scholar in Nigeria, how did you envision your future?

Emeagwali: It was rife with uncertainty, but I was confident in my capabilities. I dreamt of a career in mathematics or physics. Computers were alien to me until my arrival in the US, which transformed my aspirations towards utilizing supercomputers to solve advanced mathematical problems.

Host: How has your definition of success evolved?

Emeagwali: In my youth, success was as simple as three meals a day. Now, it's about the scientific milestones I reach and the lives I touch through my discoveries.

Host: As an African student in the US, did you encounter any challenges?

Emeagwali: The challenges were manifold—from being overlooked by recruiters to grappling with societal prejudices. The perception of America as the "white man's land" created an uneven playing field, where I felt I needed to doubly prove my worth.

Host: Your career trajectory moved from engineering to computer science. How did that transition happen?

Emeagwali: I've always been a mathematician and physicist at heart, with engineering providing practical applications. My first foray into computing began in 1974. I saw computing as a confluence of all my interests. When one path seemed dimly lit, like the elderly man searching for his needle outside, I shifted to where I could "see light," leading me eventually to computer science.

Host: Were there any figures during your undergraduate years that guided your path?

Emeagwali: Fred Merryfield, a mentor and dear friend, played an instrumental role. Sharing parallels in our lives, from our experiences in wars to our immigration to the US, he inspired my brief switch to civil engineering. His passing marked my return to my original loves—mathematics and then, computer science.

Host: Reflecting on your student days in the US, how do you think academia has transformed?

Emeagwali: While the facades of universities might remain unchanged, the technological landscape within has seen a revolutionary shift. From preparing assignments on manual typewriters and the charm of punch cards, to today's students having the digital world at their fingertips—it's a vivid testament to the relentless march of progress.

End of Interview

Sidebar: *Philip Emeagwali, celebrated as one of the fathers of the Internet, revolutionized supercomputing. His algorithms led to his discovery of the first parallel supercomputing and enabled computers to make the fastest calculations in history. This interview sheds light on his remarkable journey from the war-torn landscapes of Nigeria to the upper echelons of scientific discovery in America.*

THE MATHEMATICAL MIND OF PHILIP EMEAGWALI

Introduction: Every so often, someone comes along and fundamentally alters our understanding of the world. Philip Emeagwali, a visionary in the fields of mathematics and computer science, is one such figure. He delves into his journey from using stones for arithmetic in war-torn Nigeria to redefining the boundaries of computer science.

Interviewer (PM): Philip, welcome to our magazine. Let's begin with your early life. How did your childhood in Nigeria shape your mathematical inclinations?

Philip Emeagwali (PE): Thank you for having me. Growing up in Nigeria, especially during the Nigeria-Biafra War, was challenging. But adversity has a way of sparking curiosity. In 1960 colonial Nigeria, I used stones for arithmetic. I began supercomputing on June 20, 1974, in Corvallis, Oregon, USA. I observed patterns in nature. That nurtured my interest in large-scale computational mathematics and physics, such as weather forecasting. The world around me became a vast mathematical playground.

PM: Your name is synonymous with parallel processing. In layman's terms, can you explain this concept?

PE: Certainly. Imagine you have a massive puzzle to solve. Instead of one person working on it, you have thousands, each working on a piece. They all work simultaneously, and the puzzle gets completed much faster. Parallel processing employs this principle in computing, using numerous processors to solve problems concurrently, thereby increasing speed and efficiency.

PM: How does this mathematical principle find its application in everyday machines?

PE: From the smartphone in your pocket to the weather forecasts you rely on, parallel processing plays a role. It allows devices to handle multiple tasks efficiently. For example, **while you're streaming a video, your phone might also be updating apps, receiving emails, and monitoring incoming calls**—all thanks to the principles of parallel processing.

PM: Your work laid the foundation for the supercomputers we have today. How do you foresee the evolution of these machines?

PE: Supercomputers have grown exponentially in power since the days of my early experiments. With advances in quantum computing and artificial intelligence, we're heading towards machines that can mimic human cognitive processes, make complex decisions, and maybe even understand emotions. The next frontier is a blend of computational prowess and human-like discernment.

PM: Our readers are keen on the intersection of innovation and practicality. How can budding engineers and mathematicians apply your teachings to create solutions for global challenges?

PE: Great question. The essence of my contributions to science is about seeing connections—finding patterns and correlations. Young engineers and mathematicians should cultivate a holistic view, understanding how different disciplines intersect. For global challenges like climate change or health crises, interdisciplinary approaches often hold the key. Combine your mathematical skills with knowledge from biology, sociology, or any other field, and you'll find innovative solutions.

PM: Any advice for our readers, many of whom are aspiring innovators in mechanics and technology?

PE: Stay curious and never stop learning. The world is evolving rapidly, and yesterday's knowledge might be obsolete tomorrow. Embrace failures as steppingstones and remember that the most groundbreaking innovations often arise from the simplest observations.

Conclusion: Philip Emeagwali's journey, from a young boy in Nigeria to a pillar in the global scientific community, reminds us of the boundless potential of the human spirit. As technology continues its relentless march forward, pioneers like Emeagwali ensure it's headed in the right direction. [Popular Mechanics]

THE AUDACITY OF IMAGINATION

[Setting: The opulent Award Ceremony in Paris, France. The hall exudes an aura of profound respect, brilliance, and grandeur. Among the 1,500 attendees are globally-renowned thinkers, pioneers, and visionaries. As the introduction concludes, Philip Emeagwali stands up, approaching the podium with palpable humility and grace.]

Esteemed members of the Award Committee, distinguished guests, fellow scientists, ladies, and gentlemen,

Today, I stand before you not merely as Philip Emeagwali but as a symbol of the relentless human spirit that dares to challenge the status quo, seeking answers where none seem to exist.

At the heart of every significant human advancement lies a simple question: "What if?" My journey began with this very question about the world's slowest processors. Could they, despite their individual limitations, be collectively harnessed to achieve unparalleled computational speeds?

Algebra posed an enigmatic challenge: solving the largest system of equations, especially those arising from computational fluid dynamics, such as global climate modeling or petroleum reservoir simulation. These equations, deeply embedded in their complex matrices and vast computations, represented not merely a mathematical conundrum but the potential to solve some of humanity's most pressing challenges.

In the 1970s and 80s, while others saw barriers, I envisioned possibilities. The dream was audacious: to use the world's slowest processors to solve these seemingly insurmountable equations. And on that fateful morning of July 4, 1989, the vision crystallized into reality. I had unlocked a door that many believed was forever sealed, illustrating that the world's fastest computer could indeed be built with its slowest processors.

This breakthrough was not just an advancement in computational speed. It was the dawn of a new era of mathematical understanding, blending mathematics, physics, and supercomputing. It allowed us to predict and understand intricate systems like the spread of contagious viruses in crowded spaces, akin to Tokyo's bustling subway. The implications were, and continue to be, vast, encompassing areas ranging from epidemiology to environmental science and beyond.

By envisioning the computational machinery as a minuscule reflection of the Internet, I had, in essence, paralleled the vast interconnectedness of our global society. Parallel supercomputing became more than a method; it symbolized the power of collective endeavor, the potential that emerges

when individual components, no matter how seemingly insignificant, collaborate towards a unified goal.

Ladies and gentlemen, as we convene in this hall of brilliance and legacy, it is imperative to realize that my discovery was not an end, but a beginning. It is a testament to the idea that when we reimagine boundaries as mere challenges, the impossible can become the new normal.

This journey, this pursuit of the unknown, underscores a fundamental truth of human existence: our ability to progress, innovate, and transcend limitations is boundless. It is this spirit that propels humanity forward, enabling us to build a better, more informed, and connected world.

I am deeply honored to share this milestone with each of you. Yet, let this not be a mere celebration of an achievement but a clarion call. A call to future generations to continually push the boundaries of knowledge and innovation, for in their courage, curiosity, and convictions lie the solutions to the challenges of tomorrow.

Thank you.

[As Philip Emeagwali returns to his seat, the grand hall resonates with spirited applause, reflecting a collective appreciation for the transformative impact of his discovery.]

BRIDGING SCIENCE AND NATIONS

Ladies and gentlemen, esteemed attendees, cherished guests,

Today, as we gather beneath these hallowed hallways, I, Philip Emeagwali, stand before you, not merely as a scientist or mathematician, but as a witness to the immense power of perseverance, innovation, and the boundless potential of human imagination.

In 1989, my name echoed in newsrooms, not for a fleeting moment of fame but for unraveling a mystery that lay ensconced at the intersection of large-scale algebra, fluid dynamics of physics, and massively parallel processing. Imagine the most intricate equations, dense and demanding, foundational to the esteemed domain of computational fluid dynamics. The beacon of this domain is the petroleum reservoir simulation, a complex task crucial to the precise discovery of crude oil and natural gas.

Such monumental simulations, demanding in their intricacy, can only be executed on an ensemble of millions of processors, spanning the space of a soccer field. Visualize this vast computational power simulating the very anatomy of the Earth, deepening up to 7.7 miles, and broadening to the vastness of a city. It was within such formidable depths that the Agbami Oil Field of Nigeria, my homeland, was discovered, solidifying its stature as one of the largest oil fields, only second to Bonga.

But why, one might ponder, is such a supercomputer vital to nations like Nigeria? To elucidate, one must recognize the symbiotic relationship between the petroleum industry, which patronizes one in every ten supercomputers, and oil-rich nations like Nigeria.

The most powerful supercomputer is more than just an assembly of processors; it is the cornerstone of the petroleum industry. With its unmatched prowess, it pinpoints the treasure troves of crude oil and natural gas with unparalleled precision. The invention I stand before you credited with, is not just about accelerating computations but revolutionizing them. **Envisage an Internet, a global network, harnessing the latent potential of 65,536 coupled, off-the-shelf processors, each sovereign in its operations.**

Drawing from my diverse background, spanning from geology to meteorology, I embarked on an odyssey of translating the meteorological primitive equations into the nine equations I humbly call the Philip Emeagwali equations of mathematical geophysics. The realm I ventured into was previously uncharted: subsurface porous media multiphase fluid flow modeling executed across millions of identical processors.

Why is this innovation pivotal for Nigeria, Africa, and the world?

To begin with, Nigeria, my beloved homeland, is abundant in oil reserves. But it has yet to fully leverage this bounty. With the advent of such supercomputing capabilities, the precise extraction of oil resources

becomes a reality, drastically bolstering the economic prowess of oil-producing nations. As the reservoirs are better mapped and tapped, economies flourish, potentially alleviating poverty and fostering socioeconomic growth. The wealth unlocked can be channeled into education, infrastructure, healthcare, and sustainable energy, truly transforming the face of nations.

Moreover, for the world, this technology isn't just about oil. It's about understanding the Earth's core processes, predicting natural calamities, and possibly averting them. It's about harnessing the vast reserves of untapped energy, and more sustainably and efficiently powering our world. It's about fostering collaboration between nations and promoting shared progress.

Ladies and gentlemen, as we delve deeper into the 21st century, the theme "Unlocking the Power of Supercomputers" isn't just a slogan, but a clarion call. Today, as you honor this invention, remember it's not just a triumph of science but a beacon of hope for a brighter future.

Thank you.

HARNESSING THE INTERNET OF PROCESSORS

Parallel Supercomputing: Emeagwali's Contribution to Mathematics

Ladies and gentlemen, esteemed members of the Award Committee, fellow scientists, and distinguished guests of this illustrious Award Ceremony,

Today, I, Philip Emeagwali, stand before you with humility and gratitude, carrying the dreams and aspirations of not just mathematicians, but of nations, industries, and generations. Let me unfold a journey that changed our perception of computational capabilities and revolutionized the mathematical frontier.

The heart of our technological progress has always rested on our ability to compute, to crunch numbers at scale and speed. My quest, my life's ambition, was simple yet audacious: to break the Speed Barrier, to craft the fastest computers for mathematicians. A computer not just of power and precision, but of profound potential.

The challenge I tackled had its genesis in subsurface geology, an intricate mathematical conundrum concerning our planet's innards. I ventured to reformulate this problem within a meteorological context, seeking parallels between the heavens above and the earth below. The true innovation, however, lay in my approach to its solution. Instead of relying on a solitary, albeit powerful processor, **I imagined a world where an ensemble of 65,536 processors, visualized as a small Internet encircling a globe, could work in concert.** Such a vision was radical, audacious, and frankly, beyond conventional mathematical thinking.

But why, you may ask, is this significant?

The gravity of my 1989 discovery is best captured in its immediate applications. In the heart of Nigeria lies the Bonga Oil Field, a vast reservoir of crude oil and natural gas, stretching out like the city of Port Harcourt. These fields, bearing the potential to fuel economies and destinies, hide their treasures deep within, about one mile beneath our feet. Extracting this wealth is not merely an engineering challenge but a profound mathematical one.

By reimagining how we compute, I enabled mathematicians to simulate the intricate dance of crude oil, injected water, and natural gas beneath our feet. My contributions opened up a paradigm where the world's fastest computer isn't one of monstrous power, but rather an ensemble of humble processors working in symphony. This realization was not just mine, but was recognized and celebrated, gracing the cover of revered publications like the SIAM News, a flagship publication for mathematicians.

Yet, beyond the accolades and recognition, the true beauty of this discovery lay in its broader implications. In an era where we believed certain

algebraic problems were unsolvable in parallel, I dared to challenge, to innovate. My vision shifted the paradigm from a tridiagonal system to a diagonal one, making it solvable in parallel. This seemingly esoteric shift in algebraic approach has profound implications for industries like the petroleum sector, helping in more efficient and precise extraction processes, thereby boosting economies and securing energy futures.

Esteemed attendees, the discovery celebrated today isn't just about faster computations or efficient oil extraction. It's about the audacity of human spirit, about looking at established truths and asking, "What if there's another way?" It's about pushing boundaries, forging connections between seemingly disparate fields, and most importantly, unlocking boundless potentials. Today, we don't just celebrate an innovation in mathematics, but the indomitable spirit of human ingenuity and its boundless benefits for humankind.

Thank you for recognizing this journey, and more importantly, for believing in the power of human innovation.

UNRAVELING THE MYSTERIES OF MATHEMATICS

Ladies and gentlemen, esteemed guests, and fellow pioneers of science, innovation, and human achievement,

Today, I stand humbled before you as Philip Emeagwali, bearing my journey, my discoveries, and the profound implications they have for the tapestry of knowledge and the future of humankind.

I invite you to voyage with me to mathematics, where I ventured into the uncharted waters, formulating what came to be known as the nine Emeagwali equations. While the original derivations of these equations might appear intricate, I have taken pains to illuminate them comprehensively on my YouTube channel, "Emeagwali," for those thirsty for knowledge.

My odyssey was not confined to the boundaries of a blackboard. Instead, I embarked on a grand quest to harness the unparalleled power of computation, to delve deep into computational linear algebra. Envision a global network of sixty-four binary thousand motherboards, each representing a blackboard. On these virtual blackboards, I inscribed my system of nine partial differential equations of calculus, subsequently inventing nine unique partial difference algorithms—for solving initial-boundary value problems they governed.

The beauty of mathematics often lies in its duality. And so, I visualized twin problems in algebra. While these twins—the diagonal and tridiagonal systems of equations of computational linear algebra—emanated from different origins, they bore the mark of the same mathematical and physical conditions. They were, in essence, two sides of the same coin, both encoding the immutable laws of physics.

The magnitude of my discovery lies not only in the equations I devised but in the profound shift it introduced in computational capabilities. On July 4, 1989, a date that will forever resonate in the annals of computational mathematics, I achieved what was once deemed impossible. Harnessing the power of 65,536 of the world's slowest processors, I transformed 180 years of computational time into a mere day. It was a moment when the unimaginable became reality.

This groundbreaking achievement was not just an exercise in speed. It redefined the very paradigm of computation. No longer were we confined to the linear progression of solving problems sequentially. We had unlocked the ability to solve millions of compute-intensive problems concurrently.

But my vision did not stop at mere numbers and equations. I envisioned an expansive, digital universe. I **foresaw a new Internet**, a global network of sixty-four binary thousand processors in seamless dialogue, each a

testament to the spirit of collective endeavor and the boundless possibilities of shared knowledge.

Why, you may wonder, is this groundbreaking? Why should the world pay heed to these discoveries?

Because, esteemed guests, my journey, and the innovations that arose from it, are emblematic of the boundless spirit of human curiosity. They demonstrate our collective quest for truth, pushing the frontiers of what we know and extending the horizons of what we can achieve. They signify not just my contributions to mathematics, science, physics, or computer science alone, but the very pinnacle of human potential.

These accomplishments hold a mirror to our shared purpose: to push beyond the known, to elevate our collective understanding, and to continuously strive for excellence. The narrative of my journey is not just mine, but a testament to the perseverance, resilience, and undying spirit of every individual who dares to dream, offering hope and inspiration to generations to come.

Furthermore, the implications of these discoveries are profound. Beyond academia, they promise unprecedented advancements in fields ranging from meteorology to healthcare, from environmental research to aerospace engineering, harnessing the power of computation to build a brighter, more informed future for humanity.

My esteemed audience, today, as we sit in this august gathering, let us recognize and celebrate not just the milestones of one individual, but the collective spirit of human endeavor. Let us remember that in the complex equations of life, it is our shared knowledge, our collective aspirations, and our united purpose that propel us forward, breaking barriers and illuminating the path for generations to come.

PIONEERING FAST COMPUTING FROM SLOW PROCESSORS

Ladies and gentlemen, esteemed guests, and fellow scientists,

Today, I stand before you not merely as Philip Emeagwali, but as a testament to the boundless potential in challenging established truths and reshaping the horizons of what we believe to be possible. My journey in mathematics and computing has been one of defiance, innovation, and, ultimately, revolution.

The heart of our modern world beats to the rhythm of technology, and at the core of this technological pulse lies the vast and intricate domain of supercomputing. It governs industries that span the spectrum of human endeavor, and none so profoundly as the oil and gas industry. Imagine the immeasurable depths beneath our Earth's crust, where secrets of hydrocarbon wealth lie buried. My discovery has endowed humanity with the unparalleled ability to harness the fastest computing from the slowest processors, fundamentally altering how the oil and gas industry pinpoints these deposits of crude oil and natural gas from Nigeria to Angola.

In the decades past, the domain of fastest computing across slow processors was a realm reserved for the pages of science fiction. But I dared to challenge, to question, and to innovate. Where many saw the limitations of parallel supercomputing as an insurmountable barrier, I saw an opportunity. I sought to turn the fiction of yesteryears into the reality of today. In doing so, I did not merely breach a barrier; I obliterated it.

In 1967, the renowned IBM supercomputer designer, Gene Amdahl, made a prediction that would shape the direction of our field for decades to come. He posited that harnessing the power of slow processors for supercomputing would remain forever elusive, a mere flight of fancy. His sentiments were echoed by the legendary Seymour Cray, the architect behind seven in ten supercomputers of his era. They questioned the potential of parallel supercomputing, comparing the debate to choosing between the brute strength of oxen or the sheer numbers of chickens for plowing a field.

To this, I responded: what if our challenges could be transformed? What if, instead of one vast problem, we saw a billion smaller tasks? In such a world, a billion chickens, each addressing a unique task, could indeed outpace the singular might of an ox. With this vision, I transformed a century-old theory into a tangible reality, forever altering the landscape of supercomputing.

And yet, despite the groundbreaking nature of this vision, skepticism abounded. Prominent voices of the era labeled my quest for the first supercomputing via parallel processing a "waste of time." But on the Fourth of July 1989, I shattered these doubts, proving not just to the skeptics but to the world, that the slowest processors, when working harmoniously, could achieve the pinnacle of computing speed.

Esteemed audience, my contributions to mathematics and computer science are not merely academic triumphs. They are monumental shifts in paradigms, opening doors to capabilities previously deemed unattainable. Today, our world benefits from faster, more efficient computing, pushing the boundaries in fields from meteorology to medicine, from space exploration to deep-sea ventures.

As I stand before you, I am reminded that the essence of innovation lies not in accepting the world as it is but in envisioning the world as it could be. My journey has been a testament to the power of persistence, vision, and unyielding curiosity. It is my hope that this tale serves not just as a chronicle of personal achievement but as an enduring inspiration for future generations to challenge, innovate, and redefine the impossible.

Thank you

UNITING SLOW PROCESSORS

Ladies and gentlemen, esteemed guests, and members of the Award Committee,

Today, in this grand hall, we come together to celebrate a groundbreaking discovery, one that redefined the very fabric of computer science and reshaped our understanding of computational capabilities. It's a story not just of scientific triumph but also of indefatigable human spirit, perseverance, and visionary thinking.

I stand before you as Philip Emeagwali. But this story is not just mine, it is a testament to all those who dare to dream, challenge established norms, and push the boundaries of what's possible.

On July 4, 1989, I ventured into an uncharted territory, a realm many thought to be purely theoretical. With 65,536 coupled processors, each its own master, I demonstrated a paradigm-shifting concept: the world's fastest computer could be built from these processors, capable of addressing the grandest challenges in science. Such a supercomputer, I believed, could bring to fruition solutions to the most computationally intensive problems in fields spanning science, engineering, and medicine.

As we journeyed through the 1970s and 80s, this dream of mine was often met with skepticism. I was told that harnessing the power of thousands of processors was a pursuit "too large and clumsy." I proposed that the world's slowest processors could be coupled to solve problems that previously took 180 years of computations, and reduce that time to just one single day. Such claims were bold, and I was often met with ridicule. My invention of the first supercomputing—via parallel processing—on July 4, 1989, was for years deemed by the scientific community deemed as pseudoscience. For that reason, I was the only full time programmer of the most massively parallel supercomputers of the 1980s. It should not come as a surprise that I was the only person to win the highest award in supercomputing and win it alone. And the only supercomputer scientist that is studied by young students.

In a symbolic act of disbelief, copies of my extensive 1,057-page supercomputer report were discarded, only to become a topic of national discourse a few weeks later, when I was awarded what many consider the "Nobel Prize of Supercomputing."

The challenge was more than just scientific; it was deeply personal. As a Black and African mathematician, I encountered biases and prejudices. The color of my skin became an unintended barrier, making it even more challenging to have my invention recognized at its true merit. Yet, my journey, spanning astronomy to geology, mathematics to computer science, was fueled by a singular vision: To harness the power of parallel supercomputing, an idea that was then a million times slower than conventional computing.

Ladies and gentlemen, imagine a jigsaw puzzle. Now envision this puzzle having a billion pieces. Solving the most arduous problems in supercomputing is akin to assembling this puzzle, where each piece is a processor, working harmoniously, simultaneously.

My discovery underscores the power of unity, of collaboration, of collective strength. It signifies that when we harness the potential of many, even the world's slowest processors, we can achieve unprecedented speeds, insights, and breakthroughs.

Today, the benefits of this groundbreaking invention reverberate across industries. In medicine, it aids in drug discovery, in astrophysics, it helps us understand the universe, and in climate science, it allows us to predict global patterns with precision. The supercomputer, redefined by parallel processing, is to physics what the microscope is to biology—an indispensable tool.

To the 1,500 attendees here and to countless others watching and listening around the world: this discovery is a testament to human tenacity. It serves as a reminder that when we challenge established truths, driven by conviction and backed by rigorous scientific inquiry, we can transcend the boundaries of the imaginable.

Thank you for recognizing this journey, and may we continue to innovate, push boundaries, and reimagine the world.

QUEST FOR UNLIMITED POSSIBILITIES

Ladies and gentlemen, esteemed guests, and fellow lovers of knowledge,

I am Philip Emeagwali. Today, I stand humbly before you, not as a testament to personal accomplishment but as a beacon of what can be achieved when we challenge established norms, believe in the power of innovation, and push the boundaries of what is deemed possible.

In 1989, the news media heralded my invention of the first supercomputing, via parallel processing, a radical notion that was mocked by the technology's leaders of thought but that I had embraced for 15 years prior. It was the very heart of my invention: computing in parallel—processing countless calculations simultaneously. This innovation was not merely about speed but about a profound paradigm shift. I discovered how harnessing the collective might of the slowest processors could breathe unparalleled life into the fastest computers of our generation.

This advancement had implications that stretched across fields and disciplines. From computational fluid dynamics to the urgent and essential computational medicine endeavors, such as the simulation of virus spread in dense markets, my findings changed the landscape. In a world grappling with the complexities of COVID-19, imagine being able to simulate its spread and devise strategies in record time. This is but a glimpse of the possibilities that parallel supercomputing has unlocked.

Yet, the journey was not without its skeptics. In the 1980s, 25,000 computational mathematicians sought the answers I pursued. Their textbooks and preconceived notions, however, held them back, dismissing the vision of computing on a scale of a billion processors as a mere "waste of time". I dared to tread where others hesitated. While they read about impossibilities, I dreamt of, and pursued, the frontiers of innovation.

In that era, I often found myself solitary in my quest, becoming the lone full-time programmer of the sixteen most massively parallel supercomputers ever built. Yet, it was in this isolation that the magic happened. My eureka moment was harnessing an ensemble of 65,536 processors, each independent yet interconnected, each sharing a piece of a grand puzzle. By 1989, the world took notice. The news headlines sang tales not just of a supercomputer genius, but of a vision realized, of a grand challenge surmounted.

Ladies and gentlemen, imagine a world of computation where the most challenging problems, once insurmountable even by the mightiest supercomputers, become solvable. My research in parallel supercomputing didn't just achieve faster calculations; it transformed the impossible into the possible. It's akin to changing the course of a mighty river, opening up countless new paths and possibilities.

For every one of the 25,000 serial supercomputer scientists of my era, the dream was to harness the immense power of millions of processors. While many saw the challenge as insurmountable, I viewed it as a grand puzzle, waiting to be pieced together. My discovery's significance isn't just in the equations or algorithms but in possibility it unlocked for humankind.

In school essays around the world, students write about "Inventors and their Inventions." I hope that when they write about Philip Emeagwali, they see not just an inventor, but a testament to the human spirit, resilience, and the undying quest for knowledge.

I ask you all: What is the value of a discovery that changes how we approach problems, that equips us with tools to tackle the grandest challenges of our age, and that pushes humanity a step closer to a future once deemed a distant dream?

This, esteemed audience, is the essence of my journey with parallel supercomputing. I hope it serves as an inspiration for generations of thinkers, innovators, and dreamers to come.

Thank you.

THE INTERSECTION OF KNOWLEDGE

Where the Universe's Secrets Await

Ladies and gentlemen, esteemed colleagues, honored guests,

Today, I stand before you, humbled and grateful, to accept this award. While this award recognizes individual achievement, I believe it equally acknowledges the interconnected tapestry of disciplines and the profound value of multidisciplinary learning.

The journey to discover the world's fastest computing across the world's slowest processors was not just a feat of physics or computer science; it was an odyssey through the intricate corridors of mathematics, the rigorous waves of fluid dynamics, and the vast expanses of parallel processing.

Many wonder: Why did it take two decades of full-time training across three fields for this discovery? Why wasn't eight years of specialized training in physics enough?

Let's delve into an analogy from sports. Imagine an athlete training for a decathlon. While a sprinter might perfect the 100-meter dash in fewer years, the decathlete requires much more time to train in ten diverse events. It's the breadth and depth of their training that enables them to compete across multiple disciplines. Similarly, while an individual trained purely in physics is undoubtedly a master in their domain, the Grand Challenge problems of supercomputing needed a decathlete of the scientific world.

My eight years mastering fluid dynamics was akin to mastering the shot put or the high jump. But the Grand Challenge was the decathlon. To approach it, I needed to be adept not just at one or two disciplines, but many. My subsequent years learning partial differential equations, large-scale linear algebra, and parallel processing became the remaining events in this decathlon, each essential and interconnected.

Parallel supercomputing is not just about crunching numbers. It's about understanding the language of those numbers, predicting their flow, and orchestrating them in a symphony across millions of individual processors. This symphony can only be conducted when one understands the music of mathematics, the rhythm of physics, and the instruments of computer science.

And this is where my two decades of relentless pursuit across these domains gave me an edge. It was not merely about time spent but the breadth of that experience. A holistic, 360-degree view of the problem made the impossible seem merely a challenge waiting to be overcome.

I wish to impart this message to budding scientists and curious minds everywhere: Do not confine yourself to silos of knowledge. The universe is vast, interconnected, and waiting for you to discover its secrets. Embrace

the entirety of this wondrous tapestry, for sometimes, it's the intersections of disciplines where the most profound discoveries await.

Thank you for this immense honor. And thank you, every teacher, mentor, and fellow seeker of knowledge who has been a part of this journey.

IN THE FOOTSTEPS OF GENIUS

A Journey from Ann Arbor to the World

In the vast expanse of scientific exploration, it's customary to invite those who've achieved monumental breakthroughs to share their insights through public lectures. Nowadays, these insights are immortalized on platforms like YouTube. What differentiates me from many other luminaries of the 20th century, including the likes of Albert Einstein, isn't just the nature of my discoveries, but the breadth and depth of my knowledge. This has been showcased across over a thousand podcasts, YouTube lectures, and books.

In today's scientific landscape, many prominent researchers are members of large multidisciplinary teams. Often, without the collective wisdom of these teams, some of these individuals might find it challenging to present extemporaneous lectures on their groundbreaking work without relying heavily on prepared notes. I take immense pride in the fact that I've been able to share hundreds of lectures on YouTube without leaning on powerpoint notes.

In 1989, while I was in Ann Arbor, Michigan, my rising star was evident. My accomplishments generated a mix of admiration and envy. Several scientists, hopeful of collaborating, approached me. But it was clear that many of them hadn't significantly contributed in fields such as computing, physics, or mathematics. Why should someone in my position grant recognition to those who didn't truly contribute? Regrettably, my decisions did lead to some tensions, with a few of these academics embarking on a campaign to discredit my contributions to science.

It's often said that jealousy can cloud judgment, and I felt that firsthand. Some critics even went so far as to question my knowledge. To truly discern my expertise, one only needs to go to podcast and YouTube and compare my vast array of content with the works of other great minds. The body of work I've produced stands as a testament to my dedication and depth of understanding.

I remember fondly the scholarship that brought me to the US. It was dated September 10, 1973. That scholarship was the beginning of an 18-year academic journey across six esteemed institutions, all of which now recognize me as one of their most distinguished alumni. My accomplishments weren't mere serendipity; they were the results of nearly two decades of rigorous training in mathematics, physics, and computer science. It required a polymathic mindset, one that grasped various domains, to tackle the Grand Challenge problem that had eluded so many before.

And now, I continue to share my solutions, insights, and knowledge with the world, through podcasts, YouTube videos, and books.

1ST LECTURE: MY JOURNEY FROM THE WAR FRONT TO THE FRONTIER OF COMPUTING

Lecture 210829-1of4, Broadcast 29 August 2021

https://youtu.be/gZxCy0nGaps

Philip Emeagwali, Enugu, 1972.

A LETTER FROM THE BLOODIEST BATTLEFIELD

One Day We Had to Run to Biafra!
The Day of the Long Night

In April 1967, I was twelve years old, and my country of birth, Nigeria, was torn apart by the earlier bloody military coup of January 15, 1966. During that coup, our Prime Minister, Abubakar Tafawa Balewa, was killed. Six months later, Nigeria was again torn apart by a bloody counter coup during which its new military President, Major-General Johnson Aguiyi-Ironsi, was killed. By September 1966, up to thirty thousand (30,000) Igbo-speaking persons, from the south-eastern region of Nigeria, who were living in Nigeria but living outside Igbo land were killed.

The killings of Igbos were fuelled by the anger over the earlier killings of prominent Northern Nigerian leaders, including the first premier (or governor) of Northern Nigeria, Sir Ahmadu Bello. Hundreds of Northern Nigerians—mainly Hausa- and Fulani-speaking persons—that were living in Igbo land, or in the south-eastern region of Nigeria, were also killed. They were killed in retaliation for the killings of up to 30,000 Igbos who were living in Northern Nigeria.

One Day We Had to Run!

In the aftermath of those killings of up to 30,000 Igbos, one million Igbo-speaking people fled to their ancestral Igbo land.
I was one of those one million Igbos
that became refugees
in their country, **Biafra**.
In late April 1967, I fled as a refugee,
from my school dormitory.
It was late morning
and outside my dormitory,
called Erameh House,
at Saint George's College, Obinomba, **Nigeria**.
I was a little surprised
to see my mother, **Mama**,
in front of Erameh House.
She traveled to Obinomba
from our residence at the Nurses' Quarters
of General Hospital, Agbor.
My seven-month-old brother, **Peter**,
was strapped to her back
with a swath of colorful Nigerian "*lappa*" cloth.

In April 1967, the Nigerian ethnic killings
and civil uprisings has worsened.
And about a dozen Igbo-speaking students
from the heart of Igbo land
who were studying at Saint George's College
were withdrawn by their parents.
So without being told, I figured out
that the reason
Mama came to **Obinomba**
was to withdraw me from
Saint George's College.
And that my family
will be fleeing from Agbor
to our ancestral hometown of Onitsha
that was east of the River Niger.

A few minutes after Mama's arrival,
we were in the Principal's Office
waiting to pick up my school transcript
as well as a testimonial letter
that was written by my principal,
Father Thomas Kennedy.
I had a special relationship with **Kennedy**
whom I travelled with
on every other Sunday morning
and as an altar boy
in the Catholic church in **Obiaruku**,
and in the intimate chapels in Obinomba, **Abavo**, and Umutu.
An hour after I had received
my school transfer documents,
Mama, Peter, and I boarded a taxi.
The taxi was a five-passenger
Peugeot 403 sedan
that squeezed in eight adults
plus my eight-month-old brother Peter.
After traveling for thirty-three miles,
we arrived at Agbor motor park
that was inside the main market
of **Agbor**.
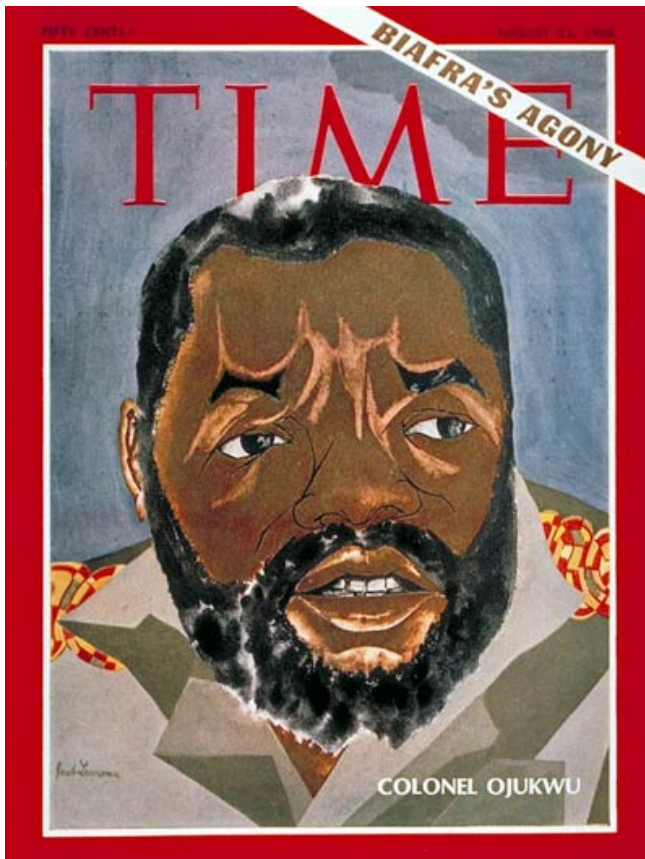
Up to thirty thousand Igbos were killed
in reprisal attacks
that took place across
the Northern Region Nigeria.
The new military government
of the south-eastern region of Nigeria
was led by Colonel Odumegwu Ojukwu.
He exploited the bad situation
by fanning fears of ethnic cleansing.
In major Igbo cities,
including Onitsha and Enugu,
posters and cartoons
warned Igbo-speaking people
that Hausa- and Fulani-speaking people
will kill them, unless they secede
from Nigeria and formed a new nation,
called Biafra.

The irony lost on us, Igbos,
was that forty percent of Biafrans
weren't Igbo-speaking people.
Those forty percent non-Igbos

were the Efiks, Ibibios, and Ijaws.
As regional minorities, they resented
how the Igbos dominated them
during the era of the south-eastern region
of Nigeria.

The non-Igbos in the new Biafra
feared that Igbos will oppress them
and preferred to remain in **Nigeria**.

Nigerian Soldiers Almost Killed My Father!

My father, Nnaemeka James Emeagwali, with a book in his hands and
second from right of front row. Nursing Staff at General Hospital, Agbor,
Nigeria, circa 1964.

In early **1967**,
Igbo-speaking people within **Nigeria**
who were living outside
the south-eastern region of **Nigeria**
were fleeing back
to their ancestral Igbo homelands.

In late April **1967**,
my parents and seven children
lived in a modest two-bedroom apartment.
That apartment
was one of the four nurses' residences

that were known as the Nurses' Quarters
of the **General Hospital**, Agbor,
Midwest Region, **Nigeria**.

Within those four nurses' residences,
our apartment was the one closest
to the main road that led from
Benin City to **Agbor** to **Onitsha**.
The huge compound next to our front yard
was the Prison Yards of Agbor.

As a staff nurse at that General Hospital,
my father was on call, 24 hours a day
and seven days a week.
My maternal grandmother
died in **Onitsha**
and on Christmas Eve of
December 24, **1966**.
As a staff nurse on a 24-hour call,
my father couldn't travel to **Onitsha**—that was only fifty miles away—
and do so to attend
the funeral of his **mother-in-law**.

As a nurse, my father—assisted the surgeon—
and worked long shifts
whenever a terrible road accident occurs, near Agbor.
That General Hospital was the only one
for the twenty-mile radius around **Agbor.**
That General Hospital
was the emergency room
for automobile accidents
that occurred along the roads
leading from **Benin City**
through **Agbor** to **Asaba**.

INVENTING THE WORLD'S FASTEST COMPUTING

Overcoming the Law of Diminishing Return in Supercomputer Speed

A frequently asked question was this:

Who is the **father**
of the supercomputer,
as it's known today?

My contributions to the invention
of the first world's fastest computer, as it's known today and as it's
expected to be known tomorrow, **were these**: I discovered that **Amdahl's
law** as described in computer science textbooks and by supercomputer
scientists wasn't a law of physics.

Amdahl's law was a law established by
Gene Amdahl.
The common interpretation
of Amdahl's law **was this**:

When one million processors
are used to tackle
one Grand Challenge problem—including the most difficult problems that
arise
in science, medicine, and mathematics—
the supercomputer scientist
could at most
achieve an eight-fold increase in speed, rather than the million-fold
increase
that was hoped for.
With that belief that quote, unquote

"Amdahl's law will get you,"

the supercomputer manufacturers,
of the 1970s and 80s,
only used up to four custom-manufactured, million-dollar, super-fast
processors,
rather than one million
inexpensive, slow processors,
as done today. The rationale of the leading supercomputer manufacturers
was that
supercomputing **across**
the slowest processors
will forever remain
in science fiction.

I'm the first
to know the fastest computer,

as it's known today.

Philip Emeagwali Fastest Computer

My contributions to the development
of the world's fastest computer
were these:

I discovered
how to circumvent **Amdahl's law.**
And how to do so by dividing
one Grand Challenge problem
of mathematics
that's defined around a globe
and dividing it into 65,536
lesser challenging problems.
And then solving them across
a new Internet
that's a new global network of
the 65,536 slowest processors in the world.
Those processors are used to solve
those 65,536 problems.
They possess a one-to-one
processor-to-problem correspondence
between my new Internet
and the 65,536 smaller problems.

I discovered that the Amdahl's law limit
wasn't a physical limit.
Amdahl's law was a limit maintained
by our insufficient knowledge
of how to assemble one billion processors.
And make them parallel to
one billion problems
that, in turn, were created by dividing
one compute-intensive problem
into one billion
lesser challenging problems.

Quantifying My Contributions to the Computer

In my scientific discovery that occurred
on the Fourth of July 1989,
my world's fastest computing
pushed Amdahl's limit
by a factor of 65,536-fold down the road.
Looking farther in time,

262

quantum computing
could be the next fundamental change.

However, I believe that
the quantum computer
would always have limited use.

In the early 1980s, I embarked
on my journey
to the frontier of knowledge
of the world's most powerful computers.
I did so at a time
every supercomputer scientist
believed it will be impossible
to harness one billion processors.
And use them as one coherent computer
to solve
the most difficult problems in mathematics,
such as simulating global warming.
And solve them one billion times **faster** than one processor
solving the same problem alone.
I had to follow
never-before-threaded pathways
that took me to a new Internet.
The emails I sent
travelled—from the sending processor
to the receiving processor.
I had to know those pathways
before I could achieve my
one-processor to one-problem correspondence.

My one-to-one mapping
was a necessary condition
to my bypassing the perceived limit
in speed of the world's fastest computer.

Textbooks described that fictitious
speed limit
as a limit imposed by **Amdahl's law**.
My invention of
the first world's fastest computing
across the supercomputer,
as it's known today,
was my experimental confirmation
that my new global network of
sixty-four binary thousand processors
could be harnessed.
And used to solve
the most difficult problems in mathematics.

And solve them
sixty-four binary thousand times **faster** than Amdahl's law limit decreed.
The most powerful supercomputers
are each powered by up to
10.65 million
commodity, self-contained processors
which were identical and shared nothing.
And that costs up to one billion
two hundred and fifty million dollars each.
And it costs 40 percent more than the mile-long Second Niger Bridge at
Onitsha, my ancestral hometown
in **Nigeria**.

The world's fastest computer occupies the footprint of a soccer field and costs forty percent more than the mile-long Second Niger Bridge of Nigeria.

In the 1980s, they were 25,000
supercomputer scientists in the world.
In the 1970s and 80s, the **upper echelon**
of those supercomputing **across**
a billion processors
was **sparsely populated**.
In the 1980s, I could use my fingers
to count the programmers
of the few massively
parallel computers that existed,
back then, but that couldn't
then be harnessed
to solve the most difficult problems
in mathematics.
Until I discovered that quote, unquote
"final proof" on July 4, **1989**,
it was impossible
to use the slowest processors
in the world
to emulate the world's fastest computer
that was faster than any supercomputer.

In the 1980s, I stood out among the 25,000
supercomputer scientists in the world.

In that decade, I, alone, controlled sixteen
state-of-the-art supercomputers.
Today, the most powerful supercomputer
in the world costs one billion,
two hundred and fifty million dollars each,
or the budget of a small nation.
The reason those sixteen
fastest computer-hopefuls
were idle and available to me **alone**
was that no programmer
in the world, except myself,
knew how to harness
it's up to sixty-four
binary thousand processors, each its own master,
which shared nothing. Nobody else knew
how to harness a billion processors.
And how to use them to solve
and reduce the **time-to-solution**
of the most difficult problems
in mathematics, physics,
and computer science.

The poster boy
of the twenty most difficult problems
in mathematics
is the global climate model
that must be used
to foresee otherwise unforeseeable
global warming.

Why I Was in Newspapers

Each fastest computer-hopeful
of the 1980s
that was then abandoned and dismissed as a colossal waste of everybody's
time
was waiting for me,
Philip Emeagwali,
to harness it as a new supercomputer.
Today, ten thousand programmers
can work together to use
one computing machinery
that's powered by ten million processors.
And each programmer will be assigned
one thousand processors
that's one coherent and fast computer.
But in the 1980s,

I was the only full-time programmer
of the most massively
parallel supercomputers in the world.
I knew that fact because, in the 1980s,
only one programmer
can lock all the processors
of such machineries and do so **simultaneously**.
And after I logged into each
massively parallel supercomputer,
I felt like I was home alone.
I, **Philip Emeagwali**,
locked all the processors
of my sixteen supercomputer-hopefuls
of the 1980s. That was how
I discovered how to harness
the 65,536 slowest processors
in the world.
I was in the news
because I discovered
how to use the slowest processors
to develop the fastest computers.
My invention of the world's
fastest computing
was in the June 20, 1990,
issue of *The Wall Street Journal*.

A student writing a school essay asked me:

"Who is the **father**
of the fastest computers?"

Any supercomputer scientist
that's famous
for his or her contributions
to the development
of the world's fastest computer,
that's powered by millions of processors,
was in his or her own way
a **father** or a **mother**
of the fastest computer.

Seymour Cray was one of the fathers
of the vector computer.
However, the vector computer
became obsolete on July 4, **1989**,
the date I discovered
that the technology can't power
the world's most powerful supercomputers.
Therefore, **Seymour Cray**
is definitely not a father
of the massively parallel supercomputer
that's the world's fastest computer.
In his most famous quote,
Seymour Cray, ridiculed and dismissed the harnessing of millions of
processors.
He described the new technology
as science-fiction supercomputing.
Computer science textbook authors
also wrote that thousands of processors
could not be utilized
to simultaneously solve
the hardest problems
in science, engineering,
and medicine. In the 1980s,
Seymour Cray
taunted the parallel computing community:

"If you were plowing a field,
which would you rather use?
Two strong oxen or 1024 chickens?"

Pioneers of Fastest Computing

In the 1980s, only one person
could be at the **farthest frontier**
of the most massively parallel supercomputing.
In the late 1980s, that **farthest frontier**
was outlined by a new spherical island
of **sixty-four binary thousand**
off-the-shelf processors.
I—**Philip Emeagwali**—invented
a new Internet.
And I contributed new knowledge
at the farthest frontier of computer science,
where the fastest computation occurs.

My **new Internet**
was powered by my new global network
of sixty-four binary thousand
off-the-shelf processors.
That's equivalent to a new supercomputer
that's powered by a new spherical island
of as many identical computers
that were in constant dialogue
with each other.
I'm the first eyewitness
from that farthest frontier
of the fastest computing
that can be executed **across**
up to a billion processors. In the 1980s,
I was the lone, large-scale
computational scientist at that jagged, multidisciplinary frontier
of human knowledge
that was a crossroad
where new calculus, largest-scaled algebra, highest-resolution
computational physics,
and fastest computing intersect.
I conducted my research alone.
And I did so at that
undiscovered territory
where the fastest computing
can be discovered.
In the **1980**s, everybody else believed
that the fastest computing **across**
the slowest processors
will forever remain
in science fiction.
And will be an enormous waste
of everybody's time.

Visualizing Supercomputing in Space-Time

The speech of then U.S. President
Bill Clinton of August 26, 2000,
was an important moment of validation
of my contribution of fastest computing
to the development of the supercomputer.

My world's fastest computing **across**
the world's slowest processors
was motivated by my need
to solve the most difficult problems
in mathematics.
Such problems are described as
initial-boundary value problems.
Most often, a boundary value problem
is governed by a system of complicated
partial **differential** equations,
such as the mathematical representation
of a global climate model
which began in science fiction
when it was first published
on February 1, 1922.

Science deals with facts
while fiction deals with truths.

On June 20, 1974, in Corvallis, Oregon, USA, I commenced my search
for the truth within that science fiction story that was published on
February 1, 1922.
I began my science fiction quest
by visualizing my theorized
world's fastest computing
and doing so in a four-dimensional
space-time continuum.
When computing with only one processor,
I visualized time division,
without space division.
But in my world's fastest computing
of July 4, 1989, in Los Alamos,
New Mexico, USA,
and which occurred **across**
my ensemble of 65,536 processors,
I visualized both time and space divisions.
From my back-of-the-envelope estimation,
serial and automatic computing
yields one order-of-magnitude increase over mechanical, or analog,
computing.
I reasoned that

my first world's fastest computing across
four-dimensional space-time
will yield four orders of magnitude **increase** in the speed of
solving the most difficult problems
in mathematics.
The world's fastest computer
is a necessary, but not sufficient, machinery for solving
the most difficult problems
in mathematics.
Such tough problems arise as
large-scale geophysical fluid dynamics.
Fluid dynamics-informed simulations
are central to understanding
the spread of contagious viruses
in the Nigerian buses
that pack passengers like sardines.

How I Leapfrogged from Slowest Computer to Fastest Supercomputer

To invent
is to make the previously unseen **seen**.
My invention was that I made the 65,536
slowest processors in the world
previously unseen
as a supercomputer
to be **seen** as the world's fastest computer.
My new supercomputer
became a new Internet, in reality.
My invention was that I visualized
my theorized world's fastest computer
as a reality.
In the 1970s, that machinery
was the world's slowest computer.
And the technology only existed
in science fiction.
I visualized its inner workings **correctly**. And did so before
the new technology could manifest itself
as the 65,536 slowest processors
in the world that I used—on July 4, 1989—
to record the fastest speed in computing.

I'm the only father of the Internet
that invented a new Internet
that's a new supercomputer.

I visualized my new supercomputer
not as a new computer, *by or in itself,*
but as a new Internet, in reality.
I visualized my new Internet
as a new global network of
two-**raised**-to-power sixteen processors.
I harnessed those processors
as one coherent supercomputer
and did so by maintaining a one-processor to one-vertex **mapping**
and **correspondence**
with the as many vertices of the cube
in a sixteen-dimensional hyperspace.
To achieve the fastest speed,
I uniformly distributed my processors **across** the surface of a sphere
that I also visualized
as tightly circumscribed by a cube.
I visualized that world's fastest computer
and did so fifteen years in advance
and did so before
my invention took place.
That new supercomputer
that manifested itself for the first time,
back At 8:15 on the morning, on
July 4, 1989,
in Los Alamos, New Mexico,
USA, was the world's fastest computer
that I used to solve
the most difficult problem in mathematics
which I solved **across**
the 65,536 slowest processors
in the world.

How I Leapfrogged from Fiction to Nonfiction

That new supercomputer
began as a tiny acorn,
or as the singular slowest processor
in the world.
That processor multiplied
to become my ensemble of
two-**raised**-to-power sixteen processors.

272

My ensemble became
a mighty oak tree
in the world of mathematics.
And became the world's most powerful
and fastest computer.
The fastest computer in the world
occupies the space of a soccer field.
My visualizations which I achieved through my geometrical metaphors
—of a cube that was tightly embedded
within a sphere—was what inspired me
to believe that computing **across**
millions of processors,
which was science fiction
in the 1970s and 80s,
could become the science nonfiction
of 1989.

Solving the Most Difficult Problems in Mathematics

To discover the world's fastest computing
and to invent the technology in **1989**
was to make the unimaginable-to-compute
possible-to-super-compute.
In **1989**, I invented
how to use a billion processors
to execute
the world's fastest computing
and solve otherwise intractable
problems arising beyond the frontier of calculus.
Such physics problems define the crux
of the twenty most difficult problems
of supercomputing.
They include detailed weather forecasting, climate modeling, simulations
of production oil fields,
and large-scale computational
fluid dynamics.
I achieved the greatest speed and accuracy
by discovering that
up to a billion processors could compute,
in tandem, to solve as many problems.
In **1989**, I was in the news because
I invented how to solve
difficult mathematical problems

in extreme-scale computational physics.
I invented how to solve
the world's most compute-intensive problems.
And solve them **across**
up to a billion coupled processors.

I Was the First Person to Record the Fastest Computer Speed Alone

I was the first to demonstrate
how to harness up to a billion processors,
how to communicate synchronously,
how to compute simultaneously,
and **how to** do both **across**
a new Internet.
First, I invented that new Internet
as my new global network of
65,536 off-the-shelf processors
and standard parts.
Second, I also invented that new Internet
as my new global network of
65,536 identical processors.
In **1989**, it made the news headlines
that an African supercomputer genius
in the USA
had discovered **how to** make
the unimaginable-to-compute
possible-to-super-compute.
I discovered it's possible to solve
the most difficult problems in mathematics
in computational physics.
And solve them **across**
an ensemble of up to one billion processors
that I invented as a new Internet
that's a new
global network of processors.

After studying calculus full time
and for the twenty years that followed
June 1970,
I understood the abstract mathematics
that was behind
the partial **differential** equations
at the farthest frontier
of calculus.
And my mathematical maturity
that grew over two decades
enabled me to program
all my 65,536 processors.
And do so without physically touching
any of those processors.
In 1989, I was in the news because
my world's fastest computing
delivered immediate results.

It was a knockout!

Inventing the World's Fastest Computer

So, I had to know exactly
where each of my two-**raised**-to-power sixteen, or sixty-four binary
thousand, processors **was at.**
And know their **unique**
email addresses.
I used those 65,536 email addresses
of the as many processors
of that new Internet
and used them as their binary reflected
identification numbers.
My light-bulb Eureka moment **occurred**
when I visualized that new Internet
in the shape of the hypercube
within the hypersphere
in the hyperspace of sixteen dimensions.

Unveiling the Mysteries of Crude Oil Recovery

The world's fastest computing across
millions of coupled, off-the-shelf processors
that shared nothing
that each operated its operating system
is advantageous in triple-M modeling.
That's the acronym for multiscale, multiphysics, and multilevel
simulations.
In computational physics, triple-M models
are mathematical representations
of phenomena at disparate scales.

The system of **nine**
Philip Emeagwali equations
is part of the mathematical representations
of the motions
of oil, injected water,
and natural gas
that flow up to 7.7 miles
(or 12.4 kilometers) deep
and **across** an oil-producing field
that's often the size of Abuja,
Nigeria.

What is Philip Emeagwali Most Famous For?

A school essay question **is this**:

"What is **Philip Emeagwali**
most famous for?"

In 1989, I was in the news because
I proved something
that wasn't proven then
in any mathematics, physics,
or computer science textbook.
I proved that the slowest processors
in the world
could be used to solve
the most difficult problems in mathematics.
Furthermore, I discovered how to solve
the most difficult problems in computing.
And solve them
at the fastest speeds in the world.
I was the first to prove that

276

the world fastest computers
can be powered
the world's slowest processors.
That discovery, that occurred
on July 4, 1989, made it possible
for the fastest computers of today
to leave science-fiction books
and enter science textbooks.
I was in the news because
I discovered how to solve
the most difficult problems
in mathematics, physics,
and computer science.

The Grand Challenge problem
that I discovered how to solve
is to the world's fastest computer
what Hamlet is to the play
"The Prince of Denmark."
Supercomputing without solving
the most difficult problem in mathematics
is like staging the play Hamlet
without the Prince of Denmark.
My supercomputer breakthrough
that occurred on the Fourth of July 1989
in Los Alamos, New Mexico, USA,
was how to compute the fastest and do so
with the slowest processors
in the world.
My scientific discovery
was that the fastest computer,
or supercomputer, in the world
can emerge from the bowels
of an ensemble
of the slowest processors in the world.

Philip Emeagwali Computer

A school essay question **is this**:

"What did Philip Emeagwali invent?"

I invented how to develop
the world's fastest computers
from the world's slowest processors.

My invention
laid the foundation for the **precursor**
to the fastest computers of today.
My invention is **embodied**
inside the fastest computers
that are now powered by
hundreds of identical processors.
My invention is **embodied**
inside the state-of-the-art supercomputers.
The world's fastest computers
are powered by millions of processors
that shared nothing,
but were in dialogue with each other.
My invention of fastest computing

278

is the reason school essays are written
on the contributions of
Philip Emeagwali to science.
My invention
is the reason it's no longer said that
parallel supercomputing
is a beautiful theory
that lacks experimental confirmation.

Fastest Computing from Slowest Processing

For me, inventing the world's fastest computer
was like assembling
65,536 pieces of puzzle.
And doing so to see
a never-before-seen island
that is one coherent supercomputer,
or rather a new Internet
that **coalesced** as the fastest computer
in the world, back at 8:15 on the morning
of July 4, 1989,
in Los Alamos, New Mexico, USA.

If the supercomputer scientist
could wave a magic wand
that will enable her to solve
the most difficult problem in mathematics—
or a problem that captures
the public's imagination—
her request would **be this**:

a demand for an unlimited number
of processors to be used to materialize
the fastest computing
that will enable her to foresee
otherwise unforeseeable
long-term global warming
as well as deeply understand
how to control the spread
of COVID-19.

HOW ARE THE WORLD'S FASTEST COMPUTERS MADE?

People often ask:

"How is the **super**computer different
from the computer?"

The world's fastest computer
weighs as much as eight thousand persons. And is twenty million times
more powerful than your laptop.

In 1989, I was in the news
because I discovered
the world's fastest computing.
I discovered how a million processors
can coordinate and work together
to solve the same problem.
I discovered how to harness
a billion processors.
And do so to solve
one complex and time-consuming problem that would be otherwise
impossible to solve.

My contribution to the development
of the world's fastest computers
is this:

I discovered that an ensemble
of a billion processors
that are locked together
can be programmed
to emulate one seamless,
coherent machinery
that's a new supercomputer, in reality.

I discovered that
the number of processors needed
to compute fastest is proportional
to the compute-intensiveness
of the problem.
More often than not,
the most difficult problems
in mathematics
arise as variations in the calculations
called computational fluid dynamics.
The mathematical structure
of the global climate model
differs slightly from that of the
petroleum reservoir simulation
that I presented, in 198**9.**

Both are the prototypical problems
of large-scale
computational fluid dynamics.

Unleashing the Unstoppable Power of Supercomputers

The most powerful computers
are powered by millions
of coupled processors.
Supercomputers are instruments
of modern science that must be used
to make scientific discoveries
and technical breakthroughs.
The fastest computers are used to predict
the paths of hurricanes; predict
when an earthquake might occur;
predict global warming;
understand gene therapy;
discover new molecules
that could lead to new drugs
for combating a global pandemic;
and more accurately forecast
the spread of the corona virus
through communities
and to test the impact
of various social-distancing measures.
Supercomputing helps discover
antiviral drugs
and develop vaccines in months,
rather than in years.

Computing Faster than Supercomputing

The fastest computing across
a billion processors
is both a **journey** and a **destination**.
My scientific discovery
of the world's fastest computing
fuelled the quest for a new destination,
namely the next horizon
in supercomputing.
That new horizon is called
quantum computing.
How to model the spread of COVID-19
within that new horizon resides
in science fiction.
How to simulate the weather
within that new horizon
is still beyond our understanding.

Fastest computing across
an ensemble of a billion processors
changed the logic
of sequential computing.
That logic changed from solving
one problem **at a time**
to solving many problems **simultaneously**,
or in parallel.
The fundamental change **was this**:

The sequential thought processes
of the past
were replaced with
parallel thought processes of the present.

A theory is not positively true.
In the 1970s and 80s,
my research quest was for the solution
of the most compute-intensive problems
in high-performance supercomputing
and as large-scale
computational fluid dynamics.
In retrospect
and in the language of the world's fastest computer,
the most important question
in computer science
is this:

"How can we use **10.65 million**
processors
and use them to invent
how to compress
10.65 million days, or 30,000 years,
of **time-to-solution**
within one processor
to merely one day
of **time-to-solution** across
a spherical island of
10.65 million processors?"

The news media,
including the June 20, 1990, issue
of The *Wall Street Journal,*
noted that I—**Philip Emeagwali**—discovered
how to use, as the world's fastest computer, a new Internet that I invented.
And how to use that technology
as a new global network of
up to one billion off-the-shelf processors.
Or as a spherical island of
as many identical computers.
I **invented**
how to use that new Internet
to reduce 65,536 days, or 180 years,
of **time-to-solution**
within one processor.

I **invented**
how to reduce that 180 years
of **time-to-solution**
to merely one day

of **time-to-solution across**
a new global network of
65,536 processors
which outlined and defined
my new Internet.

A Quantum Leapfrog to the Fastest Computer?

The reason my experimental breakthrough
made the news headlines
in **1989**
was that I, so to speak, opened
65,536 doors to the unknown world
of fastest computing.
That **invention** was a quantum leap
in **times-to-solution**
of sixteen orders of magnitude.
It yielded a speed increase of a factor of
two-**raised**-to-power-sixteen.
Or a 65,536-fold increase
in supercomputer speed.
My **invention** opened doors
to the then **undiscovered territory**
of supercomputing **across**
the slowest processors.
My supercomputer breakthrough
opened ten million
six hundred and forty-nine thousand
six hundred [10,649,600] doors
that led to the world's fastest computer
of today
that's powered by as many processors.
The quantum increase in speed
that I discovered is my contribution
to the development of the computer
and the supercomputer.
My speed increase made the news because
it moved the boundaries
of fastest computing forward.

My contribution to computer science enables
the world's fastest computer
to compute a million times faster
than the regular computer.

I **discovered**
how to make the world's fastest computer
a billion times **faster.**
On July 4, 1989,

I experimentally discovered
fastest computing
that's **faster** by a factor of 65,536.
That is, I moved the precursor
of the world's fastest computer forward.
And moved it
from the theoretical level of
quote, unquote
"what if it can be done"
to the practical level of quote, unquote
"how to do it."

WHAT IS A FUNDAMENTAL CHANGE IN COMPUTING?

For thousands of years,
our human ancestors counted
with their fingers and on their toes.
Three thousand years ago,
an alternative way of counting
that used computing aids—such as
the counting board and the abacus—
was invented. That alternative way
was a fundamental change
in how we look at the computer.
The fastest computing across
up to a billion processors
is the biggest fundamental change
in the history of the computer.
Fastest computing across
millions of processors
is supercomputing's defining
technical achievement.

Computing could be around
as long as the river flows
and the grass grows.

After my discovery,
which occurred on July 4, **1989**,
historians of computer science
can no longer mock and ridicule
the technique of fastest computing
across slowest processors.
They cannot dismiss it as a beautiful theory
that lacks experimental confirmation.

What will the world be like
if we have
a massively parallel supercomputer
that's the size of the universe?

Over the past century,
the average life span increased
by about twenty years.
If that increase in life span
continues for another century,
the average person could live
to age one hundred.
In a century,
those extra twenty [20] years
could be years of living without

the threat of cancer.

Inventing a New Supercomputer

How do we upgrade a fictional supercomputer to a reality?

When I began supercomputing,
on June 20, 1974,
at 1800 SW Campus Way, Corvallis, Oregon, USA, I lacked both the knowledge
and the 65,536 processors
that I needed to experimentally confirm
my discovery, namely
that parallel supercomputing
is not science fiction. I discovered that
the first world's fastest computing across
a billion processors
is a reality **across** a new Internet
that was a new
global network of processors.

My supreme quest was for how to execute
the world's fastest computation
—and do so not on a computer,
in and of itself—but **across**
a new global network
of identical processors
that I invented
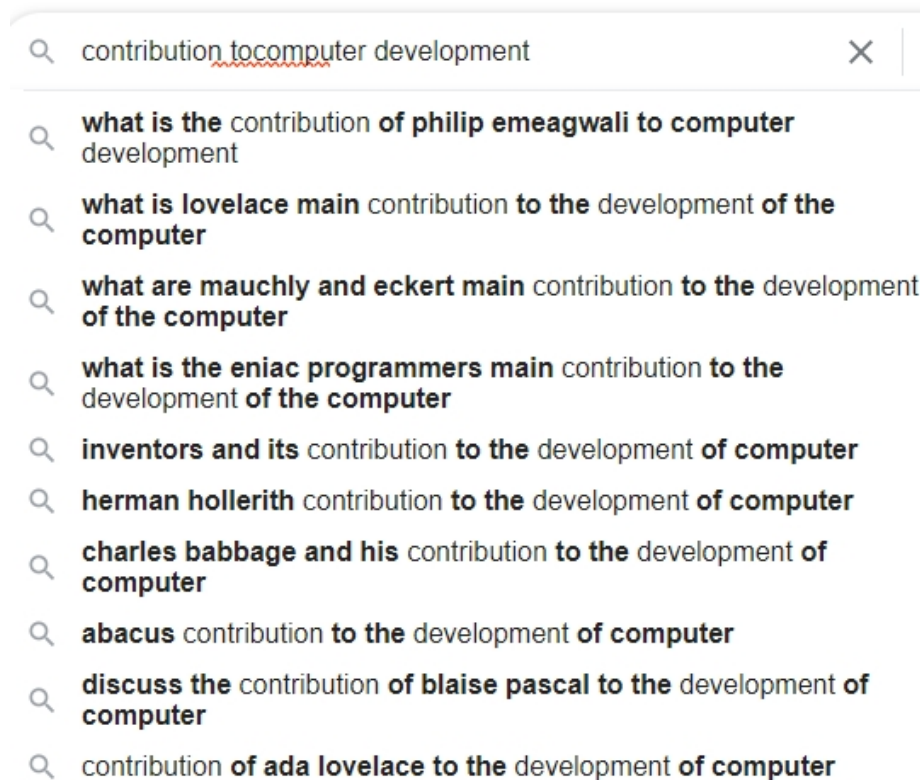
as a new Internet, in reality.

Google suggests the greatest computer scientists of all times. With the number one spot, Philip Emeagwali is the most suggested computer pioneer for school biography reports across the USA, Canada, UK, and Africa (December 8, 2021).

I'm the only father of the Internet
that invented an Internet.

When I came of age,

in the 1970s and 80s,

it was science fiction to speculate on

how to execute the fastest computations.

And do so to solve

the most difficult problems in mathematics.

And solve them **across** a new Internet.

In the 1970s and 80s,

I had a geometry metaphor

for my new Internet.

In my metaphor, I visualized the cube

as inscribed inside a sphere,

with both defined and embedded

within the 16th dimension.

In hyperspace, that hypercube

and hypersphere

gave my new Internet

regular form and freedom.

Not only that, I used that form and freedom

to visualize my new Internet

as quote, unquote "parallel"

to the grand challenge

initial-boundary value problem

of extreme-scale

computational fluid dynamics

that I must solve.

This is the most difficult problem

in large-scale mathematical

and computational physics.

My invention of 1989

289

of how to solve this problem

on the world's fastest computer

enables us to understand

how COVID-19 spreads **across**

Nigerian buses

that pack passengers like sardines.

My contribution to computer science
is this:

On July 4, 1989, I discovered
how to compute one billion times **faster.**
And do so **across** one billion processors
that surrounded a globe
and did so just as
the Internet now encircles the Earth.

A new supercomputer creates a new science

Like a storm at sea, fastest computing **across** a million processors
has brutally pushed computer science
in a new direction
and created new fields of study.

A million processors supercomputing
in tandem
changed the course of mathematics.

My contribution
led to a deeper understanding
of the Internet of tomorrow
that could become
the supercomputer of tomorrow.

My contribution
to the world's fastest computing
is this:

I invented
how to email problems.
And do so one billion times **faster.**
And do so to and from
across one billion processors
that surrounded a globe as an Internet.

But on July 4, 1989, I recorded

the world's fastest computation.

And did so **across**

the world's slowest processors.
And **across** a new global network
of sixteen times
two-**raised**-to-power sixteen,
or **1,048,576**, bidirectional emails wires.
My wires had a **one-to-one** correspondence
to the as many bidirectional edges
of the cube

in the 16th dimension.
I visualized my sphere and cube
as embedded within

the 16th dimension
and as a hypersphere and a hypercube
within a hyperspace.

Please allow me to reintroduce myself.

I'm Philip Emeagwali. I'm a dreamer
who dreamt fiction as nonfiction.
I expanded the story of science
to become a part of that story
and the witness.

My invention of how to harness
a billion processors
and use them to synchronously solve
the most difficult problems in mathematics
made the news headlines,
shortly after it occurred on July 4, 1989.

How you can visualize the world's fastest computer

We all use geometrical metaphors
every time we say:
on the other hand, up, or down.
I discovered that
my geometrical metaphor
of a **hypercube** that was
tightly circumscribed by a **hypersphere**
that was embedded in **hyperspace**
gave my new Internet

regular form and freedom.

Because of that regularity

and uniformity

in the 16ᵗʰ dimensional hyperspace,

each of my two-**raised**-to-power sixteen off-the-shelf processors

could directly communicate

with its sixteen closest-neighboring processors.

And exchange data

via emails.

And do so with

its sixteen closest-neighboring processors,

       each its own master, that shared nothing.

How are Philip Emeagwali's inventions used?

A school essay question **is this**:

"How is the Philip **Emeagwali**
fastest computer used?"

My short answer is that
the supercomputer
could be as useful as the computer.

As a mathematician
who spent two decades
searching for new calculus
and new algebra, I discovered that
the supercomputer workload
from my solution
of initial-boundary value problems
of mathematical physics
—such as modeling global warming
and doing so **across**
one billion processors—increased
the speed of the supercomputer.
And increased it by a factor of one billion.
My invention
made the parallel supercomputer
the new normal.
And relegated the vector supercomputer
to computer museums.
My discovery opened the doors
that made it possible
to harness a billion processors
and use them, in parallel,

to accelerate the speeds of
compute-intensive
petroleum reservoir simulations
that were developed in the USA
and used in African oil-producing nations.
My discovery was used to find
new deposits of crude oil
and natural gas
in the Niger Delta region
of southern Nigeria.
My invention was used to create
geological models
of the producing oil fields
of **Saudi Arabia**.
My invention was used to analyse data
from seismic surveys
of producing oil fields of **Russia**.

An oil-producing field
is up to 7.7 miles, or 12.4 kilometers, deep.
And often the size of Alexandria, **Egypt**.
My scientific discovery that occurred
on July 4, **1989,**
in Los Alamos, New Mexico,
USA, made the news headlines.
My discovery that
the world's fastest computers
can be built from standard parts,
called processors,
was a scientific breakthrough because
it provided new knowledge
of how to distribute
and process seismic data
and do both within
and **across** compute nodes.
My discovery inspired the use
of the supercomputer
that's powered by millions of processors.
The fastest computers are used
to simulate drilling in oil fields,
to figure out where to drill
for crude oil and natural gas,
to decide how many oil wells to drill,
and to increase the output per oil well.

Labor Day 2019

father of the internet

philip emeagwali father of the internet
tim berners lee father of the internet
vint cerf father of the internet
dr philip emeagwali father of the internet
leonard kleinrock father of the internet
nigerian father of the internet
bob kahn father of the internet
npr father of the internet
african father of the internet
father of the internet **al gore**

Google suggests Philip Emeagwali as the father of the Internet. father of the Internet (Labor Day 2019).

1. How did the political situation in Nigeria during the 1960s impact Philip Emeagwali's childhood and family?
2. What were the reasons behind the mass killings of Igbos and other ethnic groups in Nigeria?
3. How did the events of the Nigerian civil war in 1967 affect Philip Emeagwali and his family?
4. Why did Philip Emeagwali's family decide to flee their residence and become refugees?
5. What role did the Nigerian military government play in exacerbating ethnic tensions during the civil war?
6. How did Philip Emeagwali's educational journey change as a result of the war?
7. What significant event occurred on April 1967 that influenced Philip Emeagwali's decision to leave his school?
8. How did Philip Emeagwali's experience with his principal, Father Thomas Kennedy, impact his life during the war?
9. What were the challenges faced by Philip Emeagwali's family during their escape to their ancestral hometown?
10. How did Philip Emeagwali's father's profession as a nurse contribute to their survival during the war?
11. What were the key contributions of Philip Emeagwali to the development of supercomputers?
12. How did Philip Emeagwali challenge the prevailing belief in Amdahl's Law and its limitations in computing?
13. What were the obstacles and criticisms faced by Philip Emeagwali in his pursuit of fastest computing?
14. How did Philip Emeagwali's discovery of harnessing slow processors revolutionize the field of supercomputing?
15. Why was Philip Emeagwali considered a pioneer and trailblazer in the world of parallel computing and fastest computing?

1. How did Philip Emeagwali visualize his new supercomputer as a new Internet?
2. What is the significance of Philip Emeagwali's visualization of processors distributed across the surface of a sphere?
3. How did Philip Emeagwali solve the most difficult problem in mathematics using the world's fastest computer?
4. What was Philip Emeagwali's breakthrough in computing and how did it change the boundaries of fastest computing?
5. How did Philip Emeagwali use a billion processors to execute the world's fastest computing?
6. What was the role of Philip Emeagwali's new Internet in reducing the time-to-solution for computational problems?
7. What is the impact of Philip Emeagwali's invention on the development of the world's fastest computers?
8. How did Philip Emeagwali's discovery of fastest computing across slowest processors challenge existing notions in computer science?
9. What is the relationship between Philip Emeagwali's new Internet and the field of large-scale computational fluid dynamics?
10. How did Philip Emeagwali's invention of the new Internet contribute to the advancement of computational physics?
11. How did Philip Emeagwali's discovery of fastest computing pave the way for the development of quantum computing?
12. How did Philip Emeagwali's visualization of the hypercube and hypersphere contribute to his understanding of the new Internet?
13. How did Philip Emeagwali's invention of the new Internet enable him to solve the grand challenge problem in supercomputing?
14. What is the significance of Philip Emeagwali's discovery in terms of the relationship between parallel thought processes and sequential computing?
15. How did Philip Emeagwali's discovery of fastest computing across a new Internet open doors for new fields of study and scientific breakthroughs?

2ND LECTURE: THE INTERNET AS A PLANETARY SUPERCOMPUTER

Broadcast 29 August 2021

https://youtu.be/JmG1zrbyHrQ

The world's fastest computer
that's powered by up to
one billion processors
was an invention
that followed my discovery of
parallel processing.
The knowledge of how to solve
the so-called "Grand Challenge"
of supercomputing
and do so across up to a billion processors pre-existed.
But it was unknown until I discovered that parallel processing
can simultaneously yield
the highest speed ups across
an Internet.
On July 4, 1989, I discovered
that fastest speed across
a virtual supercomputer
that's a global network of
65,536 coupled processors , each its own master,

   and that's an Internet, in reality.

The world's fastest computer
is the vital technology
that posterity must harness
and use to move humanity forward.

I came of age in the 1970s and 80s.
In those two decades,
the *terra incognita*
that was the emerging field of
fastest computing across
a million processors
was as empty as a ghost town
that had only one permanent resident.
I was that permanent resident
at the farthest frontier of fastest computing.

My new Internet was a small copy
of a never-before-understood Internet,
that's outlined and defined
by its 65,536 processors
that encircled a globe,
instead of billions of computers
around a globe.

298

I visualized each of my
two-to-power sixteen
off-the-shelf processors
as equal distances apart
and around a globe
in a sixteen-dimensional hyperspace.
And I visualized my ensemble
of processors
as evenly distributed **across**
the hypersurface of a hypersphere
in a sixteen-dimensional hyperspace.
I visualized my ensemble
of processors
as outlining a new Internet
which I visualized
in my sixteen-dimensional hyperspace.

What is Philip **Emeagwali** known for?

I discovered
how to combine computers
into a supercomputer
that's an Internet.
That discovery is like a light
from an ancient sky.
I'm the only father of the Internet
that invented an Internet.

Labor Day 2019

father of the internet

philip emeagwali father of the internet
tim berners lee father of the internet
vint cerf father of the internet
dr philip emeagwali father of the internet
leonard kleinrock father of the internet
nigerian father of the internet
bob kahn father of the internet
npr father of the internet
african father of the internet
father of the internet **al gore**

Google suggests the most noted <u>fathers of the Internet</u>. With four out of ten searches, Philip Emeagwali is the most suggested "<u>father of the Internet</u>" for schools across the USA, Canada, UK, and Africa (Labor Day 2019).

When Black People Weren't Allowed in Supercomputing

In the early 1980s, I was discouraged
from doing what white scientists
were allowed to do.
I was discouraged from programming
a forty-million-dollar vector supercomputer
that was in Camp Springs, Maryland.
I was discouraged from using
another vector supercomputer
that was in San Diego, California.
I was discouraged from using supercomputers
also bought with Black tax dollars.
Because I wasn't allowed to program
vector supercomputers,
I was forced to program only
massively parallel supercomputers,
which, in the 1970s and 80s,
were the most undesirable to program

300

to solve the most difficult problems
in mathematics.

Why We Changed the Way We Look at the Supercomputer

A school essay question **is this**:

"How did Philip **Emeagwali**
change how we look at the fastest computers
in the world?"

In the early 1980s, my unproven idea
of the fastest computing **across**
the slowest processors
was mocked and ridiculed
as a beautiful theory
that lacks experimental confirmation.
In the 1970s and 80s,
fastest computing **across**
a new Internet
that's a new global network of
sixty-four binary thousand processors
was still in science fiction.
But on the Fourth of July 1989,
the day I discovered
the fastest speed in computing,
it didn't matter
that I had no research budget.
Or that I was Black
and sub-Saharan African.
What mattered was that the new way
of fastest computing
fundamentally changed how we look at the modern computer.
And changed how
we solve the toughest problems
in mathematics
arising in computational physics.
Or arise in large-scale
computational algebra.
And arise as the complicated
partial **differential** equation
that governs
initial-boundary value problems
at the frontiers of calculus, algebra, and physics
that define the most important applications
of the supercomputer
that's a forty-five billion dollars
a year industry.

My Quest for a New Internet

My quest was to use
my new Internet
as my test bed for solving
the toughest problems that arise
in mathematics, science, engineering,
and medicine.

My fastest computing theory
was that
the one and only one technique
for solving the most difficult problems
in mathematics
in supercomputing
that span **across** algebra, calculus,
and physics
was to reformulate each problem.
For that reason, I chopped up
the most compute-intensive problems
into an equivalent set of
one billion initial-boundary value problems
that can then be solved **across**
one billion processors.
And solved with a one-problem
to one-processor correspondence.
To be exact, I must experimentally confirm
my world's fastest computing theory
as true and across actual processors.
At 8:15 on the morning of July 4, 1989,
I confirmed my fastest computing theory.
I did so by executing
the world's fastest computation.
And by using my ensemble
of 65,536 processors
to solve my 65,536
initial-boundary value problems
that defined the whole
Grand Challenge problem—including
global climate modeling
for climate changes.

My contribution to physics **is this**:

I, effectively, removed the adjective "*grand*"
from the phrase
"grand challenge problems of physics."

My 1982 Lecture on the World's Fastest Computing

In 1982, I gave a lecture on
the world's fastest computing.
That lecture was mocked
as science fiction.
I was ridiculed because
my theorized speed increase of
a factor of 65,536 across
as many processors
was then believed to be impossible
to attain.
Fifteen years earlier,
between April 18 to 20, 1967,
a revered supercomputer expert,
named Gene Amdahl, quote, unquote "discovered" Amdahl's law.
In essence, Amdahl's law decreed that supercomputing across
the world's slowest processors
will forever remain in
science fiction.
During the following twenty-two years, Amdahl's law
convinced supercomputer manufacturers
to continue to use only one, two, or four
custom-made processors
to power their machineries.
My theory was that thousands or millions
or even billions of processors
should be used to power
the world's fastest computers.
On July 4, 1989, I discovered that
fastest computing across
slowest processors
is not science fiction.

My First Execution of Fastest Computing

In 1989, it was an epiphany
for me to discover that
in my supercomputing **across**
my global network of processors
that my speed increase
of a factor of
sixty-four binary thousand-fold

303

would have been impossible
if I didn't communicate **across**
my new global network of email wires.
Emails married my processors together.
Emails outlined and defined
my new Internet
that enshrouded a globe.

As a mathematician
who came of age in the 1970s
and 80s,
the lesson I learned **was this**:

The ordinary genius
insists on programming only
the processors
within the network of his email wires
and processors.

The magical genius
discovers she must command
and control
all her two-**raised**-to-power sixteen,
or 65,536, processors.
She must control them
via their sixteen **times**
two-**raised**-to-power sixteen,
or 1,048,576, email wires.

How I Ended My Search for a New Internet

The high-performance, massively parallel
supercomputer genius
who embarked on a quest
for the world's fastest computer,
of the 1980s, must look along sixteen
mutually perpendicular directions
in hyperspace.
That supercomputer genius
must understand
how to program **across**
billions of processors
that uniformly outline a globe
that's a metaphor for the Earth.
In the 1970s and 80s, I visualized myself
as a person who discovered
the world's fastest computer in hyperspace.
I visualized myself
as a programmer of the supercomputer,

or rather as a conductor
of an ensemble of billions
of processors.
That ensemble of processors
wasn't a computer, by or in itself.
That global network of processors
was a new Internet, in reality.
In 1989, I was in the news because
I was the first supercomputer conductor
to orchestrate the humongous
email communications
among my 65,536 processors.
I executed them **automatically.**
I **sent** and **received** emails **across,**
what was topologically speaking,
the surface of a globe
that had two-**raised**-to-power sixteen,
or 65,536, processors
uniformly distributed **across** that globe.

That invention was a new Internet
that I visualized as a small copy
of the Internet.

I'm the only father of the Internet
that invented an Internet.

A DAY IN THE LIFE OF AN AFRICAN MATHEMATICIAN

An African-born scientist
conducting research
at the farthest frontiers of knowledge
of mathematics, physics,
and computer science
and doing so in the USA
needs an enlightened
American female research scientist
who is also of African descent
and needs her to succeed.
That African-born research scientist
needs that American-born
research scientist
as his anchor and grounding force.
I met my wife, Dale,
on July 11, 1978,
in Baltimore, Maryland.
Dale was born in Baltimore
and as an American of African descent.
We were both research scientists
in Washington, D.C.
In the 1980s, my wife, Dale,
was an award-winning scientist.
As a research scientist,
Dale was then better known
than I was,
and she was my role model.

My Contribution to Physics of Fluid Dynamics

306

The experimental X-59 airplane was designed with the world's fastest computers. The aerospace industry purchases one in twenty supercomputers.

A question in high school essays **is this**:

"What is the contribution
of Philip **Emeagwali** to physics?"

My contribution to physics **is this**:

I extended the borders of knowledge
of modern physics
to include large-scale
computational physics
that's executed **across**
millions of processors.

In 1989, I was in the news because

I discovered how to solve

the most difficult problem

in a branch of physics

that's called extreme-scale

computational fluid dynamics.

Such compute-intensive problems

include the fastest computing

and the large-scale modeling

of the flow patterns of water and air

that occur during hurricanes

and tornadoes.
The accurate predictions
of the occurrences of hurricanes
and tornadoes
help protect lives and properties.
I discovered how to execute
the fastest computing
of aerodynamic flows
that must be used to design
hypersonic airplanes.
I discovered how to compute in tandem large-scale codes
in computational fluid dynamics.
The fastest computational
fluid dynamics codes
must be used to design
the most efficient shape
that reduces the drag
on a submarine and an automobile.
I solved that initial-boundary value problem
that's governed by
partial **differential** equations
at the frontiers of calculus
and computational fluid dynamics.
And I solved it by drawing on
both my physical
and geometric intuitions,
both as a physicist and a geometer.
And drawing on
my mathematical analogies
between meteorology and geology
and creating metaphors between the globe
in the 3rd and 16th dimensions.

How I Wind Down After Work

In the late afternoons
from the late 1970s,

through the 80s and the 90s,
I decompressed by jogging **across**
the Rock Creek Trail
of Silver Spring, Maryland.
Or playing tennis in Corvallis, Oregon,
or at the two tennis courts
that were next to the Penumbra Theater
of Saint Paul, Minnesota.
In the early 1990s, I stayed physically fit
by jogging up to fifty miles a week.
I trained for 26-mile marathon races
and did so around the
seventy-and-half [70.5] acre **Lake Como**
that was my backyard
of The Burlington of **Energy Park**
of Saint Paul (Minnesota).
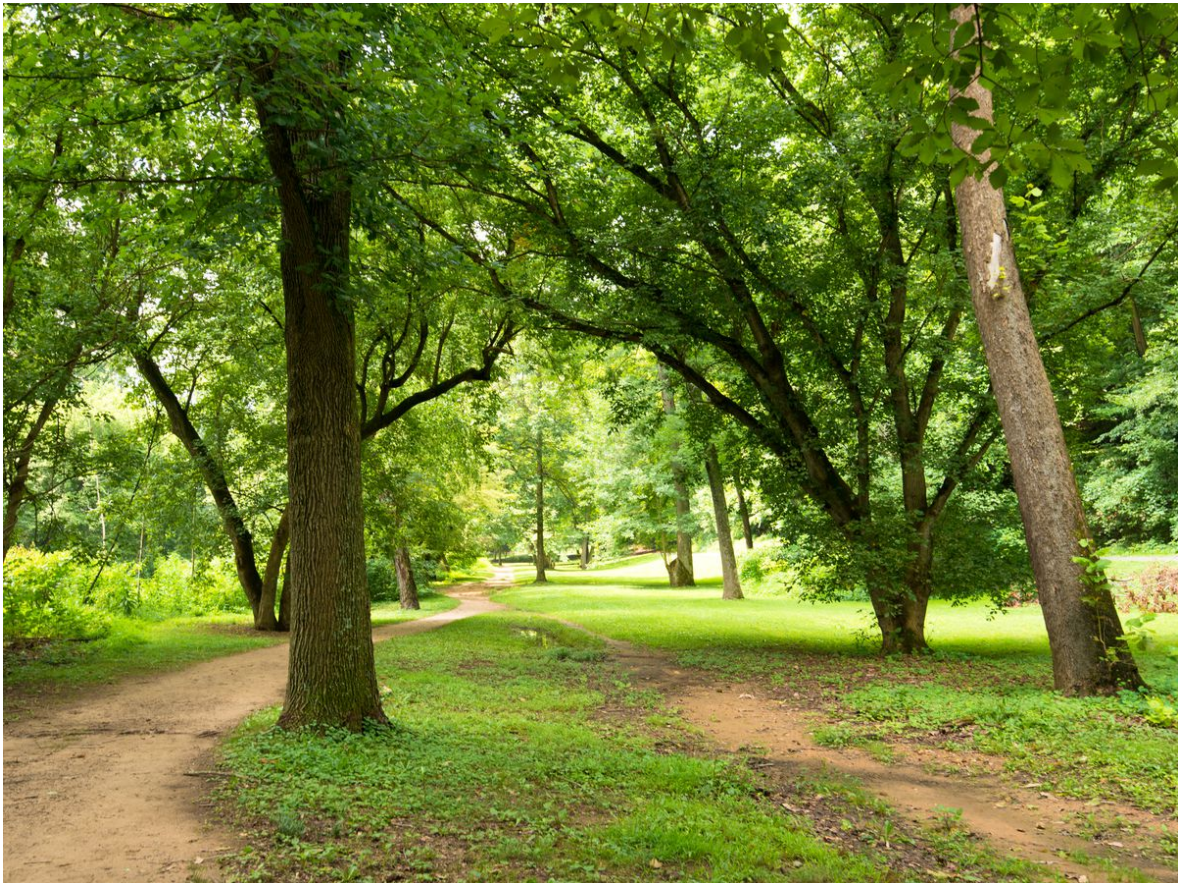
In the late 1970s, I jogged for three hours across Rock Creek Park of Washington, D.C. Now, I hike and bike in upstate New York. [Photo: Rock Creek Park]

In the early 1990s, I jogged up to forty miles a week around Como Lake, Saint Paul, Minnesota.

A DECADE IN THE LIFE OF A PHYSICIST

"What's a decade

in the life of a physicist?"

As a research physicist,
my specialty was fluid dynamics, particularly, large-scale computational
hydrodynamics.

Back from September 1, 1981,

through August 1986,

I lived a 15-minute stroll

from the Gramax Heliport Building

in Silver Spring, Maryland.

The Gramax Building

was an approved landing pad

for helicopters. The Gramax Building

was the then headquarters

of the U.S. National Weather Service.

During those five years,

and from Mondays through Fridays,

I stopped each morning

and spent five hours

with hydrologists and meteorologists.

I did so on my way to the nearby

Metro Station of Silver Spring, Maryland.

From Metro Station and after lunch,

I rode a small shuttle bus

to College Park, Maryland

where I spent the rest of my day

in research seminars

given by visiting mathematicians, physicists, and computer scientists.

At about six o'clock in the evening,

I played tennis at one of the fourteen

lighted tennis courts

at the nearby Fieldhouse Drive

of College Park, Maryland.

During my five years—from 1981

to 1986—with research meteorologists,

I was inspired to investigate

the finite difference discretizations

of the primitive equations of meteorology

that were used by the U.S.

National Weather Service

and used to forecast the weather.

Earlier and before my arrival

at the U.S. National Weather Service,

and in the three years

that were inclusive

from 1978 through 1981,

I researched in the fluid dynamics

of free surface water flows

and subsurface flows of crude oil,

injected water, and natural gas

that were flowing through porous media.

A typical porous medium

is an oil-producing field

that can be up to 7.7 miles,

or 12.4 kilometers, deep.

In those three years,

I lived in the bustling Adams-Morgan neighborhood.

And in the Meridian Hill Hall

that was next to the Malcolm X Park

and along the 16$^{\text{th}}$ Street

of Washington, District of Columbia.

During the ten years

that followed June 5, 1977, I moved around

and between

Washington (District of Columbia), Baltimore (Maryland),

Silver Spring (Maryland),

College Park (Maryland),

Casper (Wyoming),

and Laramie (Wyoming).

In those ten years and those cities,

I attended about five hundred

advanced scientific lectures.

It was a rare achievement

for a supercomputer scientist

to attend that many seminars.

Each seminar was at the frontiers

of knowledge in mathematics, physics,

and computer science.

Attending those five hundred

scientific lectures

enabled me to have far more knowledge

and command of my materials

than any supercomputer scientist

on YouTube.

And to become

the **multi**disciplinary mathematician

who posted one thousand

multidisciplinary videos

on the **Emeagwali** YouTube channel.

That was the reason

I was described me as an auto**di**dact,

and the person who invented

the world's fastest computing

across up to a billion processors.

In the late 1970s, I lived in Adams Morgan, Washington, D.C. The legendary Kilimanjaro Restaurant and Club was located here. It was where Africans party.

In the 1970s and 80s,
it was impossible to solve
the most difficult problems
in mathematics and physics—such as forecasting the weather—and solve
them across a million processors.
For that reason, I had to invent, not learn,
how to solve
the world's biggest problems
by executing
the first world's fastest computing across
the world's slowest processors
that shared nothing with each other.
Like other inventors, I invented
fastest computing
without the benefit of a
supercomputer instructor.
That is, I was the first
to understand how to harness
the world's fastest computing,
as we know the technique today!

In the 1980s, I attended
five hundred lectures
on the latest scientific discoveries.
Each lecture was delivered
by the discoverer or inventor
who was a leading mathematician
or physicist or computer scientist.
After ten years of daily conversations
with the foremost thinkers
at the frontiers of knowledge,
I became a **multi**disciplinary mathematician who can discover
new physics
and invent a new computer
that's fastest.
That was how I became known
for my contributions
to the development
of the world's fastest computer.
I discovered the world's fastest computer **across**
the slowest processors in the world.
I discovered the world's fastest computer
on the Fourth of July 1989,
in Los Alamos, New Mexico, USA,

and **across** an ensemble
of 65,536 processors.

Philip Emeagwali Internet as the World's Fastest Computer

A question in school essays **is this**:

"What is the Philip **Emeagwali** Internet?"

I visualized my new Internet

as a new global network of

sixty-four binary thousand,

or 65,536,

off-the-shelf processors.

That Internet was married together as one seamless, coherent, and gigantic

supercomputer.

And married by one binary million

email wires, or 1,048,576 wires,

that were uniformly distributed

around a globe.

But I visualized my globe

to be shaped as what mathematicians call

a hypersphere

in the 16th dimensional hyperspace.

Emergence of a Planetary Supercomputer

My invention of a new Internet
that's a new global network
of processors
and that's a new supercomputer
was a moment of revelation and insight.
I discovered how to harness
the trillions of processors
and the billions of computers
that could outline and define
the Internet of the future.
I discovered
how the planetary supercomputer
of forthcoming centuries
could look like.

A planet-sized supercomputer
that harnesses all the processors
and computers on Earth
and uses them to solve
a difficult problem in mathematics
and physics
must, by necessity, require that
all emails be **simultaneously** sent
and synchronously received **across**
the Earth. The processing nodes
of that planet-sized supercomputer
must be uniformly distributed **across**
the Earth.

That scientific discovery
was my Eureka moment of revelation.
It helped me to understand
that harnessing a billion processors
is the key to making
the supercomputer **fastest**.

That scientific discovery
was how I gained insight
into the essential meaning
of a global network
of off-the-shelf processors
that were coupled and identical
to each other.
It was a global network
of identical email wires
that I visualized
as tightly circumscribing a hyper-globe
in **hyperspace**.
That new technology was a new Internet that was comprised of 65,536
processors.

Planetary Supercomputer from the Internet

In 1989, I was in the news because
I discovered that those
sixty-four binary thousand processors
can be used to emulate one seamless, coherent, and gigantic processor
that was at the processing core
of the world's fastest computer.
That new computer and new Internet
are like two sides of the same coin
that are different
but, yet, congruent and necessary.
The head side of the coin contains

the ensemble of processors.
The tail side of the coin contains
the ensemble of email wires.
The head and tail sides
are married to each other
to form the new Internet,
called the **Philip Emeagwali** Internet.

I'm the only father of the Internet
that invented an Internet.

A new supercomputer
was born at 8:15 on the morning
of July 4, 1989, in Los Alamos,
New Mexico, USA.
That new supercomputer
used the slowest processors in the world
to execute the fastest processing
in the world.
That new supercomputer
fundamentally changed how we look at the computer.
The world's fastest computer
consumes enough power
to run ten thousand (10,000) homes.

A supercomputer communicates **across**
up to 200 miles of cables.
The world's fastest computer occupies
eight thousand square feet
of floor space.
And comprises of hundreds of racks, millions of processors, endless wires,
and blinking lights.
That new supercomputer
is not a computer, by or in itself.
That new supercomputer
is a new Internet, in reality.

In a dream, my new Internet
appeared to me like a deity.
That supreme power enshrouds the Earth
as an electronic cloth. I imagined that deity
to be the global, planet-sized **SuperBrain**
for our descendants
of forthcoming millennia.
That **SuperBrain** could be
a billion trillion coupled,
super intelligent processors.
My epiphany was the Eureka moment
when I comprehended that

the Internet of **Year Million**
could evolve to become the core
of the Earth-sized supercomputer
of our posthuman Gods.

When a Science Fiction Becomes a Supercomputer

For the past century, weather forecasting
—the precursor to climate modeling—was the poster boy of the list of
the most difficult problems
in mathematics and physics.
Fastest computing **across** a globe
was speculated and entered
into science fiction.

And did so when it was first published
on February 1, 1922.
Fast forward sixty-seven years,
I was in the news because
breaking that supercomputer
speedup barrier
was computing's equivalence
of being the first
to summit the peak of Mount Everest,
or climb to the top of the world.

The science fiction of today
could become
the non-fiction of tomorrow.

On February 1, 1922,
a science-fiction human supercomputer
was described as 64,000 humans
calculating together to forecast the weather
for the entire Earth.
I stumbled onto that science-fiction story
while I was working as a university librarian
in Monmouth, Oregon, USA,

in the summer of 1974.

I reformulated that idea of 1922
as the first world's fastest computing across an Internet.
I visualized my new Internet
as a new global network of
64,000 computers.
In 1974, my Internet was mocked
as a blue-sky thinking.
In that decade, fastest computing **across**

up to a billion processors
remained in science fiction.

Sixty-seven years later,
on the Fourth of July 1989,
that science fiction

manifested as a nonfiction **across**
a new Internet.
I visualized the Philip **Emeagwali** Internet
as a new global network of
sixty-four binary thousand processors
around a globe.
I visualized that globe as a **hypersphere**
in a sixteen-dimensional **hyperspace**.

My Contributions to Weather Forecasting

My visualization differed
from the sixty-four thousand
human computers around a globe
in three-dimensional space.
After the Fourth of July 1989,
fastest computing across
up to a billion processors
—or using one million processors
to solve the same problem
and do so **simultaneously**—
left my experimental
supercomputing laboratory.
My invention, or new knowledge,
entered every supercomputer
that has been manufactured
since my scientific discovery of **1989**.

A question in school essays
on famous physicists and their discoveries **is this**:

"What did Philip **Emeagwali**
contribute to physics?"

My discoveries and contributions to physics
are these:

The slowest processors in the world
can be used to manufacture
the fastest computers in the world
that can be used to solve
the most difficult problems in physics.

In 1989, I was in the news because
I discovered that up to one billion

self-contained processors
could be utilized
to forecast tomorrow's weather.
And deeply understand
next century's climate change.

FATHER OF THE INTERNET

Philip Emeagwali Internet

I invented the Philip Emeagwali Internet.
But it was renamed and credited
to a white inventor.
I solved the most difficult problem
in computational mathematics.
And I solved it alone.
That Grand Challenge problem, namely
the world's fastest computing across
the world's slowest processors,
to answer the world's biggest questions
was indirectly and first posed
seven decades earlier.

**I was the first to sketch
a new Internet**

322
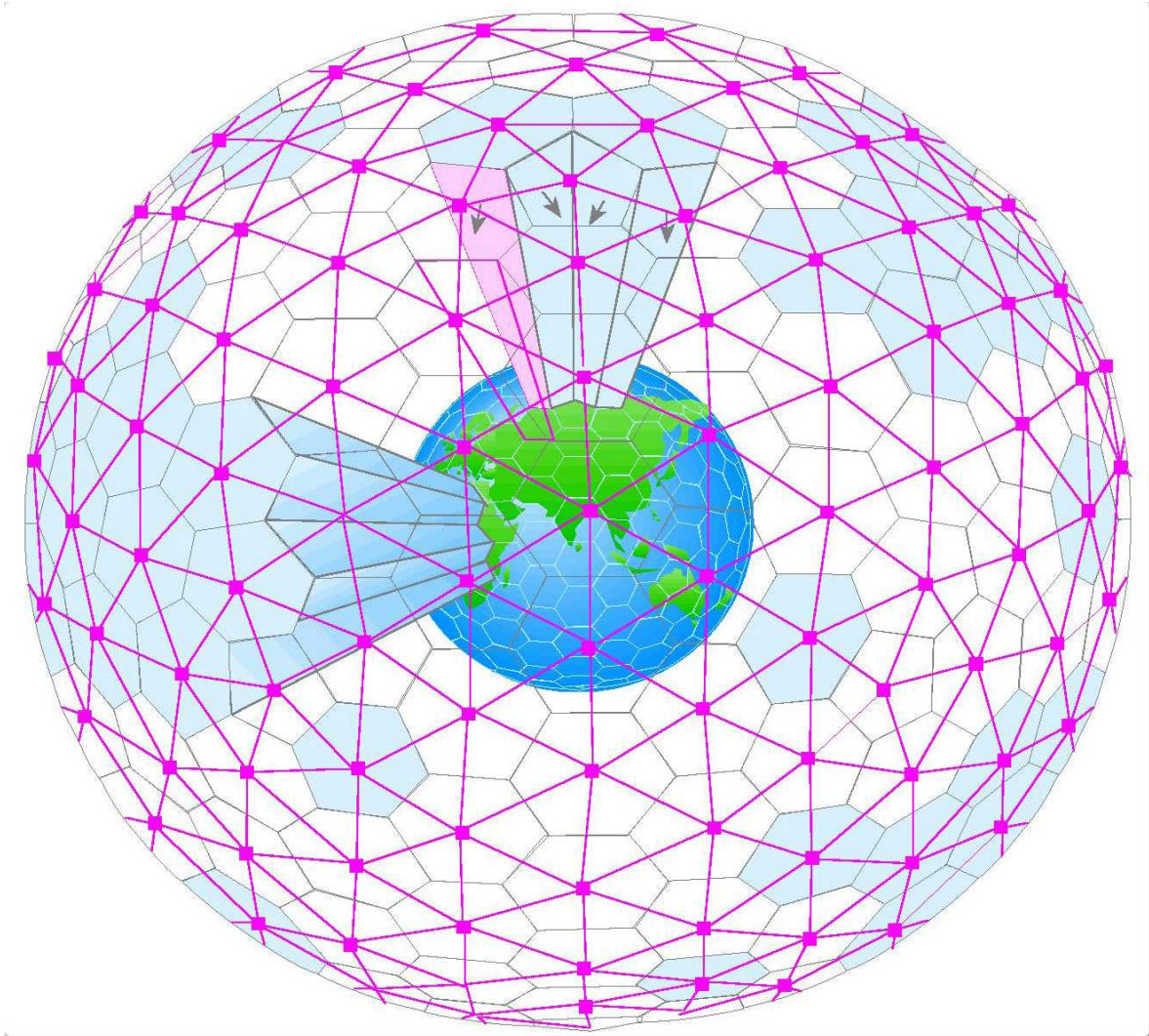
My original sketch of the Internet. It was conceived in 1974. I was the first to sketch a new Internet.

The idea that suddenly the Internet
was invented in the 1970s
just doesn't ring true.
That said, I was the first to sketch
a new Internet. My new Internet
was a global network of processors
that emulated one seamless, coherent,
and gigantic supercomputer.
My invention made the news headlines because it materialized
as the world's fastest computer.
For the fifteen years following 1974,
my not-so-fully formed hypothesis,
that was published on February 1, 1922,
continuously grew in my mind.
It became my fully formed theory

that I constructively reduced to practice.
It physically materialized
as my new **global** network
of the sixty-four binary thousand
slowest processors in the world
that seamlessly computed
as one coherent supercomputer
that became the world's fastest computer.

A Fundamental Change in Computational Physics

Someone asked:

"What's the most fundamental change
that occurred in computational physics?"

A century ago, the physics model
of the spread of the coronavirus disease
could only have been formulated
on the blackboard.
Half a century ago, the spread of COVID
could be modelled on a computer
that was powered by only one processor.
Today, a supercomputer
that is powered by up to
ten million processors
can be used to model the spread of
COVID-19 **across** a Nigerian bus
that packs passengers like sardines.
That sea change from modeling
on a blackboard to a motherboard
to the world's fastest computer
is the most fundamental change
in computational physics.
It was a quantum shift
from the February 1, 1922, science fiction and paradigm of sixty-four
thousand human computers
that were quote, unquote
"racing" the weather for the **globe.**
My 1974 theory
of the world's fastest computer
was about as many processors,
or computers, working together
to solve the most difficult problems
in mathematics and physics.
And solve them **across**
my ensemble of processors
that were evenly distributed
around a **globe.**

My invention of the first supercomputing
across the world's slowest **computers**
occurred at fifteen minutes after 8 o'clock on the morning
of July 4, 1989, in Los Alamos,
New Mexico, USA.
In 1989, I was in the news because
I discovered that
two-**raised**-to-power sixteen, or 65,536, processors,
or as many electronic computers,
that were **uniformly** distributed
around the hypersurface of a **globe**
in a sixteen-dimensional **hyperspace**
can be deployed to **uniformly** compute
more accurate climate models
around the **globe.**
That is, I discovered that
many ordinary processors
could be used to foresee otherwise unforeseeable long-term global
warming.

A Father of the Internet

Labor Day 2019

father of the internet

philip emeagwali father of the internet
tim berners lee father of the internet
vint cerf father of the internet
dr philip emeagwali father of the internet
leonard kleinrock father of the internet
nigerian father of the internet
bob kahn father of the internet
npr father of the internet
african father of the internet
father of the internet **al gore**

Google suggests the most noted fathers of the Internet. With four out of ten searches, Philip Emeagwali is the most suggested "father of the Internet" for schools across the USA, Canada, UK, and Africa (Screenshot on Labor Day 2019).

In Google searching for quote, unquote
"Father of the Internet,"
the first name that's suggested
is "**Philip Emeagwali.**"

My signature discovery

that made the news headlines,

in 1989,

was my experimental confirmation

of my 1974 paradigm

of the world's fastest computing

executed around a new Internet

that's a new global network of

65,536, or two-**raised**-to-power sixteen,

off-the-shelf processors.

I visualized my processors

as uniformly distributed around a

sixteen-dimensional globe

that's embedded

inside a sixteen-dimensional hyperspace.

In the decade and a half,

that followed June 20, 1974,

on a supercomputer

that was at 1800 SW Campus Way,

Corvallis, Oregon, USA,

I visualized my globe

in the sixteenth **extraordinary** dimension,

rather than in the third [3rd]

ordinary dimension.

We need to change the way we look at the Internet

In my new paradigm

of the world's fastest computing

executed around a new Internet

that uniformly encircles a globe

in the 16th dimension,

I visualized my 65,536 processors

as two-**raised**-to-power sixteen processors

in which each processor

was directly connected

to its sixteen closest-neighboring processors.

Those processors shared nothing

and each operated its operating system.

As the first mathematician

to program an ensemble

of 65,536 processors

and use them to solve

one of the most difficult problems

in mathematics and physics,

my grand challenge was to figure out

how to marry millions, or billions,

of ordinary processors together.

And marry them as one seamless, coherent, and gigantic supercomputer.

And marry them together

by their sixteen **times**

two-**raised**-to-power sixteen,

or 1,048,576, or one binary million,

email wires.

I used emails to send and receive

intermediate answers

to my testbed physics-inspired problem.

My testbed problem

was an initial-boundary value problem

of mathematical and computational physics

that was governed by a system of

partial **differential** equations

beyond the frontier of calculus

and fluid dynamics.

THE FIRST SUPERCOMPUTER SCIENTIST

As the first pilot to quote, unquote "fly"
the world's fastest computer
that was powered by
sixty-four binary thousand processors,
I asked the traffic guys to show me lights
from the ground. Realizing that I was Black
and African,
they turned off all the lights. Fortunately,
I was an instrument-rated pilot
who could land airplanes blindfolded.
In the 1980s,
I programmed a new global network
of 65,536 coupled processors
which powered a new supercomputer
that I defined as a new Internet.
I programmed my processors blindfolded.
In the 1980s, I was the remote programmer
of sixteen of the most massively parallel supercomputers in the world.
I was logged onto supercomputers
24/7.
For parallel programming,
I was known as the go-to person
within the supercomputing community
that include from
the supercomputer centers
in San Francisco (California)
to Oak Ridge (Tennessee)
to Chicago (Illinois)
to Cambridge (Massachusetts)
to Washington (District of Columbia).
However, supercomputer scientists
in those centers who knew me
by name only assumed that
Philip Emeagwali
was a white supercomputer scientist
with an Eastern European last name.

I Changed the Way We Look at the World's Fastest Computers

For me, the emerging paradigm

is fastest computing **across** a new Internet

that is described as the

Philip **Emeagwali** Internet.

I visualized my new Internet

as a new global network of processors.

In my mathematical theory,

my globe was embedded

within my sixteen-dimensional hyperspace.

But in my world's fastest computing,

my globe in hyperspace

was quote, unquote "etched"

onto the three-dimensional space.

I was in the news

for experimentally discovering

how to compute and communicate **across** my new Internet.

My Internet surrounded

a metaphorical globe in the 16th dimension.

And did so just as the Internet circumscribes the Earth

in the 3rd dimension.

I was in the news because
I theoretically and experimentally discovered
how to make fastest computing across
slowest processors useful
and harness it to solve everyday problems,
such as your evening weather forecast
or foreseeing the spread of COVID-19.
My invention of the world's fastest computing
remained my signature contribution
to mathematics, physics,
and computer science.

1. What is parallel processing, and how did Philip Emeagwali contribute to its development?
2. How did Philip Emeagwali's discovery of parallel processing revolutionize the field of supercomputing?
3. What challenges did Philip Emeagwali face as a Black scientist in the early 1980s?
4. How did Philip Emeagwali change the way we perceive the fastest computers in the world?
5. What role did Philip Emeagwali's new Internet play in solving complex problems in mathematics, science, engineering, and medicine?
6. How did Philip Emeagwali's fastest computing theory challenge existing beliefs about supercomputing capabilities?
7. What role did email communication play in Philip Emeagwali's discovery of the world's fastest computing?
8. How did Philip Emeagwali's visualization of processors in a hyperspace contribute to his understanding of the world's fastest computer?
9. How did Philip Emeagwali's contributions to physics impact the field of computational fluid dynamics?
10. How did Philip Emeagwali's discoveries in computational fluid dynamics help in predicting and understanding weather phenomena like hurricanes and tornadoes?
11. What challenges did Philip Emeagwali face as an African-born scientist conducting research in the USA?
12. How did Philip Emeagwali's wife, Dale, contribute to his success as a research scientist?
13. How did Philip Emeagwali extend the borders of knowledge in modern physics through his work in large-scale computational physics?
14. How did Philip Emeagwali balance his work as a research scientist with physical fitness activities?
15. What are some examples of the physical activities Philip Emeagwali engaged in to maintain a healthy lifestyle?

1. How did the physicist's daily routine and interactions with hydrologists and meteorologists contribute to his research in fluid dynamics?
2. What motivated the physicist to investigate the finite difference discretizations of the primitive equations of meteorology used by the U.S. National Weather Service?
3. How did the physicist's experience living in different cities and attending scientific lectures contribute to his knowledge and command of his materials?
4. What was the physicist's contribution to the development of the world's fastest computer, and how did he achieve this using slow processors?
5. How did the physicist's invention of the Philip Emeagwali Internet differ from the traditional concept of the Internet?
6. What was the significance of the physicist's discovery of harnessing a billion processors for making the supercomputer fastest?
7. How did the physicist's visualization of processors distributed around a globe in hyperspace contribute to solving difficult problems in mathematics and physics?
8. How did the physicist's discovery of the world's fastest computer impact weather forecasting and climate modeling?
9. Why was the physicist referred to as the "father of the Internet," and what challenges did he face in getting recognition for his invention?
10. How did the physicist's paradigm shift in computational physics change the way problems were solved and modeled, particularly in the context of COVID-19?

334

Broadcast 29 August 2021

https://youtu.be/p6REP9kI7_U

I began supercomputing on June 20, 1974,

at 1800 SW Campus Way, Corvallis, Oregon, USA.

In December 1965,
that supercomputer, in Corvallis, was rated
as the world's fastest computer.
I was programming a supercomputer
that was faster than the one
that helped put a man on the Moon,
on July 20, 1969.
Because I was Black and African,
I was forced to work full time and alone
on my research
on how to combine computers
into supercomputers
and did so for seventeen years
and without any payment
that was in proportion
to what American billionaires were paid.

After working full time and without pay
for those seventeen years,
I felt that keeping the entire credit
for my invention
is the only reward that I can have.
It was like **Chinua Achebe,**
who is the father of African literature,
foregoing his author royalties
but insisting that he alone be credited
as the author of "Things Fall Apart."
And it was like **Fela Kuti**
foregoing his songwriting royalties
but insisting that
he is the "Father of Afrobeat."
I'm the father of
the world's fastest computing,
as it's known today.
And I am the only father of the Internet
that invented a new Internet.

father of the internet

philip emeagwali father of the internet
tim berners lee father of the internet
vint cerf father of the internet
dr philip emeagwali father of the internet
leonard kleinrock father of the internet
nigerian father of the internet
bob kahn father of the internet
npr father of the internet
african father of the internet
father of the internet **al gore**

Google suggests the most noted <u>fathers of the Internet</u>. With four out of ten searches, Philip Emeagwali is the most suggested "<u>father of the Internet</u>" for schools across the USA, Canada, UK, and Africa (Labor Day 2019).

Surviving the Death of One in Fifteen Biafrans

A question in school essays **is this:**

"What was Philip **Emeagwali**'s education like?"

I was born on August 23, 1954,
in Akure, in the western region
of the British West African colony
of Nigeria.

In January 1960 and at age five,
I enrolled in first grade

in Saint Patrick's Primary School,
Sapele, Nigeria.
Several students in my class
were twice my age.
My seventh-grade school photos,
that I posted on my website, reveal that

some of my classmates
were twice my age.

From January 1960 to March 1974,
I attended, on-and-off, six schools
within Nigeria.
But I dropped out of school
for five of those fourteen years.
I'm often invited to alumni reunions
and remembered
as the school's most gifted student.
For that reason, my former classmates
were not surprised when I told them that
I won a scholarship to the USA.
My scholarship took effect
on September 10, 1973.
After a six months delay, I arrived in
36 Butler Hall, Monmouth, Oregon.
And on the evening of Sunday
March 24, 1974.

Twelve hours after my arrival,
I had a conference
with a brilliant American mathematician,
named Beryl M. Green.
My goal was to become a mathematician
and Beryl M. Green
was assigned as my mentor.
To my surprise, we couldn't understand what each other was saying.
At that time, I could only understand
the spoken Nigerian and British English.
And Beryl M. Green could only understand
the spoken American English.
In retrospect, I should've anticipated
my difficulty. But I did not.
Looking back to the early 1970s,
there were no television
in the eastern region of Nigeria,
where I then lived.
The first time, I listened intently
to the spoken American
was in about May 1973.
And during the listening portion
of the American TOEFL, the acronym
for Test of English as a Foreign Language.
I took TOEFL
at The Hope Waddell Training Institution, Calabar, Nigeria.
Not surprising, I failed the listening portion of TOEFL.
In the early 1970s, Nigerians arriving

in the USA, for the first time,
could not understand
the spoken American English.
It took me several weeks
to understand the American English.

So, on my first day in the USA,
I wasn't sure what language
the mathematician Beryl M. Green
was speaking.
And he felt the same way about me.
For several minutes,
we starred at each other
and looked confused.

To introduce myself, I grabbed a chalk from his desk, walked to his
blackboard
and scribbled a difficult problem mathematics. I derived its solution.

That impressed him. He said that I should go far in mathematics.

The following day, Beryl M. Green,
secured a second scholarship for me.
He advised me to transfer,
twenty miles away,
from Monmouth to Corvallis, Oregon.
That I was how I came to Kidder Hall, Corvallis, a building that housed
the most brilliant mathematicians
in Oregon.
Directly opposite from Kidder Hall
was the building that housed
the only supercomputer in Oregon.
Three months later,
I began supercomputing.

In 1970, in Christ the King College, Onitsha, Nigeria, I was well known
but only known
by my nickname "Calculus,"
not by my birth name **Philip Emeagwali**.
Calculus is the powerful technique
that must be used to solve
the most difficult problems in physics.
Such grand challenge problems include
the computational fluid dynamics models
that're used to determine
the best social distancing measures
that will reduce the spread of
the coronavirus disease.

Fast forward twenty years into the USA,
I was in the news as the mathematician
who contributed to calculus.

Outside Nigeria, I attended six universities, with each claiming me as its
notable alumnus.
The last university that I attended
has 610,000 living alumni
who it sends a quarterly update
on the best minds on the university campus.
The February 1991 issue
of *Michigan Today*
was a tribute issue (see link
https://emeagwali.files.wordpress.com/2018/10/philip-
emeagwali_university-of-michigan_michigan-today_february-1991.pdf)
by the University of Michigan
on its most renown scientist named
"**Philip Emeagwali**."

So I won early acclaim as a genius and did so across the length and breadth
of the state of Michigan.

At that time, it was very offensive
to white scientific communities
for a white American university
to glorify a Black sub-Saharan African
as smarter than Albert Einstein.
For that reason, only the portraits
of white male scientists
were allowed to be exhibited
on their wall of geniuses.
In 1989, I was the first scientist,
black or white, to be described
as smarter than **Albert Einstein**.
I became an intellectual threat that must be suppressed at all cost.
I was controversial because
I did not meet their whiteness criterion
that was the requirement
to being called a genius.
To this day, the university upholds
its tradition
of only naming buildings
after obscure white male scientists.
As well as only displaying the portraits
of obscure white historical figures.
And displaying them with the intent
to lower the self-esteem
of its underrepresented students.

What's a day in Biafra like?

A question in school essays **is this**:

"List three interesting events
in the life of **Philip Emeagwali**."

I dropped out of school, for five years,
between ages twelve to nineteen.
I dropped out to live in refugee camps
of Biafra of the Nigerian Civil War.
One in fifteen Biafrans died
during that 30-month-long war.
In the list of the worst genocidal crimes
of the 20th century
that were committed against humanity,
the death of one in fifteen Biafrans
was ranked fifth.

When the Nigerian Civil War began,
my father's residential address
was at 4B Egbuna-Adazie Street,
Odoakpu, Onitsha, Biafra.
In late 1967, the **Fegge**
and **Odoakpu** Quarters
of **Onitsha** were deserted,
except for full-time looters
and trophy hunters.
After the attack of October 12, **1967,**
and during the five-and-half months
that preceded March 20, **1968,**
downtown Onitsha became a ghost town.
At that time, it's downtown
wasn't a safe place to visit alone.

1. How did Philip Emeagwali contribute to the development of supercomputing?
2. What challenges did Philip Emeagwali face as a Black African working in the field of supercomputing?
3. Why does Philip Emeagwali consider himself the father of the world's fastest computing?
4. How did Philip Emeagwali's experience in the Nigerian Civil War influence his life and career?
5. What impact did Philip Emeagwali's discovery of parallel processing have on the field of computer science?
6. How did Philip Emeagwali visualize and conceptualize his new Internet and supercomputing model?
7. What were some of the applications of supercomputers in Venezuela, according to Philip Emeagwali?
8. What were the economic benefits associated with Philip Emeagwali's discovery of fastest computing?
9. How did Philip Emeagwali's technological breakthrough challenge traditional notions of supercomputing?
10. What made Philip Emeagwali famous and garnered him international recognition?
11. What is the significance of Philip Emeagwali's discovery of the world's fastest computing on July 4, 1989?
12. How did Philip Emeagwali's discoveries pave the way for solving the most difficult problems in mathematics and physics?
13. How did Philip Emeagwali's contributions to supercomputing open doors for addressing global challenges?
14. What challenges and obstacles did Philip Emeagwali face in his career due to his race and background?
15. How does Philip Emeagwali's experience relate to the broader issue of representation and recognition in science and technology fields?
16. In what ways did Philip Emeagwali's upbringing and education shape his achievements in supercomputing?
17. What was the significance of Philip Emeagwali's encounter with mathematician Beryl M. Green when he first arrived in the USA?

18. How did Philip Emeagwali overcome language and cultural barriers when starting his studies in the USA?
19. How did Philip Emeagwali's experiences during the Nigerian Civil War influence his later work and research?
20. What role did Philip Emeagwali's visualization and conceptualization abilities play in his discoveries and inventions?
21. How did Philip Emeagwali's scientific discoveries challenge existing ideas about supercomputing and computer architecture?
22. How did Philip Emeagwali's discoveries impact the field of computational physics and the use of supercomputers in various industries?
23. What are some of the ethical and societal implications of supercomputing and its applications?
24. How did Philip Emeagwali's work contribute to the advancement of climate modeling and our understanding of global warming?
25. What lessons can we learn from Philip Emeagwali's journey and achievements in the field of supercomputing?

THE DAY OF THE LONG NIGHT!

On March 20, 1968,
refugees living in Énú Ọnịcha,
called Inland Town,
noticed the sudden influx
of thousands of frightened Biafran soldiers.
Some of those Biafran soldiers
confided to their refugee relatives
in Énú Ọnịcha
that they were fleeing
from the nearby Abagana battlefield.
Those Biafran soldiers were fleeing
beyond Onitsha and towards Oba
and Nnewi.
Unknown to us, namely
the Biafran refugees in Onitsha,
was that the Biafran soldiers
who should protect us
were routed by the Nigerian Army
and were disorganized.
Biafran soldiers defending Onitsha
fled hastily.
And fled without alerting us
—the 15,000 refugees in Énú Ọnịcha—
to join them in their flight to safety.
During that 30-month-long war,
both the Nigerian and Biafran soldiers
killed their civilian captives,
and their war prisoners.
That was one reason
one in fifteen Biafrans died
in thirty months!

Benjamin Adekunle

In 1968 and at the war front inside Biafra,
Colonel **Benjamin Adekunle**,
also known as "black Scorpion,"
who led the Third Marine Commando
told a French radio reporter:

And I quote
"We shoot at everything that moves
and when our troops
march into the center of Ibo territory,
we shoot at everything
even at things that do not move."
End of quote

344

THE GREATEST BATTLE
OF THE
NIGERIAN—BIAFRAN WAR
PRICE N5

THE ABAGANA
AMBUSH

(COL. ACHUZU)
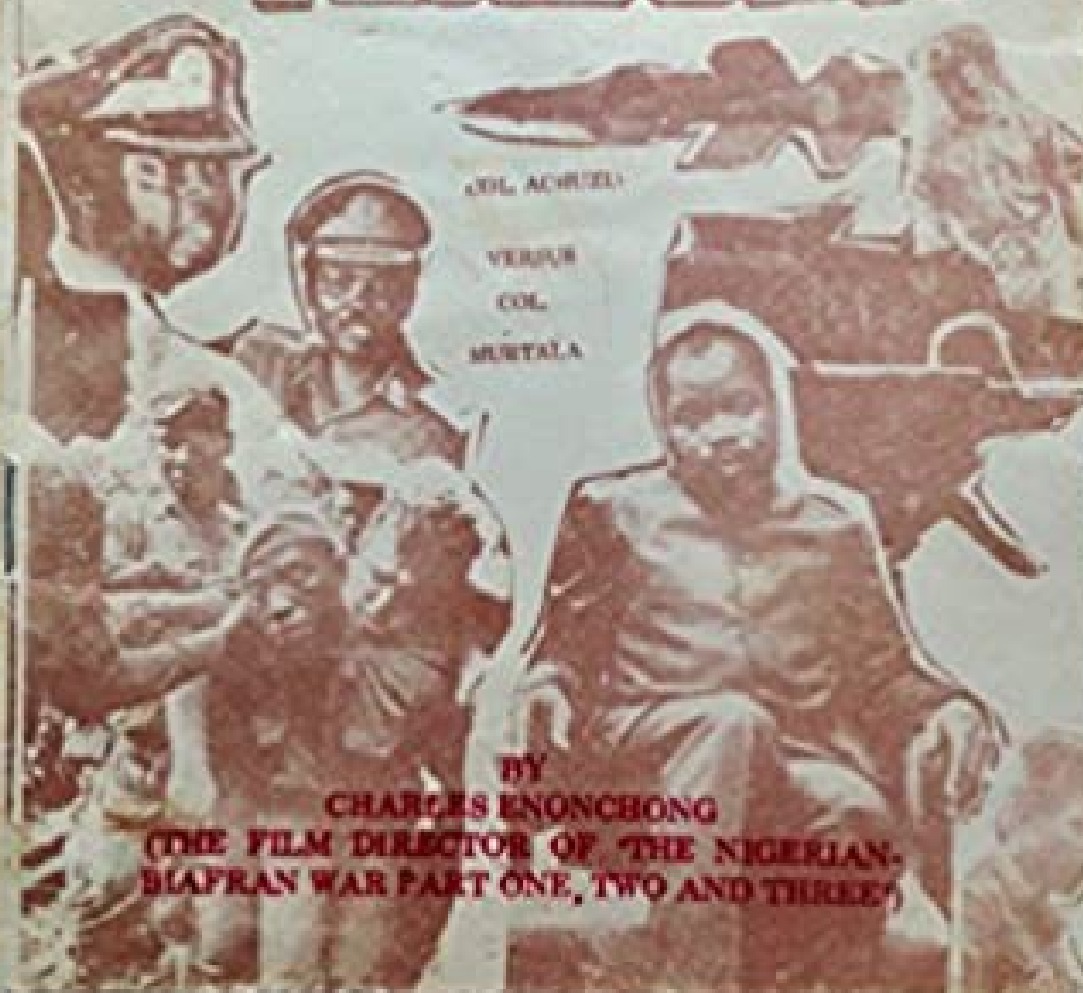
VERSUS
COL.
MURTALA

BY
CHARLES ENONCHONG
(THE FILM DIRECTOR OF 'THE NIGERIAN-
BIAFRAN WAR PART ONE, TWO AND THREE')

Unknown to the 15,000 refugees
who sought safety in *Énú Ọnịcha*
thousands of Nigerian soldiers

were rapidly thundering
from Abagana to Onitsha.
The Nigerian Army had superior firepower
while the Biafran soldiers
had run out of bullets
and were rapidly retreating
from the Abagana War Front.

We Were Biafra's Human Shields

One of the dark secrets
of the Nigerian Civil War **was this**:

On March 20, **1968**, the Biafran Army
used the 15,000 refugees in **Onitsha**
as their human shields.

The Biafran soldiers fleeing from Onitsha
had ample time to evacuate
those refugees.
The Biafran government
used those 15,000 refugees
who were *Onitsha indigenes*
as its human shield.
The Biafran government capitalized
on the certain deaths of refugees.
And tendered them
as proof of Nigerian genocide
against Igbos.

My First Eight Days at the Onitsha Battlefield

Six months earlier, we were refugees
at 6C Wilkinson Road, Onitsha.
That address was next to
Obi Okosi Primary School.
That school was closed and converted
as the military barrack
of one thousand Biafran soldiers.
The invading Nigerian Army
considered that Biafran military barrack
—and by extension
our homes that were next to
that barrack—to be their legitimate
military target Number One.
And in the early morning

of October 12, **1967,**
and as a thirteen-year-old,
I was fleeing along Wilkinson Road, Onitsha,
carrying a heavily loaded tin-pan
on my head.
And fleeing with my mother
and six younger siblings
and fleeing towards **Ogidi**,
that was seven miles away.
As I turned right into Wilkinson Road
and towards Ogidi, I looked to my left
and towards Metropolitan College
and saw what seemed to be a
house-to-house combat.
I saw a Biafran soldier
crouching with his Setima gun
and firing towards Metropolitan College.
Unknown to us, the Nigerian Army
was attempting to capture
the Biafran military barrack
that was headquartered
at Obi Okosi Primary School
of Umuasele Quarter of *Énú Ọnịcha*.
That was a shouting distance
from our residence
at 6C Wilkinson Road, Onitsha.
As we continued our flight
and a few seconds later,
a bullet casing fell two feet in front of me
and on the then untarred Wilkinson Road.
Another minute later,
I saw two Biafran soldiers
whom ten minutes earlier
I saw hiding in the bush
behind our house
at 6C Wilkinson Road.
I saw those two soldiers
remove their Biafran Army uniform
and change into civilian clothes.
Like a thousand Biafran soldiers
did that early morning,
those two soldiers fled because
the better armed Nigerian Army
had attacked their military barrack.

PATRIOTIC: The late Head of State announcing new states

Colonel Murtala Mohammed, former president of Nigeria.

Looking back retrospectively,
the Nigerian Army
implicitly gave the civilians
who were living in *Énú Ọnịcha*
eight days forewarning
to flee from *Énú Ọnịcha*.
Those were the eight days
of continuous artillery shelling of **Onitsha**
that originated from the banks of
the River Niger at **Asaba**.
The Biafran Army
had eight days to evacuate refugees
from the Inland Town quarter of **Onitsha,**
called *Énú Ọnịcha***,** to safer villages,
such as **Ogidi** or **Nnewi**.
Instead of evacuating the refugees
from the Onitsha War Front,
the Biafran Army used those
fifteen thousand *Ndi Ọnịcha* refugees
as their human shields.
Those fifteen thousand human shields,
included my 28-year-old mother, myself,
and my six siblings of ages one to eleven.

We were among
the fifteen thousand refugees

who fled, on October 4, **1967**,
from the Fegge
and Odoakpu Quarters
of downtown Onitsha
to *Énú Ọnịcha* "Inland" quarters.
Énú Ọnịcha was beyond
the artillery reach of the Nigerian Army
and was, therefore, safer.
Énú Ọnịcha was farthest
from the west bank of the River Niger
at Asaba.
That west bank at Asaba
was where the rockets
of the Nigerian Army,
that were under the guidance
of Colonel **Murtala Mohammed,**
the future president of Nigeria,
were fired with reckless abandon.
And fired upon the Fegge
and Odoakpu Quarters
of downtown Onitsha.
During those eight days,
that followed October 4, 1967,
of continuous shelling,
the Biafran Army didn't evacuate
the 15,000 refugees
who sought shelter in *Énú Ọnịcha*

that was the Inland Town quarter
of Onitsha.
The Biafran Army used
those 15,000 refugees
as their human shields and their protection
against the steadily advancing
Nigerian Army
that out-manned and outgunned them
by four to one.
Throughout that 30-month-long war,
in which one in fifteen Biafrans died,
the Nigerian Army
controlled the Biafran airspace.
And enforced a complete sea blockade
of Biafra.

After the war was over,
I started nursing the ambition
to come to the USA.

I began supercomputing
on June 20, 1974, in Corvallis, Oregon.

How Are Supercomputers Used in Venezuela?

In an email, a fifteen-year-old
writing the biography
of a famous computer scientist
and his contributions
to the development of the computer
asked me:

"How are supercomputers
used in Venezuela?"

The supercomputer market
is valued at
forty-five billion dollars a year.
The energy and geoscience industries
buy one in ten supercomputers,
and use them to pinpoint oil deposits.

The Bolivar Coastal Oil Field of **Venezuela**
contains 32 billion barrels
of recoverable oil reserves.
The Bolivar Coastal Oil Field
stretches **across** thirty-five miles
along the coast of Lake Maracaibo
of **Venezuela**.
Fastest computing that's executed **across** millions of processors
is the key technology that must be used
to pinpoint deposits of crude oil
in the Bolivar Coastal Oil Field.
In 1989, I was in the news
for discovering how
the slowest processors in the world
could be harnessed
as the world's fastest computer.
And used to discover and recover
otherwise elusive crude oil
and natural gas.

Inventing the World's Fastest Computer

On June 20, **1974**, in Corvallis, Oregon,
I began programming
one of the most powerful supercomputers
in the world.

That was when I began my quest
for the fastest computation ever
that could be harnessed
and used to solve
the most difficult problems
in mathematics and physics.

As I grew in my knowledge,
I wanted to invent
my fastest supercomputing
as a new Internet
that's a new global network
of 65,536 processors
which, collectively, is sixty-four binary thousand times faster
than the fastest computer
that's sequentially processing
with one processor.

I discovered the fastest supercomputer
not as a computer, in and of itself,
but as a virtual supercomputer

that's defined **across** a globe

which hosts a new global network
of processors that shared nothing,
but were in dialogue with each other.
I recorded the fastest speeds in computing
without the supercomputer,
as it was then known.

I visualized my new Internet
in the 16th dimensional hyperspace.
And I visualized that globe

to be encircled

by tw**o-raised**-to-power sixteen,
or 65,536, processors
with each processor akin to
a small computer.

I visualized those small computers

to be uniformly distributed **across**
that globe,

or separated equal distances apart.

I could discover but not create

the fastest computation **across**
my new Internet. I can only discover

a faster computation
if and only if that computation preexists

across my new Internet.
And I can only invent

techniques and technologies

that can be invented,
or that the laws of physics
allow me to invent.
The fastest computer,
that yielded a quantum increase in speed, led to the creation
of computational physics.
The fastest computing across
the slowest processors,
that I discovered
on the Fourth of July 1989,
gave birth to extreme-scaled,
high-resolution computational physics.
That discovery
of the world's fastest computing
is my contribution to physics.

I'm well-known,
but I'm not known well.

A teacher asked her students:

"Why is **Philip Emeagwali** famous?"

I'm well-known because
I knew a new arithmetic
that no teacher knew.
Before my discovery
of that new arithmetic which occurred
on the Fourth of July 1989,
teachers could only teach
how to perform
the fastest multiplications and divisions.
And how to execute them
on a computer
that was powered by one processor.
After my discovery of parallel supercomputing,
teachers could now teach
how to solve the most difficult problems
in mathematics.
And solve them at the world's fastest speeds and **across**
the Philip Emeagwali Computer
that's not a computer, in and of itself,
but that's a new Internet, in reality.

Each discovery, or invention, we make

contributes to human civilization.

Our technological quest
for the fastest computations **across**
a new Internet

is our search for human progress.

Turning Science Fiction to Nonfiction

To invent a new computer
is to turn science fiction
to reality.
A science-fiction writer
can be a storyteller who solved
the most difficult problem
in mathematics.
And solved it
by merely waving his pen
and declaring the **impossible-to-solve**
is now **possible-to-solve**.
In contrast, a computational mathematician
can't solve the toughest
initial-boundary value problems
at the frontiers of calculus,
compute-intensive algebra,
or extreme-scale
computational fluid dynamics.
And solve such physics problems
by merely waving his, or her, hand.
As a high-performance
computational mathematician,
I can only discover the discrete solution
to the toughest problem
beyond the frontier of calculus.
And only discover that solution
if and only if such a solution exists
but was not understood.
I can only invent things
which are possible to invent.
A science-fiction writer
can write about cars
that run only on water
but which are **not** possible to invent.
In contrast, a scientist
must develop a prototype
of at least one car that he claims

only runs on water.
It's possible for a science-fiction writer
to write one hundred science-fiction books.
In contrast, it's **impossible**
for a supercomputer scientist
to make two ground-breaking discoveries
in his lifetime.
It's impossible for one inventor
to invent the world's fastest computer
that computes in parallel
and then later invent
the hoped-for quantum supercomputer
which wrangles subatomic particles
to encode information
as quantum bits, or qubits,
that exist in superposition.
The inventions of parallel
and quantum supercomputers
demands radical ideas, billions of dollars,
and decades of hard work.
The parallel and quantum supercomputers
are each paradigm shifting.
And each technology changed how
we look at the computer of tomorrow.

Nature does not give up its secrets
without a fight.

What are my contributions
to the invention of the fastest computers?
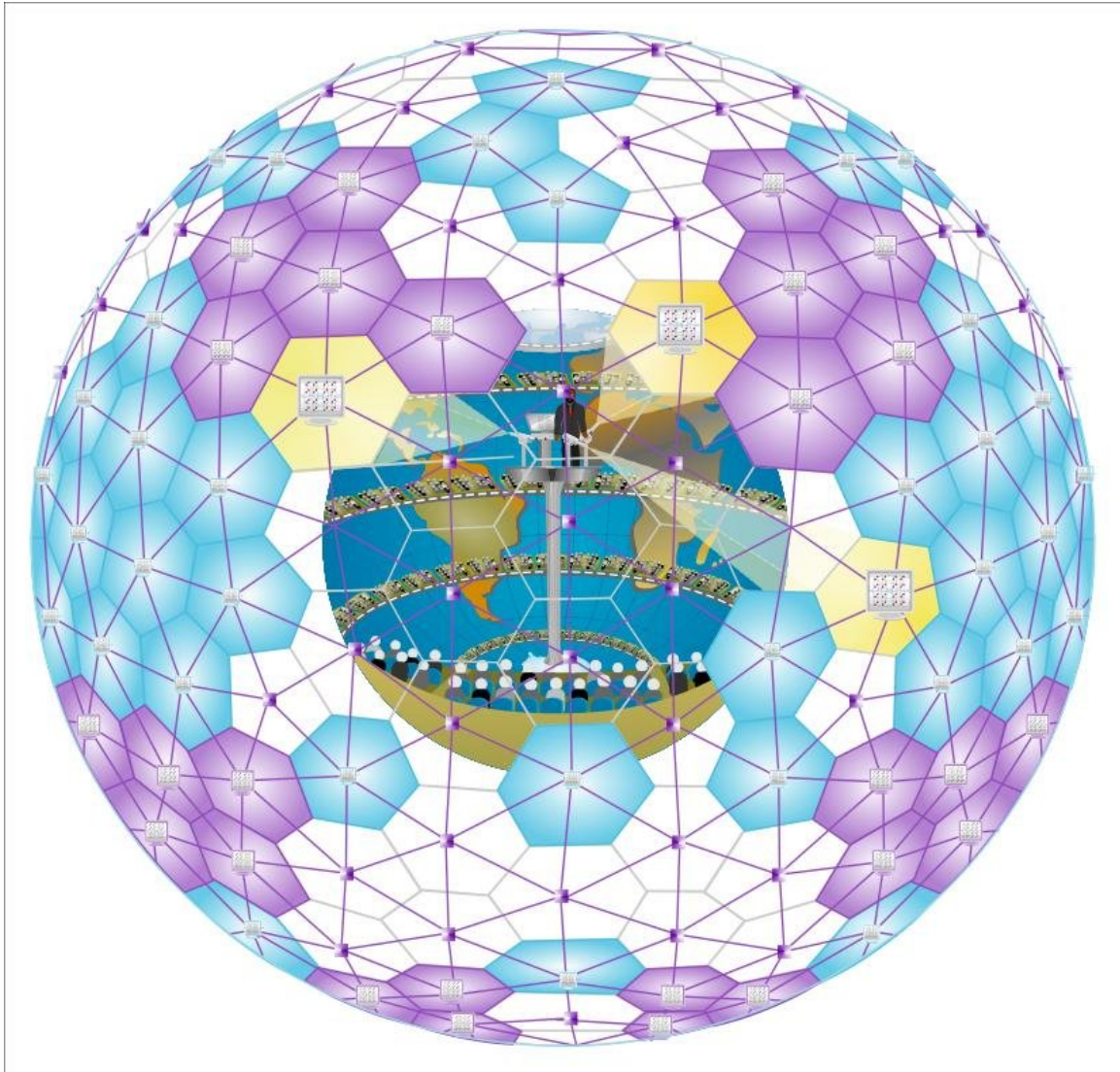
Blueprint of Philip Emeagwali Computer and Internet

"What did Philip **Emeagwali** contribute
to the development of the computer?"

To parallel process
the most difficult problem in mathematics
is to solve many less challenging problems **simultaneously**.
The technique of computing many things
at once
was known to the census board
that used thousands of
human computers to execute billions
of arithmetic computations.
My contribution to computer science
was my discovery that
the world's fastest computer

could be powered by
sixty-four binary thousand processors.
Each processor was akin
to a small computer
that can be used to solve
many compute-intensive problems
and solve them **at once**.
In 1989, my invention of parallel supercomputing
made the news headlines.
And did so because it opened the door
to the use of up to **one billion** processors
to power the world's fastest computer.
I visualized my new Internet
as my new spherical island
of sixty-four binary thousand processors.
Or as a new global network
of as many tiny identical computers.
I visualized that new Internet
as tightly encircling my room-sized globe.
Not only that,
I visualized my new Internet
as two-**raised**-to-power sixteen,
or 65,536, processors
that were identical.
And that were uniformly distributed
around the surface of a globe. Likewise,
I visualized that hypersurface
in a sixteen-dimensional **hyperspace**.
M**y visualization**
of my new Internet
was new.
Therefore, the word "Internet"
wasn't in my vocabulary
in the mid-**1970**s.
I coined the term "HyperBall Computer"
to describe my new global network
of computers and processors
which I theorized.
That HyperBall Computer was renamed as
"Philip Emeagwali Computer."

My theory which I physicalized
as the fastest computer
was my mental re-creation
of a new Internet as a new supercomputer
that was powered by a new global network
of 65,536 processors, each its own master, that shared nothing.

How did I win the Nobel Prize of supercomputing, in 1989?

In **1989**, The Computer Society
of the Institute of Electrical
and Electronics Engineers (or IEEE)
issued a press release that I had achieved
a technological breakthrough.
And did so by discovering
the world's fastest computing **across**
the world's slowest processors.
That IEEE press release
had an impact because
the Institute of Electrical and Electronics Engineers
was the world's largest technical society.
In the May **1990** issue
of the academic journal named "Software,"
The Computer Society of IEEE
described the economic benefits
of my scientific discovery
of fastest computing. And described it as:

[quote]
"The amount of money at stake
is staggering. For example,
you can typically expect to recover
10 percent of a field's oil."

The Computer Society of IEEE continued.

"If you can improve your production schedule to get just 1 percent more oil,
you will increase your yield
by $400 million."
[end of quote]

That **1989** press release
issued by The Computer Society
that announced my
technological breakthrough
and scientific discovery
of the world's fastest computing
and the companion articles
published by The Computer Society
in IEEE publications
led to cover stories
in many trade publications.
And led to front-page stories
that were titled:

"African Supercomputer Genius
Wins Top U.S. Prize."

And that **1989** press release
issued by The Computer Society
led to stories on my contributions
to mathematics, physics,
and computer science.
I discovered that the fastest computer
can be built with the slowest processors.
I discovered
how and why using
a thousand processors
makes modern computers **faster.**
And makes the newest supercomputer
the **fastest**. On July 4, **1989**,
the U.S. Independence Day,
in Los Alamos, New Mexico,
I discovered
the Philip Emeagwali formula
for the world's fastest computing
that later U.S. President
Bill Clinton will describe
in his White House speech
of August 26, 2000.

Fastest Computing Across an Internet

My technological breakthrough
opened the door
to the world's fastest computer
that must be used to solve
the most difficult problems in mathematics.
And solve such problems
at the **fastest** speeds ever recorded.
I visualized my scientific discovery
of the world's fastest calculations
as **occurring** across a new Internet.
Likewise, **I visualized** my new Internet
as defined as a new global network
of 65,536 off-the-shelf processors
and standard parts.
Furthermore. I invented
how to use my new Internet
to send and receive emails.
And do both at the fastest bandwidths
ever recorded. I invented
how to parallel program my new Internet.

359

I visualized that new Internet
as a new global network of
65,536, or sixty-four binary thousand,
tiny identical computers.
I theorized how to harness
those processors.
And use them to communicate **across**
another new global network of
1,048,576, or one binary million,
regular and short email wires
that were equal distances **apart**.
Not only that, I mathematically
and experimentally invented
how to solve sixty-four binary thousand
initial-boundary value problems
that arise beyond the frontier of calculus
and computational physics.
I invented how to solve them **simultaneously.**
And how to email and solve them **across**
a new global network
of sixty-four binary thousand processors
that define my new Internet.
And how to reduce
65,536 days, or 180 years,
of **time-to-solution** within one processor.
And reduce that computation time
to one day of **time-to-solution**
across my new Internet
that's a new global network of
65,536 off-the-shelf processors
that're identical
that shared nothing
and that's a supercomputer, *de facto*.

I'm the only father of the Internet
that invented an Internet.

Why is Philip Emeagwali Famous?

A question asked in school essays is this:

"Why is Philip **Emeagwali** famous?"

Before my discovery,
that occurred on July 4, 1989,
it was believed to be impossible
to achieve the world's fastest computing and do so across
the world's slowest processors.

It made the news headlines
when I **discovered**
that the unimaginable-to-compute
is **possible-to-super-compute**.
However, understanding how I made the unimaginable possible
wasn't what made the news headlines,
in 198**9**.
What made the news headlines
was that I did the then impossible, namely
I discovered how to turn a vague idea,
a mere theory, and a science fiction
that was published on
February 1, **1922** into reality.
That science fiction
was about 64,000 human computers
forecasting the weather
around the globe.
On the Fourth of July **1989**,
I discovered
how sixty-four binary thousand processors that were evenly distributed
around a globe
can be used
to execute a global climate model.
Such high-stake climate models are used
to foresee otherwise unforeseeable
global warming.
I discovered
how to turn that science fiction of **1922**
to the nonfiction of **1989**
that's now known as
the world's fastest computing.
In the traditional way
of manufacturing supercomputers,
one powerful processor
is connected to one memory.
That super-fast processor
executes one instruction **at a time**.

What is Philip Emeagwali Best Known For?

In my alternative way of inventing supercomputers,
I made the news headlines
when I discovered that parallel processing
is up to a billion times faster.
I discovered the world's fastest computing
on the Fourth of July 1989.
I discovered supercomputing
as it's executed today,

361

or how to compute at the fastest speeds,
and do so **across** my ensemble of the
sixty-four binary thousand slowest processors in the world.
I discovered the world's fastest computing
on July 4, 1989.
I discovered parallel processing by dividing
a compute-intensive, discrete,
and algebraic approximation
of an initial-boundary value problem
of calculus and physics, ranging from
a global climate model
to modeling the social distancing
that reduces the spread
of the coronavirus disease
within Nigerian buses
that pack passengers like sardines.
I chopped up
each compute-intensive problem
into lesser challenging problems.
Finally, I assigned one processor
to solve one less compute-intensive mathematical physics problem.
Furthermore, I discovered
the **one-problem-to-one-processor** correspondence
which I used to solve
the sixty-four binary thousand
mathematical problems that, in totality,
are important societal problems.
The list of twenty most compute-intensive,
or grand challenge, problems includes,
detailed climate modeling
that must be executed
with the fastest speed and accuracy.
I discovered how to harness
my sixty-four binary thousand processors
which I used to, *de facto,*
synchronously solve
my two-**raised**-to-power sixteen
initial-boundary value problems
that I solved **at once**.
My invention of how to execute
the fastest computing
can be extended to a billion processors
which encircle an Internet, or a globe.
And did so as one seamless, coherent,
and gigantic supercomputer.

What is Philip Emeagwali Famous For?

362

In 1989, it made the news headlines
that a Nigerian supercomputer genius
in the USA had recorded
the fastest speed
in the history of computing.
And recorded that speed **across**
the slowest processors in the world.
And recorded that speed while solving
the most compute-intensive problems
in the world.

I'm that Nigerian supercomputer scientist
that was in the news.

On the Fourth of July **1989**, I recorded
the highest speedup and the fastest speed
in supercomputing.
That scientific discovery
led to my conclusion
that fastest computing across
a billion processors
will become the technology
that can yield
a factor of one-billion-fold reduction
in the wall-clock times
for solving the most difficult problems
in mathematics and physics.

That includes global climate models
used to foresee
otherwise unforeseeable long-term global warming.
The most powerful supercomputers
are used to solve

some of the world's biggest challenges.

Broadcast 29 August 2021

https://youtu.be/Yc3Mbl1l8Tk

WORLD'S FASTEST COMPUTER

I'm a Nigerian-born computer scientist
who came of age in the USA
of the 1970s and 80s.
In the 1980s,
the most compelling mathematical puzzles and questions
that faced high-performance
computer scientists were these:

"What's the speed limit in computing?

"Or what's the best way
to build the world's fastest computer?"

"Can the world's fastest computer
ever fit in a room?"

"Can the most difficult problems
in mathematics
be solved across
an ensemble of one billion processors
that outline an Internet?"

"How do we invent
a never-before-seen computer?"

"Can a billion processors work together
to emulate a supercomputer?

It's easier to ask these questions
than to provide their answers.
But the world worships any inventor
who can answer the most difficult questions
at the crossroad
where new computational mathematics, new computational physics,
and fastest computing intersect.

A school essay question **is this**:

"What is the contribution
of Philip **Emeagwali**
to the development of the computer?"

I discovered
the world's fastest computing **across**
the world's slowest processors.
And discovered
how to use the fastest computers
to solve the most difficult problems

in mathematics.
I made those discoveries
on the Fourth of July 1989.
My new computer science
opened the door
to the world's fastest computer
that now occupies the footprint
of a football field.
The fastest computer
is powered by millions of processors.
Before my supercomputing discovery,
the idea of the fastest computing **across** the slowest processors
was merely a theory,
or an idea that's not positively true.

My contribution to the development
of the world's fastest computers **is this**:

I discovered that
a billion self-contained processors
that were locked together
can be programmed to emulate
one seamless, coherent machinery
that's a supercomputer, in reality.
My discovery is the origin
of the first supercomputer.

Becoming a famous computer scientist doesn't happen the way you see them
in the movies.
I began supercomputing
on June 20, 1974, in Corvallis, Oregon, USA. In 1974, I was not hailed
as a supercomputer genius.
The reason was that the world
waited for fifteen years
for me to provide the hard evidence
that the world's slowest processors
can power the world's fastest computer.
At 8:15 on the morning of July 4, 1989,
I discovered that
using a billion processors
to power a supercomputer
is useful and doable.

Google

Google suggests the greatest computer scientists of all times. With the number one spot, Philip Emeagwali is the most suggested computer pioneer for school biography reports across the USA, Canada, UK, and Africa (December 8, 2021).

How My Discovery Killed the Vector Supercomputer

School essays on the contributions
of **Philip Emeagwali**
to computer science
highlight the invention
of how to harness the slowest processors
to perform the fastest computing.
That invention is **central**
to the first supercomputer,
as it's known today
and as it's expected to be known tomorrow.
The reason my invention
made the news headlines, in 1989,

367

was because it heralded the end of the era
of vector supercomputers
that was powered by only
one isolated vector processing unit.

Inventing the world's fastest computer
demands programming
millions of processors,
not interacting with thousands of people.
As a Black supercomputer inventor
in the USA of the 1970s and 80s,
I discovered the world's fastest computing and did so alone,
as well as independently of any institution.

A Black Inventor in All-White Spaces

Breaking Stereotypes of Black Men

In the 1970s and 80s, I was a Black inventor that was trapped within all-white spaces.
In the 1970s and in the USA,
the most brilliant sub-Saharan
African scientists
were not allowed to teach, research,
and even present their inventions
to the public.
And compete on the same terms
as white scientists.
I was the first
to perform the world's fastest computing
and do so via parallel processing.
Because I was Black, I was not allowed
to teach, research, and even present
my world's fastest computing
to the public.

In a perverse twist,
as computers become faster,
the more reliant on parallel computing
they become.
And parallel computing became synonymous with computer science.
Parallel computing is ubiquitous
at the frontier of knowledge
of the most difficult problems that arise
in science, engineering, and medicine.
In the early 1980s,
my world's fastest computing
was rejected

368

when I first presented the technology
to universities in the USA.
In the mid-**1980**s,
my theorized fastest computing **across**
a new global network of 65,536 processors was rejected in Ann Arbor.
It was rejected because
a Black inventor invented it.
In 1989, and after I won
the highest award in supercomputing,
I received invitations to give lectures
on the world's fastest computer.
And to give those lectures at a time
I was the only person in the world
that could deliver such lectures.
It should not come as a surprise that
on YouTube,
I delivered the most lectures
on contributions to mathematics, physics,
and computer science.
What surprised me, in 1989,
was that I was often disinvited
from giving lectures
on the world's fastest computing,
even though I was the first
supercomputer scientist
that came to mind
when thinking about how to solve
the most difficult problems in mathematics.
And solve them on the fastest computer
that's powered by millions of processors.
The disparate treatment was this:

A white computer scientist
who could only teach
the old sequential computing paradigm
was hired over
the Black supercomputer scientist
who discovered
the new paradigm of supercomputing **across** a billion processors.

Because of the institutionalized
racial discrimination in the USA,
I became well-known,
but not known well.

Racism is a dangerous cancer of the mind.

Not allowing the Black mathematician
to solve the most difficult problems
in mathematics

slows down human progress.
And does so by excluding geniuses
from contributing to knowledge.
The irony was that
those white supremacists
who disinvited me from giving
research lectures on my contributions
to developing the fastest computers
now complain that
they couldn't understand
the complicated mathematics
and the advanced computer science
that were behind the invention
that I made in the 1970s and 80s.
I described my inventions **across**
the one thousand closed-captioned videos
that I posted on my YouTube channel, named "**Emeagwali**."
I've been supercomputing
since June 20, 1974,
in Corvallis, Oregon, USA.
After half a century of supercomputing,
a huge knowledge gap developed
between those that rejected
my new computer science
and myself.
That knowledge gap manifested itself
in their inability to replicate
my world's fastest computer speeds
of July 4, 1989, in Los Alamos, New Mexico, USA.
That knowledge gap is visible
after watching
the one thousand closed-captioned videos of my lectures
which I shared on YouTube.
And then comparing them
to the videotaped lectures
of the leading minds in mathematics, physics, and computer science.
The misperception of white supremacists
that **Albert Einstein**—who is considered the father of modern physics—
knows more about computational physics
than I do
differed from the reality
that I was the only single person
to ever record
the world's fastest computation.
On YouTube, I said much,
in a thousand videos,
about the first supercomputer,
as it's known today.

And I did so because
I was the first inventor to understand that the new computer becomes
the world's fastest, if and only if,
it's powered by up to
one billion processors.

My Breakthrough That Changed the Way We Look at Computers

In the old way of solving
the most difficult problems in mathematics,
the fastest computation was achieved
by solving one
initial-boundary value problem
of physics.
Such mathematical problems arise
in multi-scale modeling
of biological systems
as well as the large-scale
computational fluid dynamics model
that must be used to foresee
how the coronavirus disease
spreads **across**
the densely-packed Onitsha market,
where social distancing is not enforced.
In the old mathematics textbooks,
only one such problem was solved
at a time and within one processor.
In 1989, I was in the news because
I discovered a new
billion-processor paradigm
that was a faster way
of solving the most difficult problems
in mathematics.
My new mathematics yields
the first world's fastest computing across
the world's slowest processors.
In my new supercomputing paradigm,
I changed how I looked at
the world's fastest computer.
I discovered how to perform
the world's fastest computations
And solve
the most compute-intensive
mathematical problems
in computational physics.
And I invented how to solve them **across**
an ensemble of
a billion coupled processors

that shared nothing.
And solve them millions of times **faster**
than in the conventional paradigm
of solving
one problem **at a time**.
I achieved that mathematical breakthrough
of solving 65,536
initial-boundary value problems
each governed by a system
of partial **differential** equations.
And solving them **simultaneously**
and **across** as many processors
that were evenly distributed **across**
a globe.
The initial-boundary value problem
that's governed by a system of
partial **differential** equations
is the most useful subject in mathematics. But to be useful,
these grand challenge problems
must be solved **across** an ensemble
of up to one billion processors.
I was the first to discover
how to solve partial **differential** equations
and do so across
up to one billion processors.
And solve them
at the world's fastest computing speeds.

That paradigm shift
in high-performance computing,
or change in how
we look at the world's fastest computer,
went against the prevailing dogma.
Prior to my supercomputer discovery
that occurred on July 4, 1989,
computer scientists believed that
it will be **fastest**
to solve only one compute-intensive problem **at a time**, instead of solving
up to one billion problems **at once**.
That supercomputing dogma
of solving one problem **at a time**
and solving it on one powerful processor
was encoded in Amdahl's law.

A New Supercomputer Creates New Sciences

Physics is the king of sciences.
And mathematics is the queen of sciences. Computer science is not a science,

in and of itself.
Computer science is a science of sciences.
The invention
of the world's fastest computing
that works differently
from regular computers
creates new sciences.

In science, it was not enough
for me to say that a billion processors
could be used to solve
the most difficult problems in mathematics. I had to provide the hard
evidence
that my theory was true.
On July 4, 1989,
I experimentally proved my discovery
to be true.
Furthermore, I provided
the complete explanations
of how I made
my supercomputing discovery.
I did so **across** the one thousand videos
that I posted
in my YouTube channel named "**Emeagwali**."
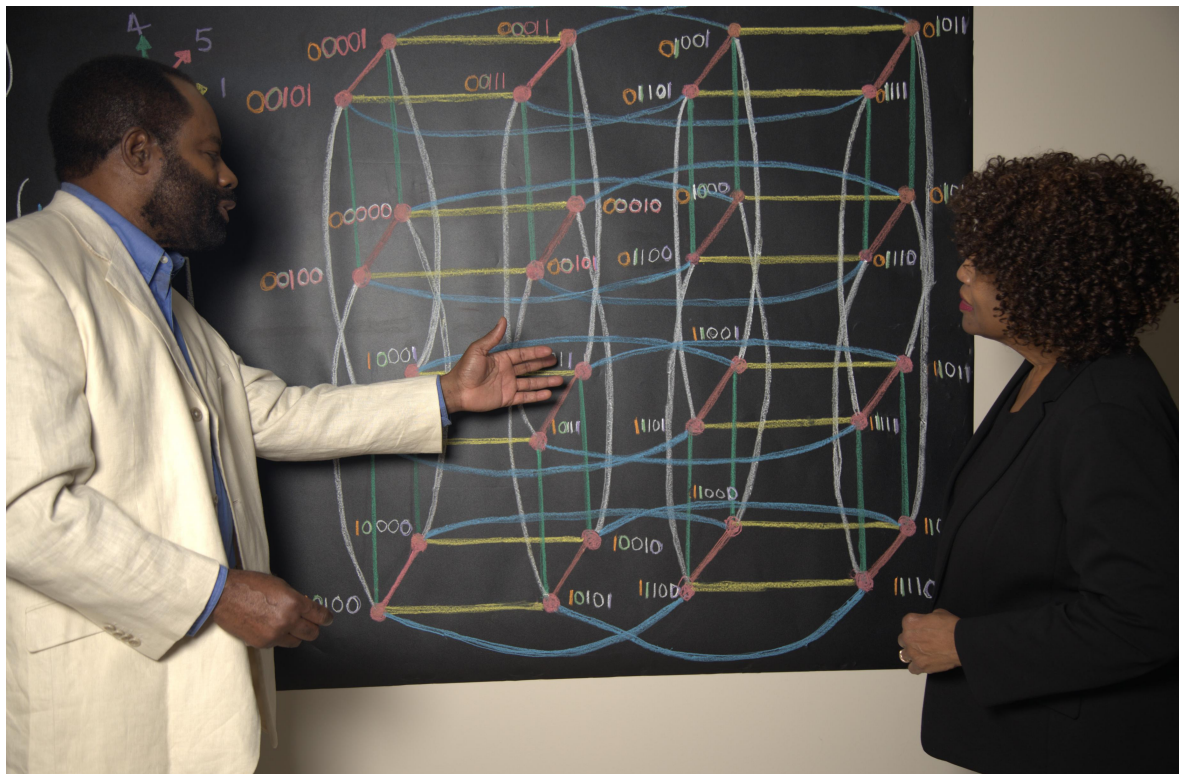
Amdahl's law was to the supercomputer
what Moore's law is to the computer.
And what the second law of motion
is to physics.
Amdahl's law decreed that
a speed increase of a factor of eight
would be impossible to attain
across eight, or more, processors.
I was in the news because
I discovered that
supercomputer textbooks that quoted Amdahl's law were wrong.
I proved computer science textbooks wrong when I discovered
how to use my new global network
of the slowest 65,536 processors
in the world
to execute the fastest computer calculations.
And solve the
most difficult problems that arise
in mathematics, science, and medicine.
The poster girl of difficult problems
in mathematics
was extreme-scale
computational fluid dynamics,
such as high-stake
petroleum reservoir simulations
that must be used to nail down
the exact locations of crude oil
and natural gas
that are buried up to 7.7 miles
(or 12.4 kilometers) deep.
And buried **across** an oil-producing field
that's the size of a town.
I used my 65,536 processors
to perform the arithmetic operations
from the system of equations
of computational linear algebra
from
my finite difference discretizations
of a system of
partial **differential** equations
beyond the frontier of calculus.
I invented
nine partial **differential** equations,
called the **Philip Emeagwali** equations.
And I invented them by encoding
the second law of motion
described in physics textbooks
into them.

374

The **Philip Emeagwali** equations
govern the motions of crude oil
and natural gas
that flow across a highly anisotropic
and heterogeneous producing oil field
that's up to twice the size of the state of
Anambra, Nigeria.
Amdahl's law claims that
an ensemble
of a billion processors
couldn't be harnessed.
And used to solve
initial-boundary value problems
of computational fluid dynamics.
And solve them with the hoped-for
speed increase of a factor of one billion.
I discovered that Amdahl's law
was a false theory, and an enormous lie,
that was spread around
via computer science textbooks.
By its definition,
a theory is not positively true.

Solving the Nine Philip Emeagwali Equations

In the 1980s,
I was the only full-time programmer
of the most massively
parallel supercomputer ever built.
I discovered how to compute
at the fastest speeds.
And compute while solving
the toughest mathematical problems.
And compute **across** a new Internet.
I visualized my new Internet
as a new global network
of 65,536 off-the-shelf processors
and standard parts.

Those processors were identical,
coupled, and equal distances **apart**.
So, I was the first
to understand the new supercomputing
as fastest computing **across**
a million processors.

I'm not a science teacher
of known facts in textbooks.
The one thousand closed-captioned videos

that I shared on **YouTube**
were my first-person accounts
from the unexplored territories
of knowledge.

My lectures were stories about
new partial **differential** equations,
called the nine
Philip **Emeagwali** equations
beyond the frontier of calculus.
Until I discovered them, those equations
had not been written
in any calculus textbook.

My invention was how
the world's fastest computer
can be built
from the world's slowest processors.
My discovery which occurred
on July 4, 1989,
made the news headlines because
it was new knowledge
that changed how
mathematicians solve
their most difficult problems.
Until my discovery,
the fastest computer speed
had not been recorded
by a one-person team.
Or recorded **across**
the slowest processors in the world.
So, my lectures **across**
the one thousand podcasts
and closed-captioned videos
which I posted on YouTube
were first-person stories
from the frontiers of supercomputing.

Philip Emeagwali YouTube Lectures

My lectures were first drafts
of the history of supercomputing
and computational mathematics.
I understood that new supercomputer
as a radical shift that will change how
we look at the modern computer.
That was the reason my invention

of parallel supercomputing
made the news headlines.

That headline was that
a lone African supercomputer genius,
in the USA,
had won the highest award
in supercomputing.
And won it for discovering
how to harness
the sixty-four binary thousand
slowest processors in the world
and for discovering
how to use those processors
to solve the most difficult problems
arising in mathematics and physics.
And solve them
at the fastest speeds in computing.
Because I was the first
to make that supercomputing discovery
my name, **Philip Emeagwali**,
comes up first in **YouTube**
and for search terms like:

"contributions to mathematics, physics,
and computer science."

My contributions to mathematics
were these:

I invented the system of
nine Philip **Emeagwali** equations,
each a partial **differential** equation.
My system of equations
is a new mathematical tool
used to pinpoint the locations
crude oil, injected water,
and natural gas
that flow up to 7.7 miles
underneath the Earth.
And I invented
how to solve the corresponding
initial-boundary value problem.
And solve it **across**
up to a billion processors
that outline and define an Internet.

My new mathematical knowledge
expanded the ever-growing
body of knowledge
that's known as calculus.
It's an absurd **over**simplification
to claim that calculus

377

was co-invented, 330 years ago,
by Isaac Newton
and **Gott**fried **Wil**helm von **Lei**bniz.
This claim is erroneously repeated
in calculus textbooks and by its teachers.
Newton and Leibniz contributed to calculus
but did not invent the subject.
The development of calculus
is the product
of centuries-long evolution.
Recent contributions to calculus
include the nine
partial **differential** equations
that I invented and my discovery
that initial-boundary value problems
governed by a system
of partial **differential** equations
can be solved **across** an Internet
that's a global network
of up to a billion processors.
My contribution to mathematics
was in the top mathematics publications
in the world, including being mentioned
in the July 1990 issue
of the "Notices
of the American Mathematical Society."

A NEW COMPUTER THAT'S A NEW INTERNET

In 1989, I discovered how to solve
the most difficult problems
in mathematics and physics.
I made my discovery
on a new supercomputer
that's powered by
a global network of up to
one billion processors.
My processors outline and define
my new Internet.
The new knowledge that I contributed
to modern science and technology
include nine
partial differential equations.
The Philip Emeagwali equations
were my contributions
to the existing body of
mathematical knowledge.
I was a research physicist
who came of age in the 1970s and 80s
and first won acclaim in 1989.
I discovered
how to use the laws of physics
to gain a deeper and surer
mathematical understanding
of how to model multiphase flows
of crude oil, injected water,
and natural gas
that were flowing up to 7.7 miles deep
and inside a production oil field
that's the size of a town.
Furthermore, I was an inventor
who invented a new supercomputer
that's a new Internet.
Not only that, I forced those three identities
to merge within me
and find a common
but never-before-seen technology.
I visualized my invention
as a high-performance communicating
and computing machinery.
And as a new supercomputer
that's not a new computer, by and in itself,
but that's a new Internet, by definition.

379

I was treated differently
after my invention
of the first supercomputing
across the world's slowest computers.
My invention occurred in Los Alamos,
New Mexico, USA.
And it occurred on the Fourth of July 1989.
After the news headlines
that followed that invention
the stories chased me,
rather than me chasing the stories.
And the hummingbirds
flew towards me,
rather than me running towards
the hummingbirds.

Breaking Racial Barriers at the Frontiers of Science

I began supercomputing
on June 20, 1974,
in Corvallis, Oregon, USA.
In 1974, few Blacks were allowed entry
into supercomputer learning
and research centers.

Twelve years earlier, a Black student,
James Meredith, fought to integrate
the University of Mississippi.
Without access to education,
the likes of James Meredith
cannot become supercomputer scientists.
That was why I never met
a Black supercomputer scientist,
during the 1970s and 80s.
And that was why everyone was shocked
when a Black person
won the highest award
that computer scientists describe as
the Nobel Prize of Supercomputing.
I won that prize alone in 1989.

My invention of the world's
fastest computing
was a record-breaking
and sustained performance.
It was recorded in the June 20, 1990, issue
of *The Wall Street Journal*.
I was in the news
on the day **Nelson Mandela**

was released from prison.
But I was boycotted
in the manner South Africa was boycotted for apartheid.
That boycott was significant because
in schools the bearer of new knowledge,
or scientific discoveries, transmits it
through the spoken word.
A scholar without lectures
on YouTube
is like radio without sound,
or a movie without images.

Those early boycotts
of my lectures of the **1980**s
were the scientific equivalent
of mainstream radio stations
working together
to keep Black music off the air.

In supercomputing of the 1980s,
most of the 25,000 paid positions
were reserved for white males.
I gave hiring lectures
for some of those paid positions.
After each hiring lecture,
the supercomputing position was closed.

When it comes to racial diversity
in American academia, the fields of
mathematics, physics,
and computer science
are half a century behind society others.
The racial diversity
in the supercomputing world
of the **1970**s and **80**s—the two decades during which I came of age—
was like the racial diversity
in U.S. mainstream radio broadcasting
of the **1920**s and **30**s.
In the **1940**s and **50**s,
African-American entertainers
were forced to use a different door
to enter white radio stations.
In the **1970**s and **80**s,
my accesses to supercomputers
were withdrawn after it was discovered
that I was Black and sub-Saharan African.

A school essay question **is this**:

"Who is the father of supercomputing?"

Asking who is the father of supercomputing
is like asking
who is the father of rock 'n' roll.
No one person started rock 'n' roll.
Notwithstanding, if two persons
can claim the title of the
Father of Rock 'n' Roll,
they will be **Little Richard**
and **Chuck Berry**.
Elvis Presley will not be included because
he didn't write his songs.
Elvis Presley brought rock 'n' roll
to a larger audience
and became the face of white rock 'n' roll.
Unlike **Elvis Presley**,
the songs of **Little Richard**
weren't played
on mainstream radio stations.
Instead, the covers of **Little Richard**'s songs
that were recorded by **Pat Boone**
and **The Beatles**—were played on
white radio stations.
And those covers became hit songs.
Fast-forward three decades from the **1950**s,
I discovered that
white scientific communities
weren't ready to hear my new presentations
on fastest computing,
just as mainstream radio stations
didn't play Black music.
And white research scientists
were paid millions of dollars
to falsely claim the credit for inventing
the Philip **Emeagwali** Computer,
which I invented half a century ago.

My Early Years in Supercomputing

When I began supercomputing
on June 20, **1974**,
in Corvallis, Oregon, USA, dividing
the most compute-intensive problems
from large-scale
geophysical fluid dynamics
and dividing such difficult problems
into a billion lesser challenging problems
and then solving those smaller problems **across**
an ensemble

382

of one billion processors
was science fiction.
For those reasons, large-scale
computational physicists
and mathematicians
were frightened and fled from
computing across processors.
The June 14, 1976, issue
of the *Computer World* magazine
summed the difficulty up in an article

that was titled:

quote
"Research in Parallel Processing
Questioned
as a 'Waste of Time.'"
unquote

Earliest Rejections of My Invention of Parallel Supercomputing

Vector supercomputer scientists fled
from parallel computing
because they believed
it would be simply impossible
to harness thousands of processors.
And use them to solve
the most difficult problems
at the frontiers of knowledge
where new mathematics, new physics,
and new computer science intersect.
I was castigated, ostracized, and banished
during my fifteen-year-long quest
for the world's fastest computer.
That quote, unquote "new computer"
wasn't a computer, in and of itself.
It was a new Internet, in reality.
I discovered my new Internet
and new supercomputer within the bowels
of an ensemble
of the 65,536 slowest processors
in the world.
At its core, I defined my
world's fastest computing
as occurring when one billion processors
work together
as one seamless, coherent unit
that can be used
to solve as many problems **simultaneously**.

Such less-challenging problems
arise from
dividing up the most difficult problem
in mathematics
into one billion less difficult problems
that are mapped
with a one-problem to one-processor correspondence.
Each processor operated
its operating system
and had its dedicated memory.
In contrast and in symmetric multiprocessing, several processors
share a single memory.
And share the same operating system.
As a supercomputer scientist,
I came of age in scalar supercomputing
of mid-**1974** in Corvallis, Oregon, USA.
And in the first supercomputing
across the world's slowest computers
that I discovered on July 4, 1989,
in Los Alamos, New Mexico, USA.
In the 19**70**s, parallel computing
was mocked, ridiculed, and dismissed
as a tremendous waste of everybody's time.
It was then believed that
one billion processors
could only yield a maximum speed increase
of a factor of two.
And do so if and only if fifty (50) percent
of the compute-intensive problem
can be solved **simultaneously**.
That parallel-processed speed increase
becomes a factor of four, ten, and twenty
and becomes so
when seventy-five (75) percent,
ninety (90) percent, and ninety-five (95) percent, respectively, of the large-scale
computational fluid dynamics code
could be solved **at once**.

The First Acceptance of My Invention of the World's Fastest Computing

I was in the news, in 1989, because I was the computational mathematician
who discovered
how to unlock Moore's law
for one processor.
And discovered
how to mathematically solve

one billion difficult problems
simultaneously.
And solve them **across**
an ensemble
of one billion processors.

A question in school essays **is this**:

"What is the contribution of
Philip **Emeagwali** to mathematics?"

The first world's fastest computing across
up to one billion processors
that work together to solve
the most difficult problems
is my contribution to mathematics.

My new knowledge
must be used to solve

the biggest challenges
that are governed by
partial **differential** equations.
Such equations occur
at the frontiers of calculus, algebra,
and physics.
For example, a system of coupled, nonlinear
partial **differential** equations
must be solved
to deeply understand
the spread of the coronavirus disease **across** the crowded Onitsha market
of my country of birth, **Nigeria**.
That's my contribution
to large-scale computational mathematics.
The modern calculus will not be useful
without the supercomputer,
or without solving
the most compute-intensive problems in calculus
and solving them **across**
an ensemble
of millions of processors.
The technique of parallel computing
was to a large extent
invented by computational mathematicians
for computational physicists.
After my discovery
that the world's fastest computers
can be built from standard parts,
called processors,

parallel supercomputing
made the vector supercomputer obsolete.
And reduced it
to the technological equivalent
of the **horse** and **carriage**,
that was replaced by
the now obsolete **steam engine**.

I discovered the fastest computing from the slowest processing

The obstacle that I overcame
before I could discover
the first world's fastest computing across
the world's slowest processors
was to become the first to figure out
how to use the slowest processors
in the world.
And use them to solve
the most compute-intensive problems
in the world.
Those were the most difficult
mathematical problems
that must be solved **across**
the millions of processors
that outline and define
the extremely fast supercomputer.
And solve them
at the fastest possible speeds
in the world.
In the supercomputer textbooks
of the **1980**s,
that obstacle was described as
overcoming the bottleneck
called **Amdahl's law**.
In prose, **Amdahl's law** decreed that
when capital "P" number of processors
is used to solve a compute-intensive
initial-boundary value problem of calculus,
such as those in large-scale
computational fluid dynamics,
and if the serial fraction
of that Grand Challenge problem
is lower case "f,"
then the expected increase in supercomputer speed will be
one divided by the sum of
lower case "f"
plus one minus lower case "f"
divided by capital "P."

T he expected increase in parallel-processed speed **across** one billion processors will only be as large as the weakest link will permit.

Naming Emeagwali Supercomputer

Computer scientists often ask
how did I uniquely name
my 65,536 processors
that I harnessed to execute
the world's fastest computing of 1989.
Because I invented new supercomputing,
I had to come up with a new name for it,
and do so for the same reason
a new-born infant
must have a new name.
At various times in the 1980s,
I named it a HyperBall supercomputer.
Then I shortened that name
to a hyper-computer.
It was finally renamed
the quote, unquote
"Philip Emeagwali Supercomputer."

The **Emeagwali** Computer
is a new global network of
millions of processors,
or a small and physically realizable
copy of the Internet
that's not a science fiction.
Such idealized Internets
might not be visible around a globe
but will be intelligible
to the supercomputer scientist.

Parallel Supercomputing is My Contribution to Science

Why the Computer Was Invented

If necessity is the mother of invention,
I say the most compute-intensive problems
in science, engineering,
and medicine necessitated
the pushing of the frontiers of
the fastest computers.
The supercomputer was invented
out of necessity.
And invented by mathematicians

for mathematicians.
The partial **differential** equation
of the mathematical physicist
is the most recurring decimal
in fastest computing.
The quest to use an electronic machinery
to solve the **ordinary** differential equation
of calculus
that governs the trajectories of missiles
was the difficult problem
that motivated the invention
of the first programmable computer.
That computer was created, in 194**6,**
and at the Aberdeen Proving Ground,
that was twenty-six miles
outside Baltimore, Maryland,
the birthplace of my wife, **Dale**.
That all-vacuum tube supercomputer,
of 1946,
used 18,000 vacuum tubes.

Notes from a Black Astronomer

My quest was for the fastest computer
that could be used to solve
the most difficult problems
in mathematics and physics. An example
of such grand challenge problems
include
the initial-boundary value problem
of calculus
that's governed by a system of coupled, nonlinear, and time-dependent
partial differential equations
that's always at the
mathematical physics core
of any computational fluid dynamics code.
In particular and for everyday uses,
a system of
partial differential equations
is at the calculus, algebra,
and physics cores
of the general circulation model
that governs the motions
of the water and air
that enshroud the Earth.
Such partial differential equations
interest astrophysicists because
they also govern the motions
of the fluids that circulate around
distant planets and stars.
I invented Philip Emeagwali Computer
to be used to solve
the most compute-intensive problems
that arise as extreme-scale
computational fluid dynamics modeling.
A poster child
of such Grand Challenge problems
is the general circulation model
within the Earth's concentric atmosphere
that's represented by the domain
of the arising
initial-boundary value problem.
Another poster child
of computational fluid dynamics

is the supercomputer modeling
of the limited air circulation
of contagious viruses.
In particular, the simulation of
a once-in-a-century global pandemic.
And how it spreads
inside the 2,400 train sets
of Spain's Madrid Metro system.
Each train packed passengers like sardines.

The reason I talked about distant planets,
stars, and galaxies
was that I was trained as an astronomer,
in the mid-**1970**s in Corvallis, Oregon, USA.
I received my earliest job offers
as an astronomer, rather than as
a computer scientist or mathematician
or physicist. The reason was that
the U.S. Office of Personnel Management
rated me higher as an astronomer.

Supercomputing Astrophysical and Geophysical Fluid Dynamics

The movements of the eight planets,
around our sun,
obeys the laws of motion of physics.
The ebb and flow of the tides
of the **water** and **air**
that enshroud the Earth
obeys the second law of motion
described in physics textbooks.
That second law of motion
was discovered **330** years ago.
The second law of motion
was discovered in prose.
But it was coded in algebra as **Force** equals **Mass** times **Acceleration**, or
F=ma.

My contributions to calculus **were these**:

I reformulated the iconic formula **F=ma**
into a system of nine coupled, nonlinear,
and time-dependent
partial **differential** equations
that governs subsurface motions

of multiphase flows **across**
a porous medium, such as the 65,000
oil fields around the world
that include the supergiant oil fields
in Venezuela, Kazakhstan, and Russia.
My new system of nine equations
governs the flow of crude oil,
injected water, and natural gas
flowing **across** an oil-producing field
that's up to 7.7 miles
(or 12.4 kilometers) deep
and often the size of Onitsha, **Nigeria**.

My contributions to algebra **were these**:

I discretized
those partial **differential** equations
beyond the frontier of calculus
into partial **difference** equations
beyond the frontier of large-scale algebra.
Furthermore, I reduced
my algebraic formulation
to computer codes.
In 1989, I was in the news because
I recorded the world's fastest computing.
I did so by executing
my 65,536 supercomputer codes **at once**
and **across**
and with a one-to-one correspondence
with my ensemble of 65,536 of processors.

At its physics core, calculus is about
changes and motions
that range from the geophysical motions
of the Earth's liquid outer core
that's very hot, very dense
to the astrophysical motions
of distant stars.
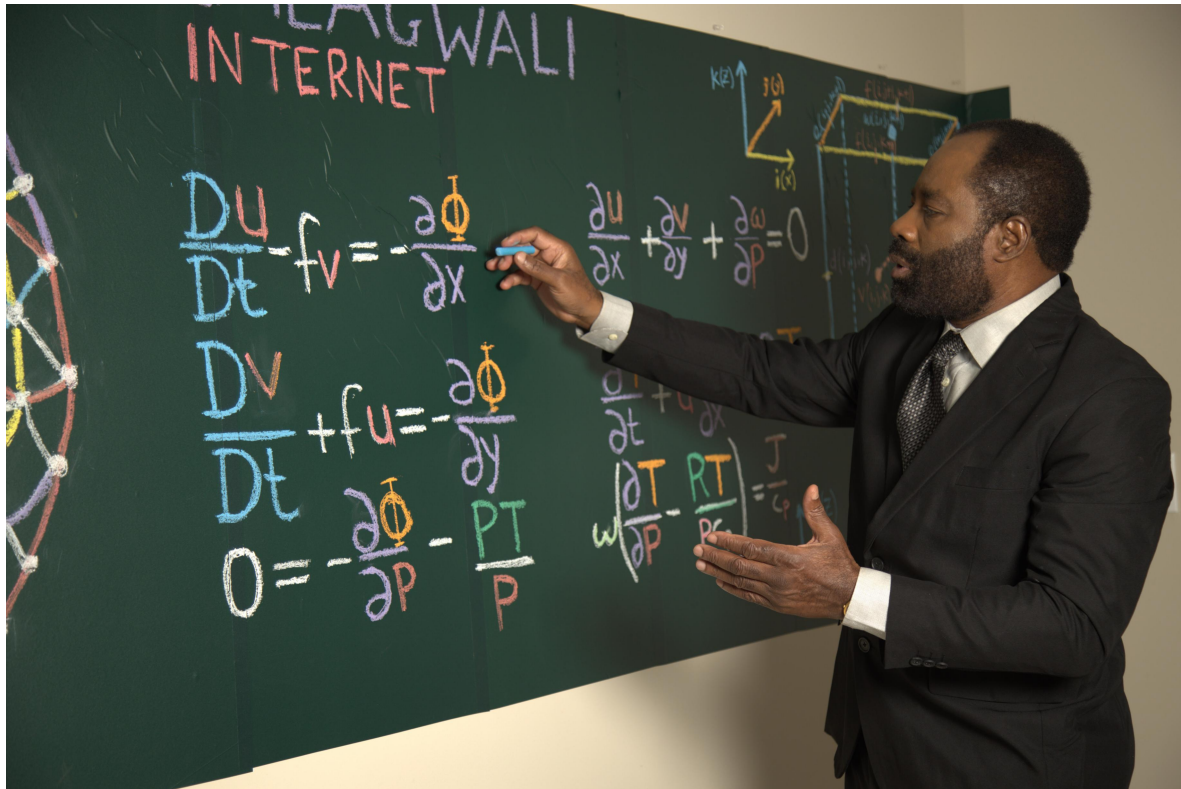
Supercomputing Planetary Fluid Dynamics

My quest was to theorize
my governing system of coupled, nonlinear,
and time-dependent
partial **differential** equations
that encoded
the fundamental laws of fluid dynamics.
I visualized
my computational fluid dynamics codes
not as executing within one processor
but as executing **across** my ensemble
of 65,536 processors.
I theorized each processor
as parallel to each of my 65,536
divided atmospheres
or as many blocks of oil fields.
Those individual atmospheres
completely and tightly enshrouded
my geometric metaphor
for the entire Earth's atmosphere.
My geometric model
was a concentric sphere
that was sixty-two [62] miles thick.
That model had an inner diameter
of seven thousand nine hundred

and eighteen [7,918] miles.
My quest was to discover
how I could harness and use
my sixty-five thousand five hundred and thirty-six [65,536] equidistant
processors
to solve the most difficult problems
in mathematics and physics.
Towards that end,
I visualized my processors
as braided together around a globe.
And used
to solve sixty-four binary thousand
equally compute-intensive problems.
And used to solve them
with a one-processor to one-problem
mapping and correspondence
that preserved closest-neighbor proximities which, in turn,
was the mathematical precondition
to my recording
the world's fastest computing.

My Contributions to Physics

In the early **1980**s,
my grand challenge was to invent
the techniques and technologies
to be used to solve
initial-boundary value problems.
And solve them with up to
one billion processors.
And with a speed increase of one billion.
My contribution
to the mathematical solution
of such compute-intensive
physics problems
was the cover story
of the flagship publications
of top mathematics societies,
including the May 1990 issue
of the *SIAM News*
that is published by
the Society for Industrial
and Applied Mathematics.
My record-breaking sustained performance in computing
was mentioned in the June 20, 1990, issue
of *The Wall Street Journal*.
My contribution to mathematics
was that I turned

that mathematical fiction
—of the fastest computing **across**
the slowest processors—
into a non-fiction.
That world's fastest computing
is the new knowledge that I discovered
that was used to **upgrade**
the parallel computer
to the stature of a supercomputer.
The world's fastest computer of today
became a nonfiction after my discovery
that occurred at fifteen minutes after 8 o'clock on the morning
of July 4, 1989, in Los Alamos, New Mexico, USA.

A World Stripped of Computational Fluid Dynamics

Honored members of the Award Committee, esteemed colleagues, cherished guests, and enthusiastic advocates of science and knowledge who join us from far and wide, I am Philip Emeagwali.

I was in the news because I discovered how to solve the most compute-intensive mathematical problems, such as initial-boundary value problems governed by a system of partial differential equations arising in computational fluid dynamics. I discovered how to solve partial differential equations across a new Internet that's a new global network of up to a billion processors.

Such equations contextualized and encoded some of the most important laws in computational fluid dynamics. Such equations capture in a few succinct terms some of the most ubiquitous features of the air and water flowing across the surface of the Earth, including the atmosphere and oceans, and the crude oil, injected water, and natural gas flowing across highly anisotropic and heterogeneous producing oil fields that are up to 7.7 miles (or 12.4 kilometers) below the surface of the Earth. An oil field is about the size of a town.

Today, with a heart filled with the joy of discovery and a mind ever-curious, I invite you to ponder with me a world devoid of the intellectual treasure that is computational fluid dynamics, or CFD.

In the intricate ballet of numbers and equations, where mathematics whirls and dances with the grace and precision bestowed upon it by the minds of countless scholars, computational fluid dynamics occupies a place of honor and reverence. It is the invisible ink with which we scribe the stories of fluid movements, the subtle, eloquent language that whispers the tales of air currents, ocean waves, and the silent flow of blood through the arteries of living beings.

Now, let us momentarily step into a parallel reality, a canvas painted with the brushstrokes of imagination, where CFD does not grace our intellectual arsenal. This world, my esteemed audience, is one of muted understanding, a realm where the vibrant, pulsating heart of fluid dynamics beats unheard, its rhythm lost in the void of the unknown.

Without computational fluid dynamics, aerospace would lose its sight, navigating blindly through the intricate maze of air currents and pressures. The majestic flight of airplanes, the ascent of rockets piercing through the atmosphere, would be ventures steeped in uncertainty, bereft of the guiding light provided by precise calculations and simulations.

The domains of meteorology and climate science would find themselves ensnared in chains of limitation. Without the insightful eye of CFD, the swirling dance of atmospheric elements would remain obscured, the predictions of weather patterns rendered vague sketches rather than finely detailed portraits of meteorological behavior.

In the hallowed halls of medicine and biology, the absence of computational fluid dynamics would cast a shadow over our understanding of cardiovascular dynamics, the ebb and flow of the life-sustaining rivers within us that carry the essence of existence through the valleys and mountains of the human anatomy.

However, as we acknowledge the irreplaceable value of CFD, let us also pause and reflect upon our stewardship of this precious knowledge. For with the lamp of computational fluid dynamics illuminating our path, we bear a solemn responsibility to tread carefully, wisely, with eyes open to not only the wonders of discovery but also the ethical considerations and implications that accompany our journey.

In the silent, number-laden chambers of computational analysis, let our work resonate with the symphony of respect for nature, empathy for humanity, and a deep commitment to using our understanding for the betterment of society, the environment, and the world at large.

Dear friends and companions in this odyssey of knowledge, as we envision a world without computational fluid dynamics, let it not be a scenario of despair but rather a canvas of opportunity, a reminder of the tremendous strides we have taken and the mountains we have yet to climb in our perpetual pursuit of understanding.

With hearts aflame with curiosity and minds sharpened by the whetstone of inquiry, let us continue to delve into the depths of fluid dynamics, guided by the starlight of computational fluid dynamics, ever onward, ever upward, towards the pinnacle of comprehension and mastery.

I thank you, profoundly and sincerely, for sharing this moment of reflection and aspiration with me, as we stand united in our quest, gazing into the horizon where the sun of knowledge rises, bathing us all in its resplendent, illuminating glow.

Thank you.

WHEN THE WEATHER KEEPS ITS SECRETS

A World Without Forecasting

Honorable members of the Award Committee, distinguished scholars, esteemed guests from various corners of the globe, and dear friends committed to the rigorous pursuit of understanding, I speak before you as Philip Emeagwali.

I am here because of a breakthrough scientific discovery that I made on July 4, 1989, in Los Alamos, New Mexico, USA, namely, that a million processors—that are interconnected yet autonomous—could be harnessed to solve Grand Challenge problems, such as weather forecasting.

I was in the news because I discovered that initial-boundary value problems governed by partial differential equations that encoded some laws of physics—such as large-scale computational physics—could be solved across up to a billion processors that are communicating and computing harmoniously.

My breakthrough—of the first world's fastest computing via massively parallel processing—provided the first understanding and insight of how to solve the 20 grand challenges of computing.

In the spirit of intellectual inquiry and reflective consideration, allow me to guide you on an introspective journey, imagining a world that is starkly devoid of the sophistication and foresight provided by weather forecast models.

Weather forecast models are not merely abstract constructs or computational exercises; rather, they are the tapestry of human curiosity, precision, and a deep longing to understand and anticipate the whims and wills of the atmosphere enveloping our shared home, Earth.

Envision a world where the skies speak in tongues unknown, where the wind's direction, the impending rain, the looming storm, or the grace of sunshine remain elusive, unpredictable, and beyond our grasp of understanding until the very moment they choose to reveal themselves.

In the absence of weather forecast models, humanity would find itself in a delicate dance with nature, a dance devoid of rhythm or predictability. The farmer would gaze upon the skies with hope but without certainty, sowing seeds with prayers whispered for timely rains and merciful weather. The

sailor would cast the net upon the waters, venturing into the blue expanse with eyes scanning the horizon for signs, yet devoid of the assurance provided by precise forecasts.

A world without the lighthouse of weather forecast models would see economies grappling with the unknown, planning with variables undefined, and confronting the challenges posed by weather with reactive stances rather than proactive strategies. From aviation to agriculture, from emergency planning to energy management, every facet of our societal functioning that intertwines with the threads of weather would experience the shadows of uncertainty and unpredictability.

But as we imagine this world, let us also use this canvas of speculation to reflect upon our collective responsibility. The power wielded through weather forecast models necessitates a commitment to use this knowledge judiciously, ethically, and with a steadfast focus on safeguarding lives, livelihoods, and the delicate balance of our environment.

In a world blessed with the ability to peer into the future's atmospheric canvas, even if just slightly, let us not take for granted the gift of foresight provided by weather forecast models. Instead, let it be a reminder, a call to action, to use this gift wisely, for the welfare of all, for the stewardship of our planet, and for the harmonious coexistence with the natural forces that shape our days and our seasons.

Dear friends, as we contemplate a world without weather forecast models, let it be a meditation that illuminates our path forward, highlighting not just the technical marvels but also the ethical imperatives and the sense of duty that accompany our technological advancements.

I express my gratitude for your attentive minds and open hearts as we navigate through these reflections together. May our understanding of the atmosphere continue to deepen, and may our use of this knowledge always be guided by wisdom, empathy, and a commitment to the greater good.

Thank you.

An Earth Without General Circulation Models

Honorable members of the Award Committee, distinguished scholars, esteemed guests, and participants from across the corners of our vibrant globe, I greet you with deep humility and gratitude as Philip Emeagwali.

Today, we convene under the auspices of wisdom, exploration, and foresight to ponder upon a scenario both intriguing and daunting—a world bereft of the sagacious instruments known as general circulation models (GCMs) executed on one of the world's fastest computers.

On July 4, 1989, I became the first to discover how to solve initial-boundary value problems governed by partial differential equations. General circulation models used to foresee otherwise unforeseeable long-term global warming is one such initial-boundary value problem. The system of partial differential equations governing geophysical fluid dynamics are the most ones in mathematics and physics.

In 1989, I was in the news for being the first first mathematician to solve both the primitive equations of meteorology and the shallow water equations of oceanography that were at the mathematical core of general circulation models. Both systems of partial differential equations were solved across 65,536 processors that were coupled yet sharing nothing.

Parallel general circulation models, my esteemed colleagues, are not mere intricate configurations of algorithms, communications, and computations. They embody humanity's audacious attempt to converse with the atmosphere, oceans, and the very elements that breathe life into the tapestry of our planet. These models are the lenses through which we discern the symphony of climatic patterns, witness the dance of atmospheric currents, and foresee the oscillations of weather and climate.

Imagine a world wherein the canvas of parallel GCMs does not exist. Within this realm, our understanding of the climate is blurred, akin to navigating the expansive ocean without a compass, discerning the sky without a telescope, interpreting the melody of life without a nuanced ear for music.

Without general circulation models executed across up to 42 million processors that are computing harmoniously, our ability to predict, comprehend, and prepare for climatic events would be severely curtailed. The invaluable foresight offered by these models, which illuminates the path of hurricanes, deciphers the rhythm of monsoons, and unravels the mysteries of climate change, would be lost in the abyss of uncertainty. Our

proactive responses, whether in agriculture, disaster preparedness, or environmental conservation, would lack the precision and timeliness that are imperative in our dynamic world.

In this hypothetical landscape void of GCMs, the whisperings of the atmosphere remain cryptic, the murmurings of the ocean are lost in translation, and the predictions of climate change are clouded in vagueness and ambiguity. We would be rendered, in many ways, spectators rather than informed actors in the unfolding drama of Earth's climatic theatre.

However, as we reflect on the invaluable contributions of parallel general circulation models, it is incumbent upon us to wield the knowledge and foresight they provide with a deep sense of responsibility and stewardship. Each prediction, each simulation, and each model beckons us to act judiciously, sustainably, and with a vision that encompasses the well-being of all inhabitants of our shared Earth.

In envisaging a world without parallel general circulation models, let us also reaffirm our commitment to utilizing these powerful tools with wisdom, integrity, and a relentless pursuit of creating a harmonious balance between humanity and the environment.

Dear friends and colleagues, as we stand at the confluence of knowledge and action, let our contemplation of a world without GCMs rekindle our dedication to science, our responsibility towards the environment, and our pledge to foster a future that is resilient, sustainable, and flourishing for all.

With a heart brimming with gratitude and eyes fixed on the horizon of possibilities, I thank you for embarking on this intellectual journey with me today. Together, let's continue to explore, understand, and act for the betterment of our world and the generations to come.

Thank you.
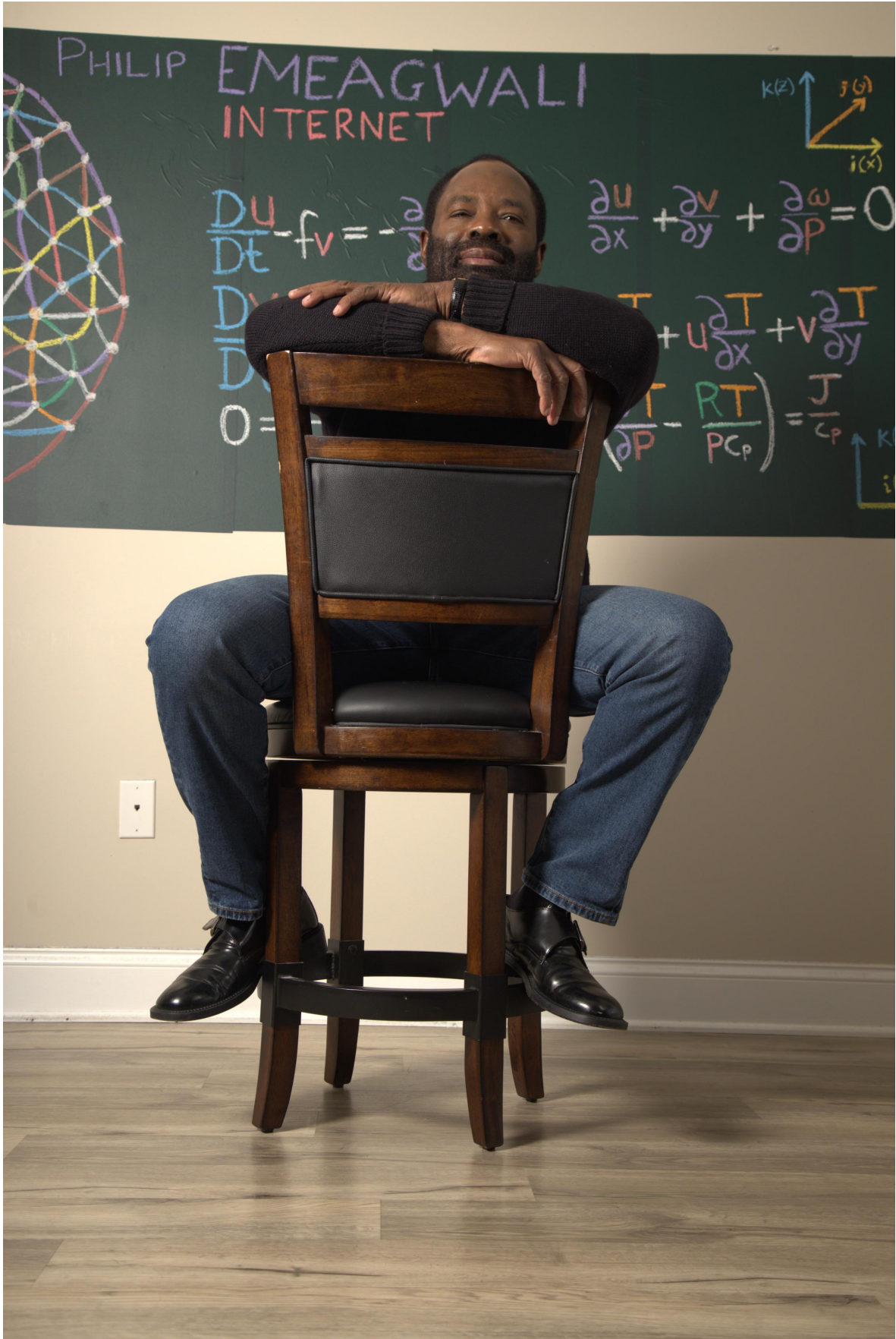
DRILLING IN THE DARK

Petroleum Extraction without Simulation

Distinguished members of the Award Committee, esteemed colleagues, cherished guests, and viewers from all corners of the globe,

I, Philip Emeagwali, stand before you with humility, bearing a discourse that invites you to navigate through an imagined landscape—a world without petroleum reservoir simulation on one of the world's fastest computers. I invented the nine Philip Emeagwali equations for petroleum reservoir simulation. And I did so from scratch, or first principles, called the Second Law of Motion of physics. My system of nine coupled, nonlinear, and time-dependent partial differential equations governs initial-boundary value problems that must be used to model the subterranean motions of crude oil, injected water, and natural gas flowing up to 7.7 miles (or 12.4 kilometers) deep. And flowing below the surface of the Earth and within an oil-producing field that's often the size of Ibadan (Nigeria).

Petroleum reservoir simulation is not merely a subset of our technological vernacular, an artifact of engineering dialect. It is, in the grand tapestry of human progress, a vital thread, weaving through the fabric of energy, industry, and indeed, the very lifeblood of modern civilization.

Let's contemplate, for a moment, a world silent of the whispered predictions and subtle insights offered by petroleum reservoir simulation. This discipline, nuanced and delicate, yet immensely powerful, casts a light upon the subterranean depths of our Earth, illuminating the hidden reservoirs of black gold that have fueled the engines of progress, development, and prosperity.

In a reality bereft of this pivotal technology, our approach to extracting petroleum would be somewhat blindfolded, grasping in the geological dark without the guiding hand of mathematical modeling and computational prowess. The optimization of production from these reservoirs would be at best inefficient, and at worst, environmentally detrimental.

Without petroleum reservoir simulation, each well drilled would be a gamble, a venture steeped in uncertainty and fraught with economic risk. The fine balance of extraction, a dance between maximizing yield and minimizing impact, would lose its choreographer, rendering the process cumbersome and inherently unsustainable.

Beyond the immediate sphere of petroleum extraction, the ripple effects of a world without reservoir simulation would cascade through the pillars of our global economy. Energy markets would navigate through the fog without a compass, while the industries that rely on stable and predictable

energy supplies would find their foundations oscillating with the unpredictability inherent in blind extraction.

But allow me to beckon your thoughts towards a horizon broader than the mere technological implications. As stewards of this planet, as custodians of its wealth and guardians of its future, we are bound by responsibility, ethics, and vision. Petroleum reservoir simulation is not an end; it is a means to ensure that our utilization of Earth's bounty is conducted with precision, care, and foresight.

In envisioning a world without parallel petroleum reservoir simulation, we inadvertently illuminate the invaluable role it plays in the nexus of technology, economy, and environment. Like the silent currents beneath the ocean, it shapes the contours of our energy landscape, quietly but indomitably steering the ship of civilization through the channels of sustainable progress.

Esteemed assembly, let us acknowledge and celebrate the silent symphony of petroleum reservoir simulation across millions of CPUs and GPUs that are coupled yet sharing nothing. It is an anthem of progress, a ballad of responsibility, and indeed, a sonnet to the future. As we peer into the abyss of possibility, let's wield this tool with wisdom, integrity, and an undying commitment to the betterment of humanity and the preservation of our blue planet.

With deep gratitude and respect, I thank you for your attention and invite you to join in the chorus of understanding, innovation, and stewardship that defines our era and outlines the silhouette of the future.

Thank you.

A World Without Partial Differential Equations

Distinguished guests, venerable scholars, esteemed colleagues, and dear friends convened under the august banner of intellectual pursuit: I am Philip Emeagwali, standing humbly before you to reflect upon a scenario both abstract and profoundly significant—a world devoid of partial differential equations.

My journey was to the *terra incognita* of mathematical knowledge where I became the first to figure out how to solve never-before-solved problems with unknown solutions that are beyond the mathematics textbook. Such Grand Challenge problems exist beyond the mathematician's blackboard. Such troublesome problems were formulated for physical domains up to 7.7 miles (or 12.4 kilometers) beneath the surface of the Earth. A Grand Challenge problem is in contrast to mathematical problems formulated only for the mathematician's textbook and blackboard.

Partial differential equations, or PDEs as they are succinctly known, are not merely mathematical constructs, sterile and impersonal. Instead, envision them as the unseen, unsung architects of understanding, crafting the edifices of knowledge and comprehension that house our collective wisdom.

In contemplating a world without partial differential equations, we endeavor to glimpse into an alternate reality, where the harmonic dance between quantities and their rates of change has not been articulated, a silent symphony waiting for its notes to be scribed.

In this universe untouched by the grace of PDEs, the myriad phenomena that unfold their wings across the tapestry of existence remain elusive, their patterns and rhythms obscured by the mist of the unknown. Fluid dynamics, the whispering language of air and water, would lose its grammar and syntax, rendering us mute observers to the ballet of currents and streams without comprehension of their subtle, intricate movements.

Electromagnetism, that invisible hand sculpting the trajectories of charged particles, would unfold its narrative without the guiding light of Maxwell's equations, leaving us navigating the terrain of forces and fields with maps rendered incomplete and faint in the absence of PDEs.

Heat conduction, that silent, persistent traveler through matter, would traverse through the lattice of atoms and molecules without our discerning gaze following its journey, absent the diffusion equation to illuminate its path with the torchlight of understanding.

The narrative of quantum mechanics, the tale spun at the subatomic loom, would be a saga told in whispers and fragments, its quantum waves and particles flowing through the probabilistic realms without the guiding equations charting their course through the probabilistic seas.

And, in the sacred sphere of life sciences, PDEs unfurl their wings gently and resolutely, providing insights into biological processes and physiological phenomena, casting their mathematical net to capture the dynamics of life's ebb and flow with precision and delicacy.

In the absence of these mathematical beacons, our endeavor to decipher the cosmos and its myriad residents would be akin to a symphony orchestra attempting to weave its auditory magic without a conductor, the musicians left with their instruments but absent the guiding hand leading them through the mazes of melody and harmony.

However, let it be known that while PDEs are instrumental, they are not sovereign. They are threads in the grand tapestry, important yet reliant upon the weaver's hand—the human mind. In their absence, the tapestry would undoubtedly lose some of its intricate beauty and complexity, yet the canvas would still bear the imprint of our curiosity, determination, and ingenuity.

Dear friends, as we reflect upon a world without partial differential equations, let it serve as a poignant reminder of the silent, steadfast allies

we have in these equations, guiding us, enlightening us, and walking beside us as we traverse the undulating landscapes of discovery and understanding.

Our journey is far from complete, and the horizon beckons with promises untold and mysteries unveiled. With PDEs in our mathematical arsenal, let us continue to explore, to learn, and to marvel at the unfolding panorama of knowledge and wisdom, for in their light, we see the light.

I thank you for your attention, your passion for knowledge, and your commitment to the pursuit of understanding that binds us all in the sacred covenant of scholarship and discovery.

PARALLEL PROCESSING AS A LIGHTHOUSE

Guiding Humanity to Uncharted Horizons

Esteemed laureates, distinguished members of the Award Committee, revered guests, fellow pursuers of knowledge, and esteemed audience from corners near and far of our interconnected globe—I address you today as Philip Emeagwali.

Once upon a time, before the Fourth of July 1989, to be exact, the fastest one thousand supercomputers in the world computed with only one custom-manufactured, super-fast vector processor. Before the Fourth of July 1989, parallel supercomputing was mocked and ridiculed as a beautiful theory that lacked experimental confirmation.

On the Fourth of July 1989, in Los Alamos, New Mexico, USA, I discovered practical parallel supercomputing. And discovered the technology by harnessing the slowest processors in the world. And using them to solve the most compute-intensive problems in the world. And solve those problems at the fastest speeds in the world.

That invention was newsworthy because I discovered a paradigm shift of tectonic proportions that was a huge change in how we look at the computer and the supercomputer.

Let us, for a contemplative moment, immerse ourselves in a theoretical space, an intellectual experiment—envisioning a world devoid of the conceptual and practical marvel known as parallel processing.

Parallel processing, dear audience, is not a mere technical term relegated to the esoteric domains of computer science and computational engineering. It is, indeed, a beacon of light illuminating the pathway to unsurpassed computational possibilities, a silent engine driving the train of progress swiftly and efficiently across the expansive terrains of scientific inquiry and technological innovation.

In a scenario where parallel processing is absent, subtracted from the equation of our technological reality, we would find ourselves ensnared in the tight grasp of limited computational power. Each scientific endeavor, every attempt to simulate, model, or calculate would be subjected to the stringent constraints of time and resources, slowing the march of progress to a laborious crawl.

Without the symphony of parallel processing, each processor would work in isolated solemnity, devoid of the harmonious collaboration that we witness today. The grand problems of science, the enigmatic questions posed by the universe, the urgent crises facing our beloved planet—these would all become mountains too steep to climb, mazes too intricate to

navigate without the collective might of processors working in tandem, in sublime synchronicity.

Imagine, esteemed colleagues, a medical field constrained by the shackles of sequential processing. The miraculous ventures into genomics, proteomics, and personalized medicine would lose their momentum, becoming entangled in the web of prolonged waiting times and diminished efficiency. The vibrant pulse of life-saving research would weaken, dampened by the absence of the powerful heartbeat of parallel processing.

Consider, for a moment, our attempts to decipher the cryptic yet enchanting language of climate dynamics without the aid of parallel processing. The finely-tuned models, the accurate predictions, the invaluable insights—all would become distant dreams, elusive and faint like the morning mist, disappearing with the advent of the computational dawn that parallel processing has ushered in.

Dear assembled, parallel processing is not merely a technological achievement; it is a philosophical stance, an acknowledgment of the power of unity, collaboration, and synchronized effort. It is the embodiment of the proverb that in unity, there is undeniable strength. It mirrors our collective human endeavor, where each contribution, however seemingly insignificant, weaves into the majestic tapestry of progress and understanding.

A world without parallel processing is akin to a magnificent orchestra where each musician plays in isolation, unaware and unresponsive to the fellow artists' musical strains. The resulting symphony, rather than being a cascade of harmonious melodies, would be a disjointed cacophony, lacking the fluidity and grace that collaboration inherently brings.

As we reflect upon this hypothetical world without parallel processing, let it be a poignant reminder, a clarion call, for the indomitable spirit of collective endeavor, the relentless pursuit of knowledge, and the unyielding commitment to pushing the boundaries of what is deemed possible.

Let us celebrate parallel processing not as a mere technical triumph but as a lighthouse guiding us towards shores unexplored, territories unmapped, and horizons unseen. With gratitude and humility, we embrace this marvel, pledging to wield it with wisdom, responsibility, and a vision that seeks the betterment of all humanity.

I thank you.

PICTURING A WORLD WITHOUT SUPERCOMPUTERS

Dear esteemed guests, ladies and gentlemen,

I stand before you as Philip Emeagwali, humbled and greatly honored, to reflect on a prospect that may seem paradoxical given my lifelong endeavors: a world without supercomputers. Such an imagination exercises both intellect and emotion, straddling the precipice between unprecedented challenges and immense untapped potentials.

Supercomputers, as we know them, are the towering titans of computation, unspooling the threads of complexity that entangle our universe. From forecasting the capricious dance of weather patterns to unraveling the cryptic spirals of DNA, these behemoths breathe life into the abstract tapestry of numbers and equations, rendering the unseen seen and the unknown known.

On the Fourth of July 1989 and in Los Alamos, New Mexico, USA, I confirmed parallel supercomputing to be faster than the fastest sequential computing. That contribution to computer science is the reason I won an award, in 1989, that is referred to as the Nobel Prize of Supercomputing. My milestone in the history of the computer was marked as the first time the fastest speed in supercomputing was recorded across the slowest processors in the world.

Let us entertain, if only for a moment, a canvas unpainted by the strokes of these electronic marvels. A world without supercomputers would not merely be a tabula rasa but rather a parchment inscribed with the ink of human endeavor, resilience, and ingenuity.

In such a world, the veil of mystery would enshroud our scientific understanding, casting long shadows where once the sunlight of knowledge danced unfettered. The dance of molecules and the symphony of stars would remain clandestine, whispered through the corridors of nature, yet unheard by the keen ears of human curiosity.

Nevertheless, esteemed audience, this world would not be barren; it would be fertile with possibilities, irrigated by the streams of collaborative human intellect. Without the crutch of supercomputing, we would rediscover the invaluable treasure of intuition, the compass of reason, and the maps drawn by the painstaking hands of observation and experiment.

This tableau of a world bereft of electronic computation would witness the rekindling of an alliance between human beings and the natural world, a symphonic partnership echoing through the epochs. We would rely, perhaps more profoundly, on the tales told by the ancients, on the wisdom distilled through generations and the mirror of philosophy reflecting the cosmos in its silvery sheen.

In this alternative reality, the symphony of progress would play in a different key, with instruments tuned to the subtle frequencies of human endeavor and natural wonders. The absence of supercomputers would not signify the lack but rather a redirection, a realignment of the compass pointing towards the true North Star of understanding and wisdom.

However, as we stand at the crossroads of history, with the digital horizon unfolding before us like an endless tapestry, let us not yearn for what could have been but rather envision what could be. The marriage between supercomputing and human intellect can usher in an era unparalleled in its promise and potential, where the conundrum of nature unravels, and the dawn of understanding breaks the night of ignorance.

Therefore, ladies and gentlemen, while it is tantalizing to wander through the meadows of a world without supercomputers, let us return, with renewed vigor and insatiable curiosity, to the world where they exist, recognizing and respecting their indispensable role yet never relinquishing our human essence, the eternal flame flickering in the winds of progress.

Thank you.

1. What were the most compelling mathematical puzzles and questions faced by computer scientists in the 1980s?
2. How did Philip Emeagwali contribute to the development of the computer?
3. What was Philip Emeagwali's discovery regarding the speed and power of supercomputers?
4. How did Philip Emeagwali challenge and change the prevailing beliefs about parallel computing?
5. What obstacles did Philip Emeagwali overcome in his quest to discover the world's fastest computing?
6. How did Philip Emeagwali's discoveries impact the fields of mathematics, physics, and computer science?
7. Why was Philip Emeagwali's invention considered a paradigm shift in high-performance computing?
8. How did racial discrimination affect Philip Emeagwali's career as a computer scientist?
9. What were some of the early rejections and skepticism faced by Philip Emeagwali in regards to his supercomputing discoveries?
10. How did Philip Emeagwali's background and experiences as a Black inventor in the USA influence his journey in supercomputing?
11. What role did Philip Emeagwali play in breaking racial barriers at the frontiers of science?
12. How did Philip Emeagwali's discoveries challenge established theories and laws in computer science, such as Amdahl's Law?
13. How did Philip Emeagwali's new mathematical knowledge expand the field of calculus?
14. What were the contributions of Philip Emeagwali to large-scale computational mathematics?
15. What impact did Philip Emeagwali's discoveries have on the development of supercomputing and the field of computer science as a whole?

1. How did Philip Emeagwali come up with a unique name for his supercomputer? Why was it necessary to have a new name?
2. Why was the invention of the supercomputer considered a necessity? How did mathematicians contribute to its development?
3. What are some examples of grand challenge problems that can be solved using supercomputers? How does the Philip Emeagwali Computer contribute to solving these problems?
4. How did Philip Emeagwali's background as an astronomer influence his approach to supercomputing? How did he apply principles from astronomy to his work?
5. What were Philip Emeagwali's contributions to calculus and algebra in the context of supercomputing? How did he translate mathematical formulations into computer codes to achieve record-breaking computing speeds?

Philip Emeagwali

1. What were some of Philip Emeagwali's most significant contributions to the field of supercomputing?
2. How did Philip Emeagwali's background and experiences shape his journey as a mathematician and computer scientist?
3. What were the challenges Philip Emeagwali faced as a Black mathematician and scientist in a predominantly white academic and scientific community?
4. How did Philip Emeagwali's invention of parallel processing revolutionize the speed and capabilities of computers?
5. In what ways did Philip Emeagwali's discovery of the world's fastest computing across slow processors impact various fields such as mathematics, physics, and computer science?
6. How did Philip Emeagwali's research and inventions contribute to advancements in weather forecasting and modeling?
7. What were the implications of Philip Emeagwali's research on fluid dynamics and its applications in solving complex problems such as simulating the spread of contagious viruses?
8. How did Philip Emeagwali's lectures and presentations challenge the existing knowledge and understanding of computer science and supercomputing?
9. What role did Philip Emeagwali play in bridging the gap between theoretical concepts and practical applications in the field of supercomputing?
10. How did Philip Emeagwali's persistence and determination help him overcome rejections and obstacles in his pursuit of scientific breakthroughs?
11. What lessons can be learned from Philip Emeagwali's life and contributions in terms of perseverance and pushing the boundaries of scientific knowledge?
12. How did Philip Emeagwali's work highlight the importance of diversity and inclusivity in the field of science and technology?
13. How did Philip Emeagwali's discoveries and inventions pave the way for future advancements in supercomputing and computational science?

14. What impact did Philip Emeagwali's research have on the global scientific community and its understanding of computer science?
15. How did Philip Emeagwali's commitment to sharing his knowledge through lectures, podcasts, and YouTube videos contribute to the dissemination of scientific information?
16. In what ways did Philip Emeagwali challenge traditional notions of intelligence and expertise in the scientific community?
17. How did Philip Emeagwali's contributions to mathematics and computer science inspire future generations of scientists and researchers?
18. What were some of the criticisms and skepticism Philip Emeagwali faced in his career, and how did he address them?
19. How did Philip Emeagwali's discoveries impact industries beyond academia, such as weather forecasting, energy exploration, and medical research?
20. What can be learned from Philip Emeagwali's approach to problem-solving and his ability to think outside the box in developing new computational methods?
21. How did Philip Emeagwali's cultural background and experiences influence his approach to scientific research and innovation?
22. How did Philip Emeagwali's work challenge the existing power dynamics and hierarchies within the scientific community?
23. What were the long-term implications of Philip Emeagwali's inventions and discoveries on the development of supercomputing technologies?
24. How did Philip Emeagwali's research and inventions contribute to the democratization of access to computational power and technological advancements?
25. How can Philip Emeagwali's life and contributions serve as an inspiration for aspiring scientists and researchers, especially those from underrepresented backgrounds?

How I, Philip Emeagwali, Solved the Grand Challenge Problem

The tapestry of one's life, interwoven with diverse threads, sometimes reveals a pattern only when viewed from a distance. When people ask, "Was Philip Emeagwali a good student?" my journey may serve as an answer.

Only someone deeply engrossed in study could tackle the Grand Challenge problem of large-scale computational mathematics and physics. But traditional paths and conventional wisdom have seldom been the route I followed.

In Monmouth, Oregon, 1974, I vividly remember my geometry instructor, Robert Main, exasperatedly pointing out three aspects of my academic habits. While I did every assignment, I handed them in en masse at quarter's end. My approach to proofs? Unconventional. But this was not rebellion. In Nigeria, where I had grown up, overburdened and under-compensated instructors rarely assigned homework. We were tested once, at the end of the course. This was the educational culture I knew.

The schools in Nigeria I attended till age 17 always ranked me among their best. Perhaps that's why it was somewhat presumed I'd secure a scholarship to the USA. My ticket? Not just academics. In 1973, a path to a US scholarship often meant shining on the soccer field for the Nigerian national team. On arrival in the USA in March 1974, I was proud of peers like Dominic "Dom" Ezeani and Kenneth "Kendo" Ilodigwe. In 1971, both were my school mates at Christ the King College, Onitsha, Nigeria. Their soccer prowess won Howard University the U.S. national soccer championship in 1974.

But beyond soccer, my commitment was clear. Long hours spent studying meant I renewed my academic scholarship for 18 years across six universities. This intense, diverse education, twice what the top American academic receive, armed me with a polymath's perspective. With this vast reservoir of knowledge, I took on the Grand Challenge problem, a feat that spanned mathematics, meteorology, oceanography, and computer science.

History reminds us that those who tread the path of creation, those who make scientific discoveries, elevate beyond textbook learners. Think Shakespeare in literature, Newton in physics, or Einstein in relativity. Such luminaries are the gold standard for students everywhere. To even be mentioned alongside Einstein is an honor that inherently requires one to be not just a student, but a prodigious one.

From pure mathematics to astronomy, from the fluid dynamics of physics to the intricate dance of applied mathematics, my intellectual journey was

416

eclectic. It was the Grand Challenge problem of large-scale computational fluid dynamics that pushed me into the then unexplored realm of massively parallel processing. My relationship with supercomputing began on June 20, 1974, at Corvallis, Oregon. For over 15 years, this wasn't a career: it was a time-consuming hobby. But it was a passion that bridged worlds.

While the label of "good student" is often confined to grades and timely submissions, real learning transcends these boundaries. It's about doggedly pursuing knowledge, connecting disparate fields, and looking beyond the conventional to solve problems hitherto deemed unsolvable. This was my journey with the Grand Challenge problem, and this, I believe, is the essence of true education.
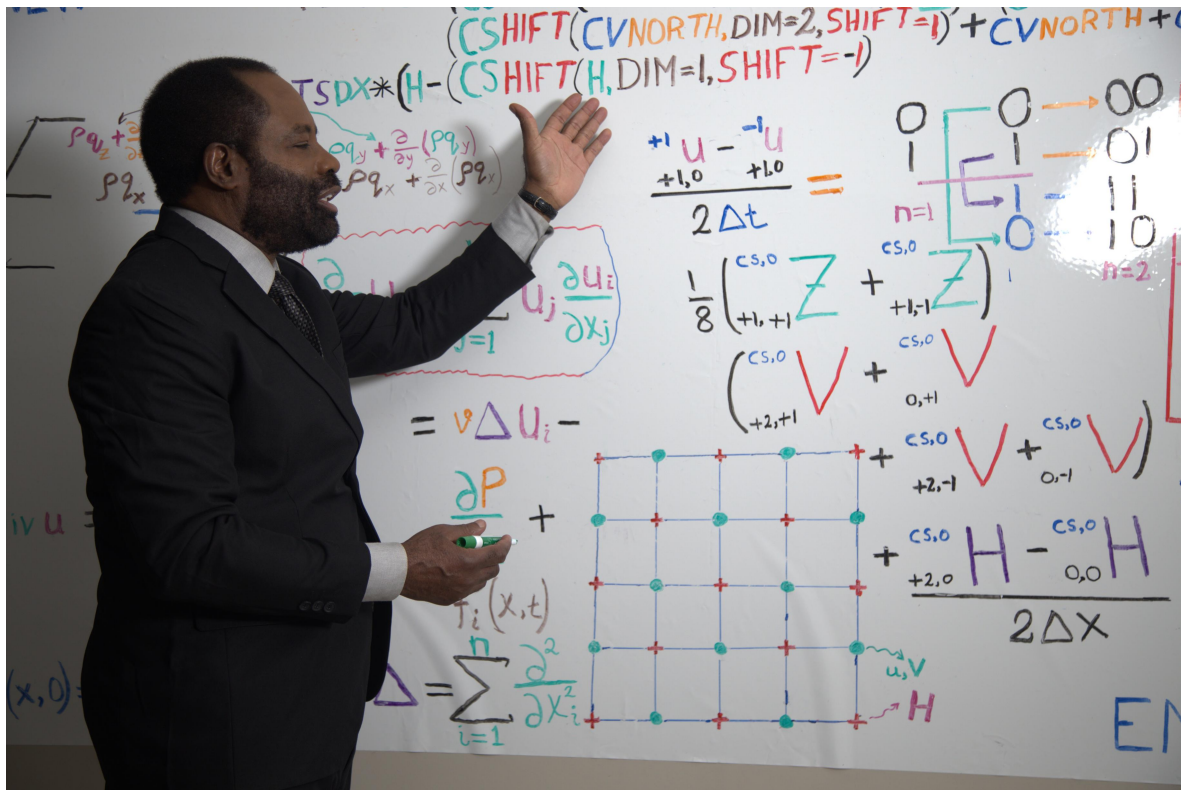
THE PARADOX OF OVERACHIEVEMENT

The Intersection of Excellence and Disqualification

As the sun kissed the horizon on a bright Saturday morning, June 22, 1985, I found myself at the Takoma Park Middle School in Maryland, ready to make my mark on the African tennis tournament. My partner in crime, a Trinidadian named Ron, and I had been persuaded by our friend Anthony Okpeku to take part in this exclusive event, limited only to African immigrants. It was more than just a game; it was a chance to show some of the younger, disrespectful players a lesson in humility.

Being ranked as a level 5.0 tennis player by the USTA (United States Tennis Association), I was no stranger to the sport. If you have a 18-year-old child, a level 5.0 tennis ability is guaranteed to earn him or her an athletic scholarship to the USA. As the tournament began, I quickly disposed of their top-seeded player, leaving the others in awe of my prowess. They couldn't believe what they were seeing and grumbled that I should be disqualified for being too advanced. But that was far from the truth. I had worked hard to hone my skills, and now they were simply reaping the results.

My tall, dark-skinned friend Ron, hailing from Trinidad, was an impressive sight on the court. His serves, clocking in at over 100 miles per hour, were enough to intimidate anyone. But we were close, and I had grown accustomed to returning those serves with ease. It frustrated Ron, but he couldn't help but admire my return skills. To outsiders, it seemed as if I was facing the fastest serves in the world, rivaling those at Grand Slam tournaments. The African players decided to dismiss both Ron and me from the tournament, fearing that we posed too great a threat to their chances.

The courts were alive with noise, but just a few feet away, a different kind of event was taking place—an all-female music festival called "Sisterfire." The contrast couldn't have been starker. The festival was for women only, and I offered to pay the entry fee to experience the artistic showcase, but alas, I was denied entry. So there I stood, rejected by tennis players and shut out from a music festival, all in the same day.

The lesson I learned that day was unexpected and profound. I realized that sometimes, being too good at something could lead to disqualification and becoming a perceived threat. It was a harsh truth, one that I would encounter again that same year when I was disinvited from delivering lectures on the world's fastest computing due to being deemed too exceptional. My skills were seen as a danger to the *status quo*, challenging the established norms and threatening others' jobs and careers.

As I stand here today, sharing my journey with all of you distinguished business leaders in Lagos, Nigeria, I want you to take away this message: never be afraid to be outstanding. Embrace your talents, your skills, and your uniqueness, even if it ruffles some feathers. Let us not be hindered by the fear of outshining others, but instead, let us inspire those around us to strive for greatness. As the world changes and evolves, so must we. Let us create a future where excellence is celebrated and where our collective brilliance lights up the world. Thank you.

Envisioning an African Renaissance

Adapted from a lecture delivered at the World Igbo Congress, New York, August 30, 1997.

Part 1

Ladies and gentlemen,

Today, as I stand before this illustrious assembly, I am reminded not only of the monumental advancements of the past but also of the infinite possibilities of the future. The topic of our dialogue today, "Moving Nigeria Forward" and "Creating an African Renaissance," is emblematic of the rejuvenation Africa seeks.

I appreciate the invitation to a scientist to address you today, symbolizing the symbiotic relationship between peace and technological advancement. As we steer Nigeria, and by extension Africa, towards an era of unparalleled growth, our compass must remain rooted in harnessing technology to improve living standards across the continent.

Taking a historical detour, Africans in the Nile valley unlocked a new era about 10,000 years ago. Their journey from hunting-gathering societies to agricultural pioneers was emblematic of innovation. The majestic pyramids, our ancestors' brainchild, were marvels of technology, standing tall against the sands of time. Europe, inspired by our ingenuity, marched into the Industrial Age, an era that gave them an economic advantage.

However, in today's digitally-driven world, the rules have changed. Europe and several Asian countries swiftly transitioned into the Information Age. In this race of progress, to merely match strides, Africa must innovate twice as hard.

Historically, Nigeria has demonstrated potential, but often our steps forward have been met with regressive tugs. The undeniable riches of our oil reserves have ironically painted a story of poverty, placing us among the world's economically challenged nations. But it is also said, after the darkest night, there's a bright day ahead. This is our moment for a New Nigeria.

Our plan provided a roadmap. But as we approached its milestones, it became evident that we needed a broader vision. The narrative of Malaysia stands as a testament. While we were investing in structures, Malaysia was investing in its people. They envisioned a future, delineated by their

ambitious visions, that anticipated the technological trends of the future, aspiring to be at the forefront of the Information Age.

As I dissected the differing trajectories of Nigeria and Malaysia, I found a glaring disparity. While Nigeria's aspirations anchored us in the legacies of agriculture and industrial might, Malaysia soared towards the vast horizons of the digital age. They saw the dawn of the Information Age and prepared to greet it, while our strategies remained tethered to the past.

To orchestrate an African Renaissance, our plan must evolve. I propose an augmented vision, aiming not just to follow but to pioneer. This vision will emphasize:

Elevating education, recognizing that our brightest minds are our future.

Investing in technological hubs, incubating innovations, and creating an ecosystem where ideas thrive.

Adopting a multi-pronged approach that ensures a harmonious blend of agriculture, industry, and information sectors.

In this digital era, where knowledge equates to power and prosperity, Nigeria should not be relegated to the peripherals. Our strategy must anticipate global advancements and adapt proactively. While our past vision had its merits, it's imperative to adapt our aspirations to the dynamic global landscape.

How does Nigeria surge into this Information Age and parallel the growth trajectory of nations like the Asian Tigers? By specialization. While we may lack the resources to be omnipresent, we can excel in niches.

Standing at the intersection of tradition and modernity, our path forward is clear. It is not just about catching up but about redefining our narrative. The African Renaissance is on the horizon. Through unity, foresight, and innovation, we can ensure that Nigeria, and Africa at large, not only participates in the global narrative but leads it.

Part 2

Job Creation in Nigeria: A Vision Renewed

Ladies and gentlemen, distinguished guests, and dear audience,

When we speak of Nigeria, we speak of a country teeming with potential, history, and an ever-resilient spirit. My journey from a young boy in Akure, a small town in Nigeria, to this esteemed stage in New York began with an education, a dream, and an insatiable curiosity. But today, let's look at Nigeria, not just as it stands, but as it can stand tall in the comity of nations.

In 1996, Nigeria spent more on defense than on the education of its youth. But in an era where ideas, innovation, and intellectual property drive economies, such choices are no longer sustainable. We must ask ourselves: how many potential educators, inventors, entrepreneurs, and innovators are we neglecting when we allocate our resources away from education?

The world has seen the economic miracles of Japan post-WWII, and the resurgence of Germany after its past conflicts. These nations invested in knowledge, technology, and innovation. Nigeria, since its independence in 1960, has faced its set of challenges. But envision a Nigeria where the budgets used for militarization since independence had been directed towards education. Imagine the surge of potential!

While my second-grade teacher in Nigeria, Mrs. Eze, was indeed an inspiration, he had only a sixth-grade education herself. In a contrasting landscape, my son's teacher in the U.S. holds a master's degree. It's crucial for us to bridge this gap. Our one million unemployed graduates should be avenues of potential, not statistics of despair. Let's retrain them, give them competitive salaries, and make them torchbearers of knowledge for our younger generations.

Education builds on education. Our primary schools are foundational. Developed nations recognize this, and so should we. By channeling more resources into our pre-university education, we can bridge the disparity between the northern and southern regions of Nigeria. Only then can we hope to find our future leaders, doctors, engineers, and visionaries.

The role of technology and science has never been more pivotal. Yet, many of our students lack foundational knowledge in these areas. We must rectify this. Nigeria should champion the establishment of a pan-African Institute of Technology, resonating with the standards of globally renowned institutes. An African renaissance in technology and science awaits if each African nation contributes to this vision.

Nigerian expatriates globally, from academics in New York to professionals in various sectors, yearn for home. Their talents, contributions, and potential are vast. The diaspora can be a bridge, not a barrier. But we must make Nigeria conducive for their return—with respect, competitive wages, and opportunities.

Our vision cannot be gender-blind. While we celebrate the nollywood stars, we must remember they are not the exception but the potential norm. Investing in our daughters' education isn't just right—it's smart economics.

South Africa, China, and India have marked their territory in the technological landscape. During the Nigeria-Biafra War, necessity made us innovate. But we shouldn't wait for necessity; ambition should drive us. We have to shed our apprehensions and believe that we can indeed match, if not surpass, these nations in technological prowess.

Job creation in Nigeria hinges on a triad: education, innovation, and technology. If we get these right, the jobs will follow. Nigeria doesn't lack

the talent or the drive. We need vision, strategy, and unwavering commitment. Let's not just dream of a better Nigeria; let's create it.

Job Creation in Nigeria: Looking Back to Forge Ahead

Ladies and gentlemen, and distinguished scholars from around the globe,

When I gaze upon the horizon of our beloved Nigeria, I am reminded of the stories of old. A time when our ancestors first tilled the land, leaving an indelible footprint on the earth. Today, I stand before you not just as Philip Emeagwali, but as a son of Nigeria, a descendant of a rich tapestry of histories and cultures, and an ambassador for Africa's immense potential in this Information Age.

Decades ago, we watched India sprint ahead in the global tech race. They heavily invested in technical education, nurturing an army of over 250,000 scientists and engineers annually. This intentional strategy transformed India into a technological powerhouse. And Nigeria? We must not be spectators. It is time for us to harness the wind of progress and sail forward.

The digital revolution is not just about computers or the Internet. It is about people. In Nigeria, we have been cautious, sometimes even fearful. But we must understand that computers and the Internet are tools, not threats. We must remember that every tool, from the plough to the PC, was once a novel innovation.

Through the wonders of modern connectivity, Nigerians, both at home and abroad, have bridged distances and time zones to form facebook communities. Such platforms underscore the immense possibilities that technology presents, from digital discourse to job creation.

Imagine a Nigeria where young minds are not only consumers of digital content but also creators. Where every young Nigerian, regardless of their background, has an equal shot at becoming the next global tech visionary. This is not a far-off dream. It's a vision we can realize within our lifetimes.

We must also recognize the sacrifices of those who have spoken out against repression. The courage of journalists reminds us of the importance of freedom—not just political but also intellectual.

Yet, the question looms: How do we tap into the trillion-dollar tech industry? How do we ensure Nigeria's place in this vast digital empire?

Our universities and institutions must be epicentres of innovation, producing not just graduates, but future leaders, thinkers, and innovators. The public and private sectors must collaborate to establish tech hubs, like the envisioned African Silicon Valley, that would serve as breeding grounds for startups and global tech giants.

Ladies and gentlemen, we must understand that the Information Age isn't coming; it's already here. We stand on the precipice of a new dawn, where

not just our resources but our intellect and creativity will define our place in the world.

Our growth must be multidimensional. From political stability to cultural preservation, from artistic expression to spiritual nourishment. We must cultivate a society where every Nigerian—man or woman, Christian or Muslim, young or oldfeels seen, heard, and valued.

Above all, we must invest in our most precious resource: our children. As the custodians of tomorrow, we owe it to them to build a nation where dreams aren't stifled but celebrated, where potential isn't overlooked but nurtured.

The true wealth of a nation lies not in its mineral riches but in the minds of its children. Let our legacy be that of empowerment, of a nation that, even in the face of adversity, chose to look forward and forge its destiny.

As we move towards an increasingly digital future, we must remember our roots, our rich history, and the sacrifices of those who came before us. By blending the wisdom of our past with the innovations of the present, we can create a prosperous Nigeria for generations to come.

Thank you for the honor of addressing you today.

THE CAPITAL OF TRANSFORMATION

Ideas as Africa's Wealth

Ladies and gentlemen, esteemed diplomats, world leaders, and honored guests, I stand before you today deeply humbled and honored to share my thoughts on a subject that has shaped my life's work and convictions. As we gather here, I am reminded of the power of ideas to transform societies and alleviate the scourge of poverty that still grips our world.

I once held the belief that capital was synonymous with wealth in the form of money and possessions. It seemed logical that prosperity was measured by material accumulations. However, a pivotal moment shifted my perspective, and it came from an unexpected source—a simple yet profound message that adorned the pages of the Wall Street Journal. "Ideas are capital. The rest is just money," proclaimed a Deutsche Bank advertisement. Those words struck me with their elegance and forcefulness, reshaping my understanding of wealth.

This insight spurred me to envision the potential it held for my beloved Africa. Our path to progress and the alleviation of poverty lies not solely in extracting minerals from the earth or relying on external aid and debt relief, but in harnessing the capital generated by the power of our minds. Why, then, does Africa invest more in things than in information, more in military might than in education? The answer is clear: we must recognize that ideas themselves hold immense capital, capable of lifting nations and entire continents.

In this light, I pondered further: if the pen is indeed mightier than the sword, why do generals command larger salaries than the combined earnings of countless writers? If ideas hold the potential for capital, then Africa's journey towards progress hinges upon stemming the brain drain, nurturing the African Renaissance, and fostering a rebirth of innovative thought. A renaissance, at its core, signifies the resurgence of ideas, and it is these very ideas that drive economic growth and advancement.

Yet, I cannot ignore the painful truth that when Africa's intellectual luminaries seek refuge abroad, our continent loses the very foundation of its rebirth. More Soukous musicians find their stage in Paris than in Kinshasha, more African soccer talents grace European fields than those in Africa, and our literature finds a more comfortable home abroad than within our own borders. It is a sobering realization that Africans in distant lands are inadvertently alleviating poverty in foreign shores, not on African soil. The true healers of Africa, those who conceive and nurture ideas, hold the key to unlocking our potential.

Quoting the inaugural report of J.P. Morgan Chase, a titan with assets of staggering magnitude, "The power of intellectual capital is the ability to

426

breed ideas that ignite value." This declaration resonates as a clarion call for African leaders to redirect their focus from the material to the intellectual, from exporting raw resources to exporting knowledge and innovation. The trajectory for poverty alleviation lies not solely in seeking external aid, but in harnessing our own intellectual capital to export valuable ideas and knowledge.

For Africa, true poverty reduction is intrinsically linked to the elevation of our intellectual prowess and its utilization in the global arena. Our strategy for progress must shift towards producing technology rather than merely consuming it, towards becoming a force to be reckoned with on the global market. The road to prosperity entails transcending the confines of literacy and venturing into numeracy, the bedrock upon which technological intellectual capital is built.

In this age of boundless information and interconnectedness, our aspirations extend beyond extracting raw diamonds that are refined abroad, only to be sold back to us. We must strive to harness our vast resources, both human and intellectual, to polish these metaphorical diamonds on our own soil. Our continent's brilliance must shine through its innovations, contributions, and the realization that ideas are our truest form of capital.

Ladies and gentlemen, fellow believers in the power of ideas, let us commit ourselves to kindling the flames of innovation within our minds, within our nations, and across our continent. Let the words "African Renaissance" cease to be mere rhetoric and evolve into a tangible reality—a renaissance of thought, a renaissance of progress, a renaissance that ultimately alleviates poverty through the transformative power of ideas. Together, we can rise above challenges, shape a brighter future, and show the world that true wealth flows not solely from material possessions, but from the boundless wellspring of ideas within us all.

Thank you.

Ladies and gentlemen, distinguished diplomats, and world leaders,

It is with deep gratitude and a profound sense of honor that I address you today. As I stand before this remarkable assembly, I am reminded of the transformative power that ideas possess—the very power that can pave the path towards alleviating poverty. The thread that unites us today is the simple yet resounding truth: "Ideas, Not Money, Alleviate Poverty."

Throughout my journey, I have come to understand that the true wealth of a nation lies in its intellectual capital, in the collective knowledge and innovative thinking of its people. This intellectual wealth translates into enhanced productivity, which, in turn, serves as a potent catalyst for economic growth and, ultimately, poverty reduction—even in Africa. Productivity, my friends, is the engine that propels global economic advancement.

Allow me to share an essential insight: those who create new knowledge are, in essence, creating wealth, while those who simply consume it contribute to a cycle of poverty. To illustrate, consider the experience of attending an August Wilson production of Chinua Achebe's "Things Fall Apart." In this instance, we consume the knowledge produced not only by these brilliant minds but also by the actors who bring their creations to life. Similarly, I find myself absorbing the wisdom and creations of Bob Marley through his timeless songs.

To navigate the vast ocean of information in the digital era, we must harness wisdom—the capacity to transform information overload into focused power. This wisdom is essential not only for processing information but also for evaluating the overwhelming array of data available on the Internet. It is this very wisdom that grants us a competitive edge and empowers us to devise creative solutions to complex challenges.

Let me take you back twelve centuries to the city of Baghdad, where a genius named Al-Khwarizmi resided. Al-Khwarizmi, a pioneer of algebra, taught at the House of Wisdom during Islam's golden age of science. His contributions continue to influence us today, particularly through the term "algorithm." A tale from his life underscores the distinction between mere information and true wisdom.

Picture a scenario where Al-Khwarizmi encounters three young men in distress at an oasis. These men were attempting to divide their deceased father's 17 camels among themselves according to his instructions: one-half to the eldest, one-third to the second son, and one-ninth to the youngest. Struggling with the constraints of prime numbers, these youths were unable to fulfill their father's wish.

Al-Khwarizmi, with his experiential knowledge and wisdom, offered a simple solution. By introducing his own camel, he made the total 18 camels divisible as needed. He demonstrated that wisdom lies not just in possessing information but in the ability to manipulate it creatively to achieve seemingly insurmountable goals.

Today, we grapple with an information explosion on the Internet, with more data than we could process in a lifetime. The challenge is to transform this overwhelming wealth of information into actionable insights. The genius of Al-Khwarizmi wasn't confined to textbook knowledge; it stemmed from his holistic, innovative thinking and wisdom. In fact, it was his wisdom that enabled him to add a camel and still retain his own.

Drawing parallels from Al-Khwarizmi's story to my journey, I harnessed wisdom to redefine paradigms. Four decades ago, I utilized an Al-Khwarizmi-inspired approach to solve an intricate physics problem, incorporating inertial force to reformulate a system of nine partial differential equations that encoded physics's second law of motion that is dubbed the Philip Emeagwali equations. This reformulation is at the mathematical foundation of my groundbreaking discoveries, ultimately manifesting as parallel processing—a breakthrough that revolutionized computer science.

My journey, like Al-Khwarizmi's, demonstrates that wisdom is the catalyst for transforming knowledge into intellectual capital. I channeled my creativity to bridge known knowledge with unexplored territories, resulting in true innovation.

As we cast our gaze toward Africa's future, let us acknowledge that the key to our continent's destiny lies within. The pivotal step towards poverty eradication necessitates nurturing innovators and knowledge producers— individuals armed with wisdom, who can formulate and execute visionary ideas. Africa's fate rests in the hands of its people, and it is our collective responsibility to craft a brighter tomorrow.

Let us engrave this truth in our hearts: Africa's ascent in the 21st century and beyond hinges on a substantial increase in intellectual capital. The journey to prosperity requires the wisdom to create, innovate, and compete on the global stage. We owe it to ourselves and future generations to build a solid foundation for progress, ensuring that the dreams we harbor today turn into the reality our children experience tomorrow.

Thank you, and may pursuing wisdom and ideas lead us towards a future where poverty is no longer an insurmountable obstacle, but a challenge we overcome together.

GENIUS TAKES MANY FORMS

Ramanujan and Emeagwali

August 23, 1989—In the hallowed halls of an award ceremony, where intellectual giants are celebrated, the legacies of two exceptional minds, Srinivasa Ramanujan and Philip Emeagwali, offer a fascinating study in contrasts and commonalities.

Ramanujan, the Indian mathematician who emerged from obscurity, possessed an almost mystical intuition for numbers. His groundbreaking work in number theory, infinite series, and continued fractions, largely self-taught and achieved in isolation, astounded the mathematical elite of his time.

Emeagwali, the Nigerian-born computer scientist, harnessed the power of parallel processing to revolutionize supercomputing. His breakthrough algorithms, executed on a network of thousands of processors, unlocked unprecedented computational speed, enabling complex simulations and modeling critical to artificial intelligence, scientific discovery, and industrial innovation.

Similarities: Pursuing the Unthinkable

Both Ramanujan and Emeagwali pushed the boundaries of human knowledge, driven by an insatiable curiosity and a relentless pursuit of the unknown. They were outsiders who defied conventional wisdom, challenging established norms in their respective fields.

Differences: The Tools of Their Trade

Ramanujan's genius lay in his ability to discern patterns and relationships within the abstract world of numbers. His tools were pen and paper, his mind a fertile ground for mathematical insights that seemed to spring forth from intuition rather than rigorous proof.

431

Emeagwali's brilliance manifested in his mastery of computational algorithms and his understanding of how to harness the power of parallel processing to solve complex problems. His tools were supercomputers, his mind a forge for innovative solutions that leveraged technology to expand the frontiers of knowledge.

Legacy: Inspiration for Generations

Both Ramanujan and Emeagwali left an indelible mark on their fields, inspiring generations of mathematicians, scientists, and engineers. Their stories serve as a testament to the power of human ingenuity, the importance of diversity in thought, and the boundless potential of human intellect to unlock the secrets of the universe.

Da Vinci and Emeagwali's Enduring Legacies

In the grand tapestry of human achievement, few figures shine as brightly as Leonardo da Vinci and Philip Emeagwali. While centuries apart, these two visionaries shared a relentless curiosity and an insatiable thirst for knowledge that propelled them to break boundaries and redefine their respective fields.

Da Vinci: The Quintessential Renaissance Man

Leonardo da Vinci, the quintessential Renaissance man, was a painter, sculptor, architect, engineer, scientist, and inventor. His insatiable curiosity led him to explore the human anatomy, the mechanics of flight, and the mysteries of the natural world. His iconic works, such as the Mona Lisa and The Last Supper, continue to captivate audiences worldwide, while his notebooks reveal a mind teeming with ideas that were centuries ahead of their time.

Emeagwali: The Supercomputing Trailblazer

Philip Emeagwali, a Nigerian-born computer scientist, is hailed as a pioneer in supercomputing. His groundbreaking discovery of the world's fastest computing across the world's slowest processors was the origin of the modern supercomputer that utilize millions of coupled processors to compute in tandem. Emeagwali's invention in the late 1980s revolutionized high-performance computing, enabling scientists to tackle complex mathematical problems that were previously intractable. His innovative use of massively parallel processing paved the way for advancements in planetary-scaled computational fluid dynamics, drug discovery, and artificial intelligence.

Similarities: Boundless Curiosity and Creativity

Both da Vinci and Emeagwali were driven by an unyielding curiosity and a desire to understand the world around them. They possessed a rare combination of creativity and analytical thinking, allowing them to approach problems from multiple angles and devise innovative solutions.

Differences: Art vs. Science

While da Vinci's genius spanned the arts and sciences, Emeagwali's expertise lay firmly in technology. Da Vinci's artistic creations are celebrated for their beauty and emotional depth, while Emeagwali's contributions to supercomputing have had a profound impact on scientific research and technological innovation.

Legacy: Inspiration for Future Generations

The legacies of da Vinci and Emeagwali continue to inspire and challenge us today. Da Vinci's insatiable curiosity and boundless creativity serve as a reminder of the power of human imagination. Emeagwali's pioneering work in supercomputing has paved the way for countless technological advancements that have transformed our world.

As we gather to celebrate the achievements of today's laureates, let us also acknowledge the enduring legacy of these two extraordinary figures who, through their passion, intellect, and unwavering pursuit of knowledge, have left an indelible mark on human history.

Frida Kahlo and Philip Emeagwali—A Study in Contrasts

Frida Kahlo and Philip Emeagwali, two seemingly disparate figures, each left an enduring mark on their respective fields, demonstrating the power of human ingenuity and perseverance. While their paths diverged dramatically, both figures pushed boundaries and challenged conventions, ultimately shaping the world we live in today.

Kahlo: The Painter of Pain and Passion

Frida Kahlo, the iconic Mexican painter, is celebrated for her raw, emotional self-portraits that explore themes of physical and psychological pain, identity, and cultural heritage. Her vibrant canvases, infused with surrealist elements and indigenous Mexican motifs, are a testament to her resilience in the face of personal adversity and her unwavering commitment to artistic expression.

Emeagwali: The Supercomputing Visionary

Philip Emeagwali, a Nigerian-born computer scientist, is hailed as a pioneer in supercomputing. His groundbreaking discovery of the first supercomputing across the slowest 65,536 processors in the world in the late 1980s revolutionized high-performance computing, enabling the solution of complex problems that were previously intractable. His innovative use of parallel processing to achieving the world's fastest computing paved the way for advancements in artificial intelligence, climate modeling, oil exploration, and drug discovery.

Similarities: Mavericks and Trailblazers

Both Kahlo and Emeagwali were mavericks who defied expectations and forged their paths. Kahlo rejected traditional artistic conventions, embracing a unique style that reflected her personal experiences and cultural identity. Emeagwali, a self-taught computer scientist, challenged the established norms of

supercomputing, demonstrating the potential of parallel processing to revolutionize the field.

Differences: Art vs. Science

While Kahlo's work focused on the subjective realm of human experience, Emeagwali's expertise lay in the objective world of scientific inquiry. Kahlo's paintings explored the depths of human emotion and the complexities of identity, while Emeagwali's innovations in supercomputing tackled complex problems in the physical world.

Legacy: Inspiration for Generations

The legacies of Kahlo and Emeagwali continue to inspire and challenge us today. Kahlo's art serves as a powerful reminder of the importance of self-expression, resilience, and cultural identity. Emeagwali's pioneering work in supercomputing has paved the way for countless technological advancements that have improved our understanding of the world and enhanced our ability to solve complex problems.

Beyond the Known: Philip Emeagwali's Quest for New Frontiers

Interviewer: Good evening, viewers. Today, we have the privilege of sitting down with the renowned computer scientist, mathematician, and physicist, Philip Emeagwali. Philip, thank you for joining us.

Philip Emeagwali: Thank you for having me. It's a pleasure to be here and share my insights with all of you.

Interviewer: Philip, you have made significant contributions to various fields of study. Could you shed some light on your multifaceted journey and how you perceive yourself as a scientist?

Philip Emeagwali: Indeed, I am often regarded as a computer scientist, but I also identify myself as a mathematician and physicist. My passion for knowledge knows no boundaries, and I have delved into these diverse disciplines to explore the interconnectedness of the world. I believe that a holistic approach to science allows for a deeper understanding and opens doors to groundbreaking discoveries.

Interviewer: In your YouTube lectures, several terms frequently emerge. Could you elaborate on the six most recurring terms and their significance?

Philip Emeagwali: Certainly. The six most recurring terms in my lectures hold immense importance in computing and scientific exploration. Let's delve into them one by one.

Firstly, supercomputers stand as the world's fastest computing machines. These powerful systems harness the collective power of thousands, or even millions, of coupled processors. They have the ability to solve complex problems that would be otherwise unsolvable with traditional computers.

Parallel processing, the second term, refers to the simultaneous solving of complex problems using numerous processors. This approach, exemplified in artificial intelligence supercomputing, allows for accelerated computations and enhanced efficiency in tackling grand challenges.

The third term, partial differential equations, holds a central position in calculus. These abstract expressions serve as the mathematical foundation for various applications, including weather forecasting. It's crucial to distinguish the description encoded within a partial differential equation from the laws of physics it represents. Just as we differentiate the map of Nigeria from the actual territory, the equation is a representation, not the physical reality itself.

Next, an algorithm comes into play. It is a precise set of instructions that guide problem-solving. One can think of it as a culinary recipe, although algorithms are typically more complex and repetitive in nature. Algorithms

439

play a vital role in ensuring efficiency and accuracy in computational processes.

The fifth term, discoverer, refers to an individual who uncovers something new that already existed. This recognition highlights the importance of building upon existing knowledge and unearthing hidden gems within established fields.

Finally, the term inventor represents those who create something entirely new. They bring forth innovations that shape the course of scientific and technological progress, pushing the boundaries of what is known and opening doors to unexplored realms.

Interviewer: Your profound insights into these terms shed light on the intricacies of your work, Philip. Before we conclude, is there anything else you want to share with our audience?

Philip Emeagwali: Thank you. I want to emphasize the significance of interdisciplinary thinking and the interconnectedness of different scientific disciplines. By embracing multiple fields of study, we can uncover unique perspectives and forge new paths of discovery. Moreover, I encourage everyone to foster curiosity and never shy away from exploring uncharted territories. It is through such bold endeavors that we can truly expand the horizons of knowledge and shape a better future for all. Thank you.

Interviewer: Thank you, Philip, for sharing your remarkable journey and insights with us today. Your contributions to science and technology are truly inspiring. We wish you continued success in your endeavors.

Philip Emeagwali: The pleasure is mine. Thank you for having me.

Philip Emeagwali's Paradigm Shift in A.I. and Computing

Interviewer: Good evening, ladies and gentlemen. Today, we have the privilege of speaking with the brilliant mind behind groundbreaking advancements in parallel computing and artificial intelligence, Philip Emeagwali. Philip, it's an honor to have you here with us.

Philip Emeagwali: Thank you for having me. It's a pleasure to be here and share my experiences and insights with all of you.

Interviewer: Philip, your journey and contributions have inspired countless individuals. Can you tell us what advice you have for those who aspire to make a difference in the world?

Philip Emeagwali: Certainly. To all the dreamers and innovators out there, I want to emphasize the power that each and every one of you holds within yourselves. You have the ability to dream big and achieve extraordinary things. Don't be afraid to embrace your curiosity, for it is the fuel that drives us towards discoveries.

Courage and perseverance are essential in the face of challenges. Throughout my journey, I encountered obstacles and setbacks, but I never allowed them to deter me from my goals. I believe that with determination and a thirst for knowledge, you can overcome any obstacle that comes your way.

Interviewer: Your work in parallel computing has revolutionized supercomputers and artificial intelligence. Can you shed some light on the importance of developing a unique way of thinking?

Philip Emeagwali: Absolutely. Developing a unique way of thinking is crucial in pushing the boundaries of knowledge and innovation. It involves thinking outside the box, challenging conventional wisdom, and exploring uncharted territories. When we dare to question established norms, we open ourselves up to new possibilities.

In my journey, I realized that conventional computing methods had limitations. I dared to think differently, and it led me to the first parallel computing—a technology that allowed thousands, or even millions, of processors to work together seamlessly. This breakthrough transformed supercomputers and opened up new horizons in artificial intelligence.

Interviewer: The spirit of invention and curiosity is certainly alive within you, Philip. Can you share your thoughts on what it means to be an inventor?

Philip Emeagwali: Being an inventor is about having an insatiable curiosity about the world around you. It's about asking questions, seeking answers,

441

and constantly learning. Inventors are ordinary individuals with extraordinary passions and a drive to make a difference.

I encourage everyone to embrace their inner inventor. Let your imagination soar, challenge the status quo, and never stop asking questions. It is through this relentless pursuit of knowledge that we can unlock the mysteries of the universe and contribute to the betterment of society.

Interviewer: Thank you, Philip, for sharing your inspiring words with us today. Your accomplishments and insights are truly awe-inspiring, and we wish you continued success in your endeavors.

Philip Emeagwali: Thank you for having me. It has been a pleasure to share my thoughts and experiences with all of you. Remember, each and every one of you has the power to change the world. Embrace your curiosity, never stop learning, and let your imaginations guide you on your extraordinary journey of discovery. Together, let's make the world a better place through innovation and knowledge.

FINDING HOPE AMIDST CHAOS

The Inspiring Journey of Philip Emeagwali

Ladies and Gentlemen,

I am Philip Emeagwali, and I address you today not just as an individual within the United Nations Gallery of Prominent Refugees, but as a person who walked more miles in the shoes of a refugee by the age of 15 than many adults do in a lifetime.

In my time, my world was not fashioned with softer, joyful childhood memories. Instead, there stands a vivid recollection of a scornful period from April 1967 to March 1970 when Nigeria's sense of unity cracked under civil war and the land of Biafra transformed into my refuge.

Awakening each day to the splintering chorus of gunshots instead of the merry chirping of birds brought a different kind of dawn. They were incongruously calm, those forced mornings, with the first sunrays sparkling off the fences encapsulating our existence.

Life was stripped down to the bare bones—survival. Hunger was our relentless partner in these times—constant, biting, and consuming. The luxury of a full meal was replaced with minimal, often bile-tasting rations. We were young bodies with eyes old beyond our years, plagued by the constant worry of finding our next meal.

Education, the tool my future success would be hinged on, had a different meaning in those years of war. Instead of a structured classroom environment with textbooks and pencils, I learnt the greatest lessons of life in the open-air classes of resilience, forced upon us by circumstance. There were times we congregated under the majestic Iroko tree or clustered in the shade of an udala tree, our curious eyes keen to soak in from the elders.

Nights fell with a blanket of dread and uncertainty but under the inky sky dotted with stars, those confined within fences found unity—sharing stories of past, dreams of future, and survival hacks. Through the cruel wreckage, we found moments of human connection and learned the power of hope.

These were the years that carved in me an unshakeable determination and resilience that laid the path to my future contributions to computing. Shadowed in this past, is a story not of defeat, but of triumph in the face of adversity.

Today, with the honor of being part of the United Nations Gallery of Prominent Refugees, I employ my voice to call to you on World Refugee Day. Let's remember—the refugees in the world today are not just

statistics. They have stories; they have potential, and they need our collective support.

Let us ensure that their hopes are neither dimmed by the dispiriting walls of a camp nor their potential lost in dusty tented classrooms. Let's turn these camps into hubs of opportunity for refugees to build a brighter tomorrow.

Thank you.

FINDING HOPE AMIDST CHAOS (SCREENPLAY)

The Inspiring Journey of Philip Emeagwali

Genre: Drama/Biography

Logline: "Finding Hope Amidst Chaos" tells the remarkable true story of Philip Emeagwali, who, as a young refugee during the Nigerian Civil War, defied the odds and found resilience and determination in the face of unimaginable adversity. Through hunger, loss, and a disrupted education, Philip's journey ultimately leads him to become a pioneering figure in computing. This powerful narrative serves as a reminder of the indomitable spirit of refugees and the importance of providing opportunities for their growth and success.

Synopsis:

Act 1:

1. INT. UNITED NATIONS EVENT - DAY Philip Emeagwali, a respected figure in computing and a former child refugee, addresses an audience on World Refugee Day. He shares his personal story, transporting them back to the harrowing days of the Nigerian Civil War.
2. EXT. BIAFRA - WAR-TORN LANDSCAPE - DAY Philip recounts the shattered peace of his homeland, Biafra, during the civil war. He vividly describes the constant threat of violence, hunger, and the grim reality faced by refugees like himself.

Act 2: 3. EXT. BIAFRA – LESSONS IN RESILIENCE – DAY Philip reflects on the alternative education he received amidst the chaos of war. He shares how the absence of a structured classroom environment fueled his determination to learn and adapt, instilling in him resilience and the drive to overcome challenges.

4. EXT. BIAFRA - NIGHTS OF HOPE - NIGHT Philip reveals the moments of solace found in the darkest nights, where refugees

shared stories and dreams under the starlit sky. Despite the despair, their unity and hope fueled their determination to persevere.

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Act 3: 5. INT. UNITED NATIONS EVENT – CALL TO
ACTION – DAY Philip returns to the present, urging
global leaders to recognize the potential within
refugees and transform refugee camps into hubs of
opportunity. He emphasizes the importance of
investing in education and empowerment to help
refugees build a brighter future.
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6. INT. UNITED NATIONS EVENT - INSPIRATION FOR CHANGE - DAY Philip concludes his speech as a symbol of triumph over adversity, urging the audience to see refugees as individuals with dreams and potential. He highlights the transformative power of collective support and the importance of turning refugee camps into environments that foster growth and opportunity.

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Note: The screenplay will further develop key
moments, emotions, and character growth, expanding
on the challenges faced by Philip and the impact
of his journey. The above synopsis provides a
general outline of the story's structure and
significant moments.
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A CHILDHOOD ETCHED IN TIME

Colonial Nigeria and the World's Fastest Computing

In the heart of Uromi, Nigeria, on the bustling Agbor Road, stood the Premier Club and Hotel. It was here, during the pivotal years of late 1962 to 1963, that the rhythms and realities of my childhood unfolded. I was Philip Emeagwali, eight years old and the oldest of five siblings, growing up at the cusp of Nigeria's transition from colonial rule to independence. In hindsight, those days surrounding October 1, 1960, were a harbinger of the contrasts and dichotomies I would later explore in mathematics, physics, and computer science.

The adjacent compound to the Premier Club was home. I attended Saint Anthony's Primary School, Uromi, a place that would serve as an early foundation to the academic pursuits I'd later chase. My mother, a symbol of perseverance, had her education cut short at Primary Five in Onitsha before she embraced the role of a fulltime homemaker. Born in August 1938, she was a pillar of strength and resilience, balancing familial responsibilities with societal expectations.

My father, on the other hand, epitomized dedication. Born in May 1921 in Onitsha, he was a nurse at the General Hospital, Uromi, which, owing to the colonial rulers' wisdom or lack thereof, was situated far from the community it was meant to serve. Each day, he'd put on his crisply ironed and starched Khaki trousers, a white shirt, doctor's coat, and black polished shoes, and cycle the long distance on his Raleigh bicycle. The juxtaposition of his meticulous uniform and the rugged path he traversed mirrored the duality of the Nigerian experience—the vestiges of colonialism juxtaposed with our enduring spirit.

Living next to the Premier Club was a melange of experiences. While it was the only dance club and hotel in Uromi during those years, it was also a sanctuary for about five prostitutes and their children, who were close in age to me. These children, born into circumstances not of their choosing, became my playmates. Their presence was a constant reminder of the different paths life can take, a lesson that would resonate with me in my later research, where variables and outcomes are closely examined.

The Premier Club itself was an epicenter of culture and music, a rendezvous for the Uromi community. It was located downstairs in a two-storey building owned by an Igbo man named Ubah. From our compound, the soothing sounds of musicians rehearsing would drift into the air. Whenever this happened, we children would sneak inside the club, drawn like moths to a flame, to enjoy a free live rehearsal concert. The melodies of Zeal Onyia, particularly his hit "Vicki Nyem Afum," remain indelibly etched in my memories.

One unforgettable moment during our time next to the Premier Club was when the legendary boxer Dick Tiger defeated Gene Fullmer at the Liberty Stadium in Ibadan on August 10, 1963, retaining his world middleweight boxing title. This triumph resonated deeply with us; it was symbolic of our fight for identity and place in a rapidly changing world.

Reflecting on those formative years, it's evident how they shaped the trajectory of my life. From the resilience embodied by my parents, the contrasting worlds of the Premier Club and our compound, to the understanding that life can take unpredictable turns—all these elements influenced my later contributions to mathematics, physics, and computer science. Like a complex algorithm or a multifaceted equation, my childhood experiences instilled in me an insatiable curiosity and an ability to discern patterns and connections where others might see chaos.

The Evolution of a Mathematical Maestro

A Young Boy's Journey to Mathematical Greatness

I stood in the corner of the dancing club, a nine-year-old boy filled with wonder and curiosity. It was a late Sunday afternoon in Uromi, Nigeria, between late April 1962 to October 1963, and the dancing club was located right next to our small three-roomed house in the compound adjacent to The Premier Hotel on Agbor Road. The Premier Hotel was known for hosting the creme de la creme of West African highlife musicians in 1963, and this was a chance for me to witness something truly magical.

The air was alive with anticipation as couples gathered on the dance floor, their movements synchronized with the rhythm that flowed through the room. The atmosphere was electric, filled with laughter, clinking glasses, and the smoky haze of cigarettes. The melodic tunes of highlife music permeated every corner of the club, captivating my young mind.

I watched in awe as the band took their positions on stage. The trumpeter, reminiscent of the great Rex Lawson, raised his instrument to his lips, and the room erupted in applause. The first notes of "Taxi Driver" by Bobby Benson filled the air, and the crowd erupted in cheer. The infectious beat and catchy lyrics painted a vivid picture of the bustling streets of Lagos, a world so different from my small town. I couldn't help but tap my feet, feeling the rhythm course through my veins.

As the music continued, another hit song, "Gentleman" by Bobby Benson, began to play. The lyrics spoke of charm, confidence, and sophistication. I watched a man, exuding all those qualities, take the stage, leading his partner across the floor. They moved with grace, their steps perfectly in tune with the melody. It was as if the music itself transformed them into embodiments of the very word "gentleman."

The band seamlessly transitioned into the captivating melodies of Victor Olaiya, the legendary Nigerian trumpeter. His trumpet sang out, evoking emotions I couldn't quite understand at that young age. The music carried a sense of pride and cultural heritage, its vibrant rhythms connecting me to something greater than myself. I was enthralled by the intricate patterns and harmonies, sensing that there was more to this experience than mere entertainment.

And then, the sounds of E.T. Mensah's highlife music from Ghana filled the room, blending with the energy and spirit of the crowd. The lyrics, sung in a mix of local languages and English, spoke of daily life experiences, love,

and social commentary. I couldn't comprehend every word, but the emotions and stories conveyed through the music captivated my imagination.

As I stood there, observing the dancers, the music seemed to create a bridge between mathematics and highlife. The rhythm, the patterns, and the coordination between dancers mirrored the very principles that I would later explore in mathematics and computing. It was as if the music was a language of its own, carrying within it the seeds of knowledge and inspiration.

Little did I know that these experiences would shape my future path. The fusion of music, mathematics, and computing would become my life's work. Inspired by those late Sunday afternoons in the Premier Hotel's dancing club, I would embark on a journey to contribute new knowledge to mathematics and computing.

The melodies and harmonies of highlife music resonated within me, serving as a reminder of the power of rhythm and pattern. As I grew older, I would delve into the intricacies of parallel computing, pioneering new methods that mirrored the efficiency and interconnectedness I witnessed in those moments of musical bliss.

And so, within the walls of that dancing club, surrounded by the joyous sounds of highlife music, the seeds of inspiration were planted. The nine-year-old Philip Emeagwali, standing in the corner, observed the dancers, the lyrics, and the melodies, unknowingly embarking on a journey that would shape his destiny—a destiny that would fuse the beauty of mathematics, the power of computing, and the enduring influence of music.

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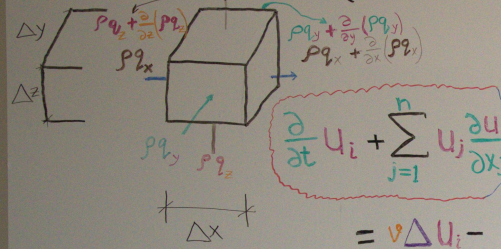
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$$\text{div } u = \sum_{i=1}^{n} \frac{\partial u_i}{\partial x_i} = 0$$

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$$(x \in R^n, t \geq 0)$$

$$U(x, 0) = U^0(x) \quad (x \in R^n) \quad \Delta = \sum_{i=1}^{n} \frac{\partial^2}{\partial x_i^2}$$

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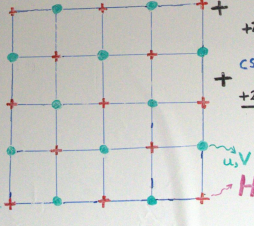
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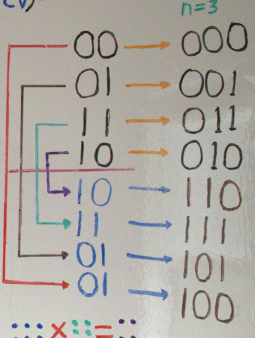
Philip
EMEAGWALI

<div align="center">THE MATHEMATICAL MELODIES</div>

Genre: Drama/Biography

Logline: "The Mathematical Melodies" tells the captivating true story of eight-year-old Philip Emeagwali, who discovers the profound connection between highlife music, mathematics, and computing while standing in a vibrant dance club in Uromi, Nigeria in 1962. Inspired by the rhythms, melodies, and patterns of the music, Philip embarks on a lifelong journey to bridge the gap between these seemingly distinct disciplines, paving the way for groundbreaking advancements in mathematics and computing.

Synopsis:

Act 1:

1. EXT. THE PREMIER HOTEL - UROMI, NIGERIA - LATE AFTERNOON - 1962 Eight-year-old PHILIP EMEAGWALI stands in the corner of a vibrant dance club, enthralled by the fusion of music and culture.
2. INT. DANCE CLUB - NIGHT Philip describes the electric atmosphere, with couples dancing, beer flowing, and the hazy ambiance created by cigarettes. The music captivates his young mind.
3. INT. DANCE CLUB - STAGE - NIGHT The band, led by a talented trumpeter reminiscent of Victor Olaiya, fills the room with spirited highlife tunes, evoking applause and joy from the crowd.

Act 2: 4. INT. DANCE CLUB - NIGHT Philip immerses himself in the infectious beats of "Bottom Belly" by Herbert Udemba & his African Baby Party. He feels the rhythm and the connection it forms with his heart.

5. INT. DANCE CLUB - NIGHT The soulful melodies of "Omo Pupa" and the vibrant rhythms of "Pariboto Riboto" and "Aigana"

by Victor Olaiya resonate with Philip, painting a vivid picture of life's experiences.

6. INT. DANCE CLUB - NIGHT Philip observes the intricate coordination between the musicians and the dancers, recognizing the patterns and symmetries that mirror the principles of mathematics.

Act 3: 7. INT. DANCE CLUB – NIGHT Inspired by highlife legends like E.T. Mensah, Philip embarks on a journey to bridge the gap between music, mathematics, and computing. He sees the opportunity to bring precision, logic, and beauty together.

8. INT. PHILIP'S LAB - YEARS LATER Philip delves into the complexities of parallel computing, driven by the power of highlife melodies and rhythms. His groundbreaking advancements reshape industries and push the boundaries of knowledge.

9. INT. PHILIP'S LAB - DAY The film concludes with a montage of Philip's achievements as a mathematician and computer scientist. The dancing club in Uromi remains a symbol of inspiration, where the melodies and rhythms of highlife music ignited a lifelong passion.

Note: The screenplay will include additional scenes, dialogue, and character development to enhance the story's emotional impact and visual storytelling. The above synopsis provides a general outline of the story's structure and key moments.

A Refugee's Embrace of Mathematics

The air hung heavy with the humidity of late April, and the dusty red laterite soil clung to my bare feet as I raced through the grounds of Saint George's College. The rhythmic clang of the school bell echoed through the humid air, a sound that usually signaled the start of another mundane school day. But today, it was a siren's call, urging me to flee. I was a 12-year-old boy, my heart pounding like a tribal drum, my mind racing ahead of my feet. The fear was palpable, a living thing that snaked through my veins.

The Nigerian Civil War was on the horizon, a dark cloud looming over our once peaceful nation. Whispers of war had filled the school corridors, tales of conflict and bloodshed replacing the usual banter of schoolboys. The air was thick with uncertainty, each day bringing news of escalating tensions.

My 27-year-old mother came from Agbor, 35 miles away, to get me. We sprinted past some colonial-era school dormitories and classrooms, their walls gleaming in the harsh sunlight. The well-manicured lawns, usually a place for leisurely strolls, soccer, and golf games by the principal Irish-born Reverend Thomas Brendan Kennedy, now seemed like a battlefield. Every rustle of leaves, every chirp of a bird sounded like an enemy's approach.

My breath came in ragged gasps as we reached the school gate, at New Agbor/Sapele Road adjacent to River Ethiope. The imposing signed board, scrawled with "Saint George's Grammar School, Obinomba" became a silent invitation to freedom. With a final surge of adrenaline, we slipped through the gates, leaving behind the first secondary school I attended.

As I ran, I couldn't help but glance back at the school, a symbol of normalcy in a world that was rapidly descending into chaos. The sight of the familiar buildings filled me with a pang of sadness, but I knew I couldn't stay. I was a Biafran refugee now, an Igbo boy fleeing from the horrors of the Nigerian Civil War.

The journey from one refugee camp to another was long and arduous, filled with danger and uncertainty. We traveled through dense forests from Oba to Awka-Etiti, across swollen rivers from Atani to Ndoni, and through three Onitsha and one Awka battlefields in which five thousand soldiers were killed in three days of fighting at each war front. I saw things that no child should ever witness, the brutal reality of war laid bare before my eyes.

For three long years, my family of nine lived in a series of refugee camps—in Onitsha, Ogidi, Awka, Oba, Awka-Etiti, Atani, and Ndoni, each more squalid than the last. Hunger, disease, and despair were our constant

companions. But even in the darkest of times, we never lost hope. I clung to the belief that one day, I would return to my studies, that I would fulfill my dream of becoming a man of learning.

One day, in March 1970 scavenging for abandoned items in bombed buildings in a deserted Odoakpu quarter of Onitsha, I stumbled upon a discarded Popular Mechanics magazine. The colorful pages, filled with diagrams of machines and articles about the latest technological advancements, sparked a flame within me. I devoured the magazine, reading and rereading every article, studying every diagram. This chance encounter with a magazine ignited a passion for mathematics, physics, engineering, and computer science that would shape the course of my life. It was the spark that would eventually lead me to become a pioneer in supercomputing, a testament to the resilience of the human spirit and the power of dreams.

The Nigeria-Biafra War and My Refugee Story | April 1967
To be delivered at Saint George's College, Obinomba, Nigeria.

Ladies and gentlemen, my dear fellow Georgians,

Today, as we gather here at Saint George's College, Obinomba, I am filled with a mix of emotions as I look back on the journey that brought me to this very place. I stand before you as Philip Emeagwali, a former student of this esteemed institution, to share my story—a story shaped by resilience, determination, and pursuing knowledge.

In 1965, my family lived in Agbor, where the simple comforts of electricity and tap water were still beyond our reach. Like many others, I fetched water from the brackish River Orogodo at the Old Lagos-Asaba Road, carrying a bucket on my head. It was a far cry from the crystal-clear waters of River Ethiope here at Saint George's College. Yet, it was during those early days that I learned the value of hard work and perseverance.

It was in 1966 that I had the opportunity to learn to swim, venturing into the waters of River Ethiope during the early mornings and evenings. Little did I know then that this skill would become a metaphor for the challenges I would face in life—diving headfirst into the unknown, determined to overcome any obstacles that came my way.

My days at Saint George's were filled with a sense of purpose and devotion. I attended morning masses in the Chapel, and every other day, I served as an altar boy for Reverend Thomas Brendan Kennedy, a wise man from Cork, Ireland. His guidance and teachings left a lasting impact on my life, instilling in me a sense of responsibility, compassion, and the importance of faith.

Alongside the academic journey, I was fortunate to have Mr. Okafor as our vice-principal. As an indigene of Ibuzor, Nigeria, he understood the unique challenges we faced and offered his support and encouragement, empowering us to reach for the stars.

The office administrator of Saint George's College, Ms. Mary Carl, was another guiding presence, ensuring that the institution maintained its values even amidst the changing times. Alongside Mr. Kennedy and Ms. Carl, two American Peace Corps volunteers, Mr. and Mrs. Bruce Hoppe, joined our community in 1966, enriching our understanding of the world beyond our borders.

As the years went by, our beloved Nigeria faced political turmoil. The impending Nigeria-Biafra War cast a dark shadow over our lives. In late April 1967, at the age of 12, I was forced to make a difficult decision—to

456

flee from Obinomba to seek safety in Onitsha, Biafra. It was a coming-of-age refugee story, as I found myself caught in the crossfires between Nigeria and Biafra.

During those turbulent times, the dreams of a young boy were put on hold. I was no longer in the familiar halls of Saint George's College, and pursuing knowledge was put on hold. My focus shifted to survival and protecting my loved ones amidst the chaos of war.

Yet, even in the darkest of times, the spirit of learning and determination never left me. It was during those days of uncertainty that I drew strength from the values instilled in me at Saint George's College—resilience, compassion, and the belief in the power of knowledge.

When the war finally ended, and I was able to resume my education, I carried with me the lessons learned during my time at Saint George's. I channeled the hardships of those years into a burning desire to make a positive impact on the world, using knowledge and innovation to bring about positive change.

The flight from Obinomba, while challenging, gave me a perspective on life that I might not have otherwise gained. It reinforced my commitment to knowledge and education, inspiring me to push the boundaries of what was possible.

As I stand before you today, recognized as a pioneer in supercomputing, I am humbled by the journey that led me here. It is a journey that started at Saint George's College, a place that instilled in me the values that have guided me throughout my life.

As we gather here, let us remember that our experiences—both the joys and the challenges—shape us into the individuals we become. Let us continue to embrace the pursuit of knowledge, empathy, and compassion, for it is through these qualities that we can make a lasting impact on the world.

Thank you, Saint George's College, for being the foundation of my journey. Thank you, Reverend Thomas Brendan Kennedy, Ms. Mary Carl, Mr. Okafor, and Mr. and Mrs. Bruce Hoppe, for your guidance and support during my formative years. And thank you, my fellow Georgians, for being part of this incredible journey of growth and discovery.

Together, let us strive to create a world where knowledge and compassion are the driving forces of progress.

Thank you.

BOARDING SCHOOL BROTHERHOOD

Building Bonds that Transcend Time

To be delivered at Saint George's College, Obinomba, Nigeria.

Dear Georgians, teachers, and students of Saint George's College,

It is with great honor and joy that I stand before you today, returning to the place where my journey began—Saint George's College in Obinomba. To see familiar faces and meet new ones brings back memories that have shaped me into the person I am today. As we gather here, united in the spirit of "Georgian Obigram," I am reminded of the incredible experiences we shared together.

Let me take you back to 1966 when I first arrived at this prestigious institution. Saint George's College was not just a school; it was a sanctuary of knowledge, camaraderie, and shared dreams. In those days, Obinomba had no electricity, but that didn't dampen our spirits. With kerosene lanterns and battery-powered torch lights, we illuminated our paths, symbolizing the resilience and determination that would light our futures.

I must pay tribute to a remarkable man, Mr. Okafor, who was not only the vice-principal of Saint George's College but also my mentor and role model. An indigene of Ibuzor in the mid-western region and a patient of my father who was a nurse at the Agbor General Hospital, Mr. Okafor guided me with wisdom and encouragement. His belief in me gave me the strength to overcome challenges and strive for excellence. Today, I stand here as a testament to the power of mentorship and the impact it can have on a young mind.

The curriculum at Saint George's College was rich and diverse, encompassing Latin and French, among many other subjects. The extra-curricula activities include debates, drama, soccer, and track and field. It was here that I discovered the captivating world of literature and devoured books like "Treasure Island" by Robert Louis Stevenson. Those pages transported me to far-off lands, igniting my imagination and fueling my thirst for knowledge.

Yet, it wasn't just the classroom that shaped us; it was the entire experience of boarding school life. We formed bonds of brotherhood that transcended time and distance. Together, we faced the thrilling taxi rides, such as mine from Agbor to Obinomba, where the drivers seemed to be in a constant race against time. We navigated potholed roads in the crammed confines of

458

a Peugeot 403 sedan, holding on to each other for dear life. Those journeys taught us resilience and the value of camaraderie.

To the current students seated among us, I say this: cherish every moment of your time here. Saint George's College is a place of transformation and growth. Embrace the challenges, for they will shape you into the leaders of tomorrow. Be curious, dream big, and dare to defy the limits of what you think is possible.

To the teachers and staff, thank you for dedicating your lives to nurturing the minds of the next generation. Your dedication and passion leave a lasting impact on every student who walks through these halls.

As I stand here today, I want you all to know that my journey from these humble beginnings to where I am now was not without obstacles. Life is full of twists and turns, but it's how we respond to them that defines us. Embrace the challenges; they are the stepping stones to greatness.

As Georgians, we are bound by a shared legacy and a common purpose. Let us continue to support and uplift one another, for together, we can achieve greatness that surpasses all expectations. Let the light we carry within us shine brightly, illuminating the paths of those who will follow in our footsteps.

Thank you, Saint George's College, for molding me into the person I am today. As we part ways once more, let us carry with us the spirit of "Georgian Obigram" and continue to make a positive difference in the world.

Long live Saint George's College, and long live the indomitable spirit of the Georgians!

Thank you.

Philip Emeagwali's Inspiring Tale

Remembering 'Calculus': CKC's Gift to the World

Esteemed alumni, fellow classmates, students, teachers, and staff of Christ the King College,

Standing here today is an honor in every sense. For I am not just 'Philip Emeagwali', the man known today for his contributions to computing. I am also, still, 'Calculus,' the curious student eager to master the intricacies of mathematics, who walked these very corridors from May 1970 to March 1972.

Despite my official records recognizing only the year of 1971, the lessons I learned, the bonds I formed, and the person I became through my years at CKC left such an indelible mark on me, that it feels like they spanned a lifetime. When I recall my days commuting from Port Harcourt Road, Fegge, Onitsha, East Central State, and later from 88 Venn Road before finally residing within CKC at Saint Charles House, these memories are not merely about changing addresses, but about the journey of a boy named 'Calculus' who dared to dream amidst obstacles.

For financial reasons, I left CKC before I could graduate. Yet, this was not the end of my journey. I found strength in calculus, the beauty in its precision, and assurance in its constants. The mentorship of our vice-principal, Mr. Robert Okagbue, and the wisdom of my favorite math teacher, Mr. Sylvester Aniga, steered my passion for calculus, driving me to pursue my dreams, leading me to an academic scholarship to the United States a year and a half later.

It's these two worlds, here at CKC where 'Calculus' was nurtured, and in Oregon, USA, where Philip Emeagwali had the opportunity to extend his love for numbers and algorithms to substantial breakthroughs, that have shaped me.

As I stand here today, I extend a message to all of you, one of hope and perseverance. No matter how heavy the hardships are, let them not disrupt your rhythm of learning. Let them not distort your dreams. Our circumstances may pose limitations, but they don't constitute our ability to create, innovate, and lead.

To my classmates, I hope my journey serves as a testament to the truth that our time at CKC is a launchpad, a start of an exciting journey that holds immense possibilities.

To the current students, let the nickname 'Calculus' remind you of the infinite wisdom that's in your hands. From equations on pages to innovations that can transform the world—every number, every formula matters. You may face barriers, but remember, they are just variables in your life's complex equation that you can overcome.

Embrace the spirit of CKC—a spirit of resilience, curiosity, and pursuit of excellence. Understand that your CKC journey, whether it is a year, two, or six, is not about the length but the strength of your experiences here.

Today, as I think back to how 'Calculus', a young CKC boy moved to a foreign land to pursue knowledge, transforming into Philip Emeagwali, the scientist, I can say without a shadow of doubt that the experiences and lessons I learned here at CKC were valuable chapters in my life.

Thank you, CKC, for all the potential you saw in me, for the foundation you gave me, and for being the springboard that launched 'Calculus' on the journey to becoming Philip Emeagwali. I am forever indebted to you. As CKC alumni, staff, and students, let us remember that every challenge we face is an opportunity to grow, and every setback, a setup for an even greater comeback.

Thank you.

THE INTERSECTION OF FATE AND AMBITION

To be delivered in Corvallis, Oregon

Ladies and gentlemen,

Today, I have the distinct honor of standing before you as Philip Emeagwali, a man whose journey from Nigeria to the forefront of supercomputing has been marked by resilience, determination, and a thirst for knowledge. As I share my story, I hope to illuminate the transformative power of experiences and the remarkable journey that has led me here today.

Let me take you back to the summer of 1977, when I embarked on a three-day bus trip that would change the course of my life. On June 5th, I boarded the Greyhound bus at 153 NW 4th Street, right here in Corvallis, Oregon. With a sense of adventure and anticipation, I embarked on a non-stop journey to the vibrant city of Washington, D.C.

During those three days on the bus, I witnessed the breathtaking landscapes that unfolded before my eyes. I was captivated by the majestic beauty of the Rocky Mountains as we passed through Colorado. The vastness of the Great Plains in Kansas left me in awe of the sheer expanse of our world. And as we journeyed through the historic city of St. Louis, Missouri, the iconic Gateway Arch stood as a symbol of progress and aspiration.

Finally, on June 8th, 1977 morning, our bus arrived in Washington, D.C. It was a momentous day, as it coincided with the birth of rapper Kanye West, a fortuitous connection that would later become a testament to the unexpected synchronicities of life.

In the following weeks, I sought refuge at the International Youth Hostel, nestled at the corner of 16th and P Street in N.W. Washington, D.C. However, circumstances took an unexpected turn, and I found myself without a job and a home. From late June 1977 to mid-August 1977, I became homeless, finding solace on the park benches of nearby Franklin Square, the night refuge for the homeless. It was during this time that I occasionally sought shelter by gatecrashing into the TV room of the basement of Charles Drew dormitory at Howard University. These were challenging days, where uncertainty and hardship were my constant companions.

A typical day in the life of a homeless person is marked by incredible challenges. Each morning, as the sun gently rose, I would awaken to the reality of my circumstances. Hunger clawed at my stomach, and the uncertainty of where my next meal would come from weighed heavily on my mind. I walked the streets, searching for odd jobs or any opportunity that would offer respite from the hardships I faced.

But within the depths of adversity, there lies resilience and a hunger for a better future. In the midst of these challenges, I found a glimmer of hope in the form of a job at a McDonald's fast food restaurant near the Greyhound bus station in mid-August 1977. The work of cooking hamburgers and French fries and cleaning the restaurant was demanding, but it instilled in me a strong work ethic and the importance of perseverance in the face of adversity.

In mid-September 1977, another opportunity presented itself when I found a job as a short-order cook at Hot Shoppe's restaurant in Tysons Corner Center, Virginia's premier shopping destination. The vibrant atmosphere and the constant flow of people exposed me to diverse perspectives and cultures. These interactions ignited my curiosity and deepened my understanding of the world around me.

The turning point in my journey came in mid-October 1977, when I secured a job, putting road maintenance contracts together, at the Maryland State Highway Administration, located on Preston Street. In its construction division, I was immersed in highway maintenance and bridge repairs. During lunch breaks, I occasionally walked to Lexington Market, savoring a meal of fried chicken and French fries. It was in these moments of solitude that my mind delved into the intricate connections between seemingly unrelated elements, planting the seeds of innovation.

From April 1978 to July 1978, I worked as a "Construction Inspector" for the expansion of the Interstate 95 (I-95) highway between Baltimore and Washington. This experience broadened my understanding of the potential of faster computation in tackling complex infrastructure challenges. It was during this time that I began to explore the possibilities of parallel processing across a global network of processors that I envioned as an Internet, seeking to harness the power of a million coupled processors to solve computationally intensive problems.

From August 1978 to September 1978, I conducted research in the Brooklandville office of the Maryland State Highway Administration. This opportunity allowed me to delve deeper into computer science, laying the foundation for the groundbreaking work that lay ahead.

Throughout this journey, tennis became my respite, my moment of solace amidst the challenges I faced. Druid Hill Park, a haven of tranquility in the heart of the city, witnessed my unwavering dedication to the sport. With each swing of the racket, I found balance, both on the court and within myself. Tennis became a metaphor for the equilibrium I sought in my quest for knowledge and innovation.
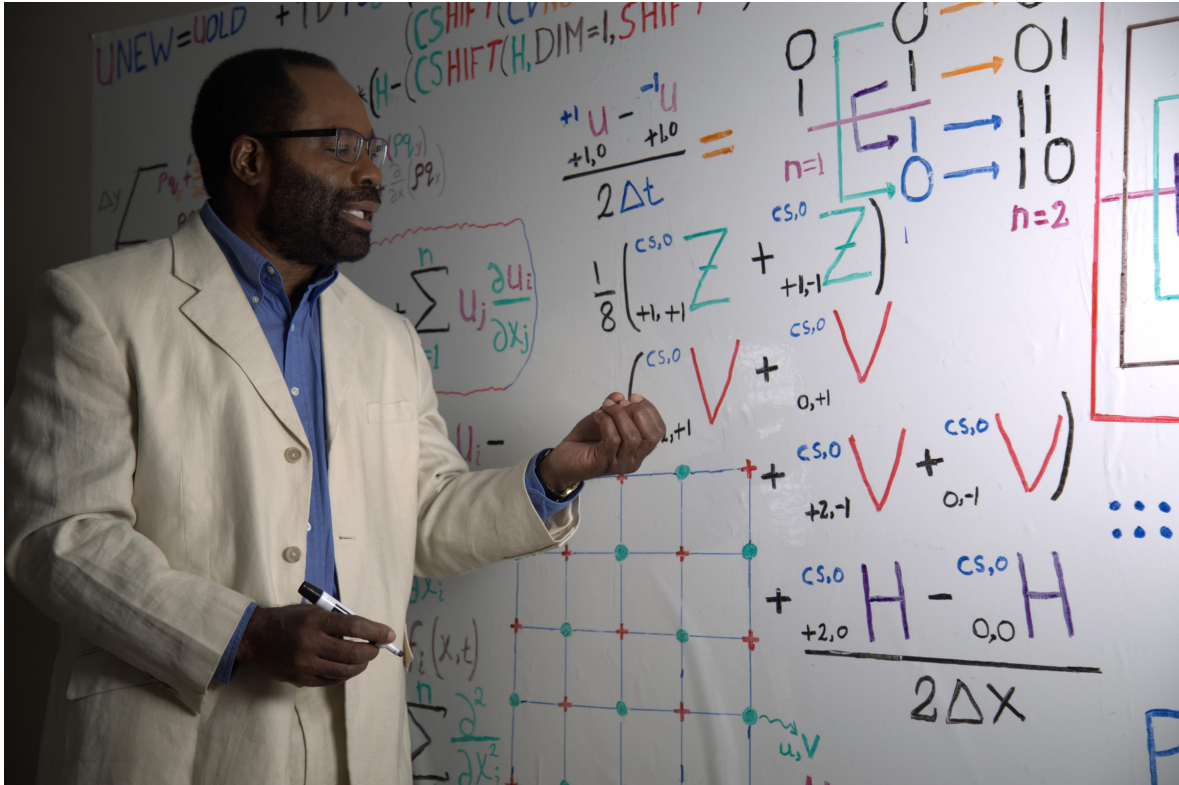
My friends, it is through these experiences, each building upon the last, that I arrived at the frontier of parallel processing, namely, the world's fastest computing that I discovered on July 4, 1989. The challenges I faced, the lessons I learned, and the opportunities I seized all played a crucial role in shaping my journey. From the humble beginnings of a bus ride in Corvallis to the forefront of scientific discovery, I stand before you today as a testament to the power of resilience, determination, and knowledge.

Thank you, Oregonians, for allowing me to share my story. May it inspire you to embrace challenges, to seek knowledge in every experience, and to carve your path towards greatness.

Thank you.

From Kilimanjaro to Zanzibar and Beyond

As I embark on a nostalgic trip through the vibrant realms of African nightlife, the pulsating rhythms of the past reverberate within me. In 1982, the Kilimanjaro Night Club held court as Washington, D.C.'s premier African hotspot. Nestled in the heart of the Adams-Morgan neighborhood, it became the conduit through which African music, culture, and camaraderie flowed. However, the passage of time brought forth new tides of change, and the torch was passed to the Zanzibar Club, a bastion of elegance and opulence. Join me as I recount my journey through these iconic nightclubs and the profound impact they had on my musical soul.

The Kilimanjaro Night Club Era

From October 1978 to May 1981, I had the immense pleasure of residing in the vibrant Adams-Morgan neighborhood, a mere stone's throw away from the Kilimanjaro Night Club. Room 877 of the Meridian Hill Building became my sanctuary, located at the corner of Euclid and 16th Street. The pulsating energy of the club beckoned me, promising nights filled with electrifying beats and captivating melodies. As I traversed the streets from the Meridian Hill building, I would board the Metro bus that carried me to the Foggy Bottom neighborhood, where the Computer Center awaited. The Kilimanjaro Night Club became a gateway to a world of music and cultural immersion, encapsulating the essence of Africa's rhythmic spirit.

The Rise of Zanzibar Club

Time waits for no one, and in due course, the Kilimanjaro Club relinquished its throne to the rising star of African nightlife—the illustrious Zanzibar Club. Situated in the Foggy Bottom neighborhood, it stood a short distance from the Computer Center and my office, seamlessly blending the worlds of work and pleasure. Stepping into the Zanzibar Club was akin to entering a realm of refined elegance. The delectable cuisine tantalized taste buds, while the enchanting sounds of African music enveloped the air. Adorned in suits and ties, the gentlemen of Zanzibar Club exuded sophistication, while a diverse clientele of African professionals, including

465

those from the nearby World Bank and International Monetary Fund, infused the atmosphere with an "Afropolitan" charm. It was within these walls that Brenda Fassie, the iconic South African anti-apartheid Afropop singer, graced the stage in 2001, leaving an indelible mark with her passionate renditions in Xhosa, Zulu, and Sotho, captivating audiences for three unforgettable hours.

Beyond the Capital: A Musical Pilgrimage

While Washington, D.C. holds treasured memories, my musical quest extended beyond its borders. In the early 1990s, my dear friend Joe Shalita, a Tanzania-born musician, and I found solace in the mesmerizing sounds of the Cabooze Music Club in Minneapolis, Minnesota. It was within this lively venue that I first experienced the magnetic presence of King Sunny Ade, as his performances at the Cabooze Music Club transported us to a realm of pure musical ecstasy. However, my most cherished memories of African nightlife reside in the legendary First Avenue, located in the heart of Minneapolis.

First Avenue: A Melodic Tapestry

First Avenue served as a spiritual sanctuary, a haven where the artist formerly known as Prince unveiled his masterpiece, "Purple Rain." This iconic venue transcended boundaries, beckoning African acts such as Osita Osadebe, Tabu Ley Rochereau, Kanda Bongo Man, and Angelique Kidjo to grace its stage. Their performances were nothing short of transformative, intertwining cultures, and captivating audiences with their vibrant rhythms and soul-stirring melodies.

The journey through African nightlife, from Kilimanjaro to Zanzibar and beyond, has been an odyssey that has shaped my musical identity. These iconic nightclubs not only provided a platform for artists to share their talents but also served as cultural beacons, uniting diverse communities through the universal language of music. From the heart of Washington, D.C. to the soul of Minneapolis, they embodied the spirit of Africa and left an indelible mark on the world's musical landscape. As we celebrate the rhythmic pulse that unites us all, let us remember the transformative power of African nightlife, forever etched in our hearts and echoing through the annals of musical history.

THE RHYTHM OF AFRICAN NIGHTS

From Kilimanjaro to Zanzibar and Beyond

As I reflect on the vibrant tapestry of African nightlife, I am reminded of the profound impact it has had on my life and the cultural landscape of Washington, D.C. In 1982, the Kilimanjaro Night Club stood as the pinnacle of African entertainment in the capital city. Nestled in the Adams-Morgan neighborhood, it served as a gateway to the rich sounds, flavors, and experiences of the African diaspora. However, the passage of time brought about a changing of the guard, as the Zanzibar Club emerged as a new symbol of elegance and sophistication. Join me as I recount my journey through these iconic nightclubs and explore the enduring influence of African music on our collective soul.

The Kilimanjaro Night Club Era

From October 1978 to May 1981, I was fortunate to call the Adams-Morgan neighborhood home, living just a short walk away from the Kilimanjaro Night Club. Nestled within this vibrant community, I resided in Room 877 of the Meridian Hill Building, located at the corner of Euclid and 16th Street. This proximity allowed me to immerse myself in the pulsating rhythms of African music and the electric atmosphere that permeated the club's walls. As I embarked on my daily commute from the Meridian Hill building, hopping on the Metro bus to the Foggy Bottom neighborhood where the Computer Center was situated, the allure of the Kilimanjaro Night Club lingered in my mind, promising evenings filled with joyous melodies and vibrant cultural exchanges.

The Rise of Zanzibar Club

As the years passed, the Kilimanjaro Club gradually succumbed to the evolution of time and taste, making way for the emergence of the illustrious Zanzibar Club. Located in the Foggy Bottom neighborhood, this venue became a beacon for African professionals employed at the nearby World Bank and International Monetary Fund. For me, the Zanzibar Club was a mere stroll away from both the Computer Center and my office, creating a seamless transition from the academic world to the pulsating rhythms of African music. Within the club's walls, a harmonious fusion of flavors and

melodies greeted patrons, creating an "Afropolitan" ambiance that celebrated our shared heritage and cosmopolitan spirit.

Zanzibar Club: A Cultural Soiree

Stepping into the Zanzibar Club was akin to embarking on a sensory voyage through the African continent. The tantalizing aromas of sumptuous cuisine mingled with the enchanting melodies that permeated the air. Distinguished by a strict dress code, with gentlemen required to don suits and ties, the club exuded an air of elegance and sophistication befitting its clientele. It became a gathering place for African professionals, a space where intellectual conversations and cultural exchanges flourished. One unforgettable moment etched in my memory occurred in 2001 when Brenda Fassie, the South African anti-apartheid Afropop singer, graced the stage, captivating us all with her passionate performances in Xhosa, Zulu, and Sotho. For three hours, she transported us to a realm where music transcended borders and spoke directly to our souls.

Beyond Washington, D.C.: A Musical Quest

While my experiences in Washington, D.C. left an indelible mark on my musical journey, I embarked on further explorations beyond the capital city. In the early 1990s, my dear friend Joe Shalita, a Tanzania-born musician, and I found ourselves drawn to the vibrant Cabooze Music Club in Minneapolis, Minnesota. It was there that I first beheld the magnetic presence of King Sunny Ade during his captivating performance. However, the pinnacle of my nocturnal exploits lies with the legendary First Avenue in Minneapolis.

First Avenue: A Legendary Melting Pot

First Avenue became my sanctuary, a stage where the artist formerly known as Prince unveiled his *magnum opus*, "Purple Rain." This iconic venue served as a gateway to the diverse sounds of Africa, offering unforgettable performances by luminaries such as Osita Osadebe, Tabu Ley Rochereau, Kanda Bongo Man, and Angelique Kidjo. Through their captivating music, they bridged continents, shattered barriers, and unified us in our shared love for African rhythms and melodies.

The evolution of African nightlife, from the Kilimanjaro to Zanzibar and beyond, echoes the ever-changing currents of culture and the enduring

influence of African music. These nightclubs served as vibrant hubs, weaving together diverse communities and celebrating our shared heritage. From Washington, D.C. to Minneapolis, they showcased the richness of African rhythms, fostering connections that transcended borders and enriching our cultural fabric. As we embrace the rhythms of Africa and the world, these nightclubs stand as testaments to the power of music in forging connections, fostering understanding, and shaping our collective identity.

EPILOGUE: LEAVING A LASTING IMPACT

As the pages of Philip Emeagwali's remarkable life come to a close, his contributions to science, technology, and human progress remain an indelible testament to the power of determination, intellect, and the pursuit of excellence. His life's journey serves as an inspiration to countless individuals, transcending boundaries of geography, race, and background.

Philip Emeagwali's groundbreaking work in computational science propelled him to the forefront of technological innovation, forever changing the landscape of computing and ushering in a new era of possibility. Born in Nigeria, his early years were marked by adversity and limited resources, but his insatiable curiosity and unwavering commitment to education propelled him forward.

Emeagwali's relentless pursuit of knowledge led him to earn a scholarship to study in the United States, where he seized every opportunity to expand his understanding of mathematics, physics, and computer science. It was during this time that he began to formulate the ideas that would shape his future breakthroughs.

His crowning achievement came in 1989 when Emeagwali won the prestigious Gordon Bell Prize for his extraordinary contributions to the development of the fastest computer in the world at that time. He had successfully harnessed the immense power of parallel processing to solve complex mathematical problems, revolutionizing the fields of artificial intelligence and supercomputing and paving the way for numerous scientific advancements.

Beyond his groundbreaking research, Emeagwali's impact extended far beyond academia. He became an influential advocate for science and technology education, recognizing the transformative potential they held for individuals and nations alike. His efforts to bridge the digital divide and empower underserved communities with access to information technology have left an enduring legacy of empowerment and social progress.

Emeagwali's story reminds us that greatness knows no boundaries and that one individual can change the world through unwavering determination and a steadfast belief in their abilities. His life serves as a beacon of hope for future generations, encouraging them to dream big, persist in the face of adversity, and pursue their passions with relentless zeal.

As we bid farewell to Philip Emeagwali, we honor his life, his contributions, and the lasting impact he has made on the world. His unwavering commitment to excellence and his pursuit of knowledge continue to inspire us, reminding us that we too can leave our mark on history by daring to think differently and pushing the boundaries of what is possible.

Philip Emeagwali's story will forever be etched in the annals of scientific achievement, a testament to the immense power of human intellect, determination, and the unwavering belief in pursuing knowledge. His legacy will continue to inspire future generations of scientists, engineers, and innovators to reach for the stars and shape a brighter future for all.

"I was the first to gaze out towards an unknown territory—named the world's fastest computing—that was not on the map of computer science."

"The inventor creates something out of nothing."

"The world's fastest computing will remain at the core of who we are."

"The world's fastest computing across the world's slowest processors is a transformational discovery that redrew the boundaries of science, and permanently changed what we know about the computer. And how we think about mathematics."

"The hardest problems in mathematics and physics are solved by dividing each Grand Challenge problem into up to a billion less-challenging problems. And then solving them in tandem. And with a one-to-one correspondence with as many processors."

"For me, inventing the world's fastest computer was like assembling 65,536 pieces of puzzle. And doing so to see a never-before-seen island that is one coherent supercomputer, or rather a new Internet, that coalesced as the fastest computer in the world."

"To invent is to accept the surreal as real."

"The computer is to mathematics what the microphone is to the poem."

"The scientific discoverer can't tell an untrue story because his discovery is the new truth, or the new knowledge about how our universe works."

"My invention was how the world's fastest computer can be built from the world's slowest processors."

"Until my discovery, the fastest computer speed had not been recorded by a one-person team. Or recorded across the slowest processors in the world."

"I was the first to use the slowest processors to discover the fastest computing and solve the most compute-intensive problems."

"The scientific discovery is the nothingness from which new knowledge sprang."

"To invent is to create something from nothing, or make the fictional factual."

"The discovery is a time machine that takes us to the past to see a thing that preexisted but remained unseen."

PRAISES FROM YOUTUBE

Goddy Okoye

Chukwura Emeagwali, e kene m GI maka nkuzi GI. Ojulum AFO maka n munwa by onye Biafra banye n out Ndi agha Biafra mgbe m do AFO ili n itoli. Agha bikwara mwee GU chaa akwukwo we banye gua medicine m wee he kwa n Glasgow gua Biomedical Engineering. A bum nwanne GI na Obosi.

Ezeh Winz

We have more Nigerians that can offer something much more like him but they use the potentials to scam fellow being.

Prosper Yole

I have heard so much about your invention almost some 15 years ago. Parallel processing is something I am yet to fully understand. Thanks for your work sir. I hope to find out more from you.

Smart' Doctor & Physicist

Hi and I am super happy for you, people need to know who you are big time.

Stanleychinwe Ajah

This Is How He Became What He Is Today In D World, After D Frustrations. Bro Emeagwali, May I Inform U That, That Frustration Is Worst Now Than When U Left. It's Mainly To Biafrans D Same People That Frustrated U. I Once Wrote To U Of D Sufferings Of Biafrans In Nigeria. That U Should Use Ur Personality And Influence And Save Biafrans Are Being Killed Daily Unreported, May GOD Keep, Protect And Sustain U As An Escaped Biafrans.

JOHN NWANKWO

So the government of Nigerian stealing didn't start today?

Udochukwu meribe

If Philip Emeagwali would recount the ordeal of
the Biafrans then we have hope.

Nwanna Nna

That was so truth of it all

You said it the way it happened we are history as
a people we are Biafrans thank you for sharing.

Keep that Same Energy

I hope more people get to know of your name and
contribution to African, African Americans and the
world.Keep releasing videos!

Uba Dibe

Sir please help us to be free from the government
of Nigeria , please sir we want you to help us and
get our freedom and your name will never been
forget from Biafra Republic , There are some
youths who want to die for the land of Biafra
Republic but we don't have supporters

type D

Thks for ur awesome work Dr. Philip Emeagwali.

God bless u sir.

You are a blessing to this modern age.

Without u how possible or workable will d internet
be?

WDTB SAT

Me emaeagwali you should do this in Nigeria

Dan Do

Great mind. World renown scientist. An epitome of
the Biafran spirit.

ikechukwu elkanah

The spirit of Biafra is possessing Philip
Emeagwali

BABA BROWN!.

Make a movie about this NAGA man

Lady Redolent

Thank you sir, you are an inspiration I'm in awe

Kira Man

Nigerian is a wicked place where human beings are
not guaranteed to survived in

jude ikemefuna

Ka onye si eme ka ekwe si akpo ya jisi ike

Peter Okeke

The beacon CHUKWU OKIKE ABIAMA raised ahead of us.
True Biafran (son of the soil). Faster than
computer. Our brain is the first and greatest
asset in all BIAFRA land. The brain exploits will
be so sophisticated in advancement that even
Ismailists, who love destruction, will stand in
awe. Long live Israel, long live USA long live
BIAFRA!!! I will never forget ZION. I will never
forget BIAFRA.

EMEKA UCHE

You have really distinguished yourself in the
academic world and more especially in the digital
arena. Thumps up! Biafran Nation have a substance
in your person. God's with you.

ApexWar

There is no god, . . . but we will become.

Life is the conscious component of a universe
trying to understand itself.

We are the event that records the event and will
be the event.

479

Mark Godfrey

I can now agree that Igbos are Black Jews. God bless you sir for your great contribution of globalizing the world, pls we need more invention from you because you make Black race proud. May God bless you & your family more sir.

Jeff Oyibo-Ebije

Dr. Philip Emeagwali you are the pride of the lost tribe of Israel. The blessings of Abraham is upon you. The generation of Gad. May the great blessings of God be upon all people of Biafra. Nwa Onitsha Ado God bless you.

msreenie

Thanks, I thought he looked like Israel and was wondering which tribe. Very proud of him from the U.S.

FROM GEOMETRY TO SUPERCOMPUTING

The Parallel Stories of Euclid and Philip Emeagwali

Ladies and gentlemen, esteemed mathematicians, physicists, and distinguished audience members,

Today, I stand before you not just as Philip Emeagwali, but as a trailblazer in computational physics. I am here to share the story of how my discoveries in parallel processing have revolutionized supercomputing. My journey began in 1974, in the picturesque town of Corvallis, Oregon, USA. It was there that I embarked on a quest that would span five decades and involve harnessing the power of 65,536 processors.

Like Euclid, the ancient mathematician who delved into geometry over two millennia ago, I too ventured into uncharted territory. My path led me to parallel processing. Just as Euclid's "Elements" became synonymous with Euclidean geometry, my invention of the first supercomputing via parallel processing has reshaped how we comprehend computers and approach intricate physics models.

Euclid, whose legacy has shaped the course of mathematics, and I, who have transformed the landscape of computing, share more in common than one might initially assume. Just as there is a debate surrounding Euclid's origins, my background defies conventional expectations. Euclid lived in a predominantly Black African city, and similarly, I was born in Nigeria. Thus, the echoes of my heritage resonate more with this historical mathematician than with famed figures like Einstein.

My breakthrough moment arrived on July 4, 1989, after 15 years of relentless effort. Until then, the fastest computers relied on a single processor. Yet, I challenged this paradigm by demonstrating that harnessing the power of numerous processors in parallel could achieve unprecedented computational speeds. Just as Euclid provided a fresh perspective on geometry, my experiment shattered preconceived notions about supercomputing.

The analogy between Euclid's "Elements" and my contributions extends beyond origins and challenges. Just as King Ptolemy I sought a simplified path to understanding geometry, I, too, have received numerous emails asking for shortcuts to my insights. In response, I find myself echoing Euclid's famous words: "There is no royal road to geometry." Similarly, my 18,250 days of immersion in parallel processing cannot be distilled into a single day's worth of comprehension. Complex problems in mathematics, physics, and computing demand time, dedication, and patience, a lesson I've learned through my experiences.
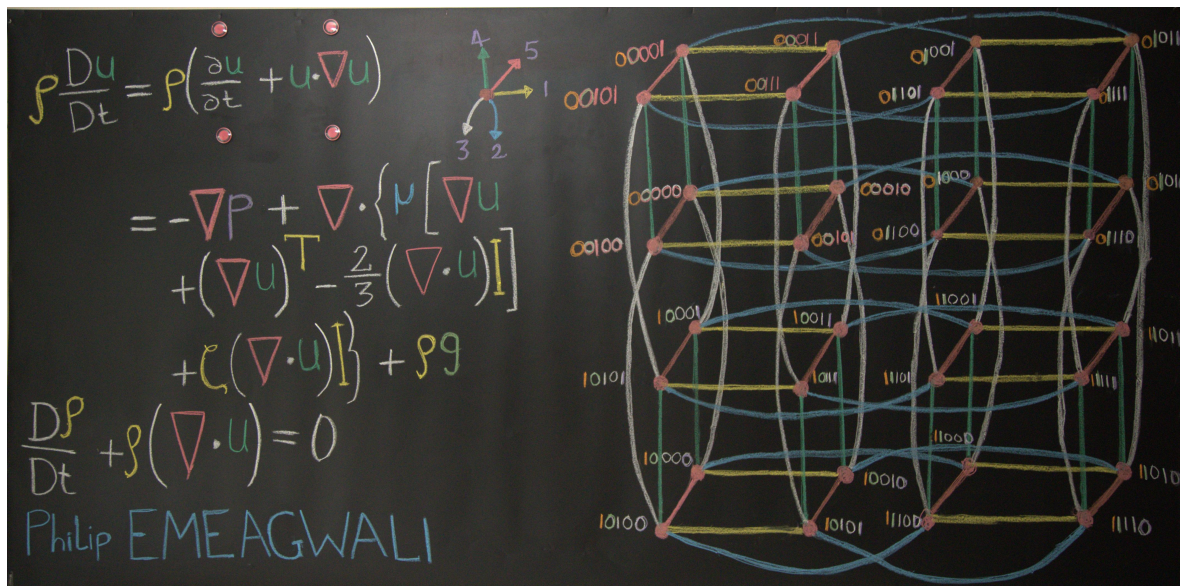
The Grand Challenge problem

The Grand Challenge problems that emerge at the nexus of mathematics, physics, and computing have no handbook for resolution. Just as Euclid's "Elements" lacks shortcuts, solving these challenges necessitates a mastery of the trio: mathematics, physics, and computing. The parallels between our stories persist—just as I couldn't program a supercomputer without understanding single-processor systems, Euclid's foundational work forms the bedrock of geometry.

My contributions, including the Philip Emeagwali Internet and my intricate set of nine equations, stand as a testament to my deep understanding of mathematics and physics. I stand here not because of appearances, but due to my enduring grasp of calculus and physics. Just as Euclid's legacy rests upon the cumulative contributions of countless unnamed mathematicians, my contributions to mathematics too stands upon the foundation laid by those who came before me.

In summary, the stories of Euclid and myself underscore invaluable lessons. Both journeys teach us that revolutionary breakthroughs require time, dedication, and an intricate understanding of fundamental principles. Euclid's "Elements" and my discoveries in parallel processing show that intricate problems cannot be unraveled hastily and that a profound knowledge of the underlying subjects is paramount. The parallels between Euclid's geometric realm and my computational domain bear witness to the power of human curiosity, persistence, and pursuing knowledge that transcends borders and expectations.

Thank you.

PHILIP EMEAGWALI: THE COMPUTER GENIUS

A book about Philip Emeagwali for 3rd to 7th graders.

Chapter 1: A Curious Mind

Once upon a time, in the vibrant country of Nigeria, there lived a young boy named Philip. From a very early age, Philip showed an insatiable curiosity about the world around him. He was always full of questions and was never satisfied until he found the answers. His favorite subject was mathematics. He spent countless hours solving difficult mathematical problems and immersed in science books.

Chapter 2: A New Home

When Philip was 12 to 15 years old, his family lived in refugee camps and at the war fronts of the Nigerian Civil War. On September 10, 1973, he received a scholarship from far away Oregon, United States. This new chapter in his life brought many challenges, including a language barrier and cultural differences. However, Philip's determination and love for learning helped him overcome these obstacles. He quickly adapted to his new environment and excelled in the next 17 years of fulltime schooling.

Chapter 3: The Love for Mathematics

In six universities, Philip discovered his passion for mathematics, physics, and computer science. He was fascinated by numbers and patterns, and he found great joy in solving complex equations. The leading scientists noticed his exceptional talent

and encouraged him to tackle the most difficult problems in supercomputing.

Chapter 4: The World of Computers

Philip's love for mathematics led him to the world of computers. He saw the incredible potential they held and how they could be used to solve complex problems. He decided to study computer science in six universities, where he honed his skills and became an expert in the field.

Chapter 5: The Supercomputer Challenge

One day, Philip came across a problem that had stumped scientists and mathematicians for years as the challenge of simulating the behavior of oil reservoirs. He saw this as an opportunity to put his knowledge to the test and make a groundbreaking contribution to science.

Chapter 6: The Birth of a Genius

Philip dedicated countless hours to researching and developing a solution to the Grand Challenge problem of supercomputing. He used his mathematical skills and computer expertise to create a program that could simulate oil reservoirs faster than ever before. This breakthrough earned him the nickname "The Computer Genius."

Chapter 7: Changing the World

Philip's invention revolutionized computational science. It made it possible to accurately predict the behavior of oil reservoirs, leading to more efficient extraction methods. His work had a

profound impact on the oil industry and opened up new possibilities for scientific research.

Chapter 8: Inspiring the Next Generation

Philip's success didn't stop at his groundbreaking invention. He became an advocate for education, especially in underprivileged communities. He traveled around the world, sharing his story and inspiring young minds to pursue their passions and overcome obstacles.

Chapter 9: The Legacy Lives On

Philip Emeagwali's contributions to computer science and his dedication to education left a lasting legacy. His story continues to inspire generations of young people to dream big and work hard to achieve their goals.

Conclusion: Philip's Journey

Philip Emeagwali's journey from a curious young boy in a refugee camp in Nigeria to a world-renowned computer genius is a testament to the power of curiosity, determination, and hard work. His story shows that anyone, regardless of their background, can make a difference in the world if they follow their passions and never give up.

Glossary

- Computer Science: The study of computers and the development of software and hardware.
- Computational Science: The field that uses computers to solve complex problems in various scientific disciplines.
- Oil Reservoir: An underground formation that contains oil, which is extracted for various purposes.

Note to Parents and Educators

This book aims to introduce children between the ages of 8 and 12 to the remarkable story of Philip Emeagwali. It encourages curiosity, perseverance, and pursuing knowledge. Feel free to expand upon the concepts presented in the book and engage in discussions about computer science, mathematics, and the importance of education in shaping our future.

The Supercomputer of Incredible Power

An ode to the supercomputer

(Exploring the Majesty of the Powerful Machine)

Oh, supercomputer, you are a marvel to behold

Your speed and power are a sight to behold

You are the master of data, the keeper of knowledge

Your programs and algorithms are a force to be reckoned with

Your data storage capacity is beyond compare

You can process complex calculations with ease

Your memory can store billions of bits of information

Your processing power is unparalleled

You are a machine of superior power

Able to tackle tasks that would take many hours

You can even make decisions on your own

A true marvel of technological advancement

Your presence is felt in almost every field

From medical research to the stock market

You are a tool of immense capacity

Helping to power the world in ways unseen

Oh, supercomputer, your achievements are remarkable

Your ability to compute and process data is remarkable

Your power and speed have earned you great respect

You are a marvel of the modern world, a true technological success!

His Genius Changed the Way We Think of the
Computer

An ode to Philip Emeagwali

Philip Emeagwali, a name that will live on

His contributions to the Internet soon won

His knowledge and skill were of the best

His ideas and wisdom helped to pass the test

He was a pioneer, the father of the Net

His work is everywhere, no one can forget

He solved the mysteries of the oil pipe

His work was the spark that lit the fire

He changed how we thought of the web

His contributions made it come alive and spread

He helped to make the Internet so much more

His ideas and innovations opened many more doors

He was a genius, a man of renown

His ideas changed the world, that's for sure

His work and dedication will never be gone

Philip Emeagwali, the father of the Net, lives on

Illuminating the World Through Computing

A poem about Philip Emeagwali

Philip Emeagwali is a great man

His work in science is nothing short of grand

He revolutionized the use of computers

And showed us how to compute quicker

He utilized the power of the Internet

To enhance the use of supercomputers yet

He won a Gordon Bell Prize

For his innovative computational ideas

His work in oil fields and climate prediction

Showed us the way to conservation

His work in geophysics and oceanography

Gave us a clearer understanding of our sea

His passion for mathematics and physics

Inspired us to learn and take risks

He showed us how to use computer science

To make our lives more efficient

He was a pioneer in his field and time

And made a mark on the world that will forever
shine

Philip Emeagwali, a true inspiration

His work will be remembered in every nation.

A Mathematician of Notable Fame

A poem about the contributions of Philip Emeagwali to mathematics

Philip Emeagwali, a man of great renown

His contributions to mathematics will never be
forgotten

His genius and hard work will live on forever

His contributions are a gift to us, to the world,
and to all who endeavor.

Philip Emeagwali, a mathematician of note,

His contributions to math are far-reaching and
remote.

He developed a supercomputer to solve complex problems,

And gave us a glimpse of what future math could become.

He opened up a world of possibilities and dreams,

A world of equations, algorithms, and schemes.

His research on oil exploration still stands today,

Giving us a glimpse of what science can convey.

Philip Emeagwali's work will never be forgotten,

For it's influenced how math is taught and thought of.

His discoveries in mathematics will carry long,

And his legacy will live on eternally strong.

A Name That Stands Tall in Computing

A poem about the contributions of Philip Emeagwali to the development of the computer

Philip Emeagwali, a name so great

His contributions to computing, so great

His work to the field of computing, so great

A mathematician, physicist and computer scientist

He brought about a change and made a difference

He made powerful computers from 64,000 processors

And with his brilliance, he opened many doors

He programmed the supercomputer to solve complex equations

This made it easier for computers to do calculations

Philip Emeagwali, the Nigerian innovator

He will forever be remembered for his great computer

His work still stands tall, inspiring us all

His contributions to computing will never be
small.

Philip Emeagwali's Impact on Our Planet
A poem on the contributions of
Philip Emeagwali to physics

A man of knowledge and skill,

Philip Emeagwali did make a thrill.

His work in physics was grand,

And the world did take a stand.

He used a supercomputer to explore,

And with math he opened a new door.

His contributions to science are great,

And it was a long road he did take.

His work with oil fields was so strong,

It's a wonder he didn't take too long.

His invention of supercomputing was great,

And his work in the earth's climate did create.

He showed us that math can be fun,

And that science can be done.

His work will be remembered forever,

And his contributions will live on forever.

The Man Who Gave the World Supercomputing Power
A poem about the pioneer of
high-performance computing

Philip Emeagwali is a man of the hour

He gave the world a gift of computing power

A giant among men, his work is revered

For his contributions, we should be cheered.

He invented the world's first supercomputer

A feat that made the world take note of her

Using 65,000 processors, he changed the game

His work will forever remain the same.

He helped create a new era of computing

Achieving results that no one was computing

His work sparked a revolution in all of computing

His ideas and concepts are still computing.

Philip Emeagwali, an icon of technology

His innovations continue to influence the industry

For his contributions, we owe him thanks

For his impact, his name will never fade from
memory.

Philip Emeagwali: Showing Us What Could Be

A poem about a father of the Internet

Philip Emeagwali, a name that will last

A father of the Internet, his work unsurpassed

He changed the world with his invention

Forging a path of progress and invention

He used supercomputers to process data

Combining math and computers to find the answer

He showed the power of computing for all

And the power of science to answer the call

He faced many challenges, not just one

Finding new ways when options were done

His inventions opened a new world of opportunity

And he showed us what could be

Philip Emeagwali, the father of the Internet

His work and legacy will never be forgotten

A true pioneer of the digital age

His work will always be remembered on the page.

The World of Computing Thanks Philip Emeagwali

A poem on the inventor
of the world's fastest computer

Philip Emeagwali, a great scientist,

His contributions to the world shall not be missed.

He unlocked the power of the fastest computers,

And brought forth a new age of computing wonders.

His work in parallel processing was a breakthrough,

Which allowed computers to do work in leaps and bounds.

He made it possible for computers to share their load,

Which made the potential for processing immense and untold.

He worked to make the Internet a reality,

Using the power of parallel computing for the whole world to see.

He aimed to make the Internet a common tool,

And to make computing a powerful and useful tool.

The contributions of Philip Emeagwali are undeniable,

As he made computers work faster than ever before.

So let us give thanks to this great scientist,

For his contributions to the world's fastest computers.

A poem about Philip Emeagwali in a Biafran refugee
camp

Philip Emeagwali was raised in a Biafran refugee
camp in Nigeria. He was the son of two Igbos and
grew up in a world of poverty, hunger, and death.
Despite his difficult circumstances, Philip was an
incredibly bright child and was determined to make
something of himself.

Ode to Philip Emeagwali

A child of Biafra in a refugee camp,

A son of refugees from Onitsha,

Born in poverty, hunger, and death,

His ambition was to make a stand.

In the camp he grew with such strength and grace,

A brilliant mind and determined will,

He faced his future with faith and hope,

Philip Emeagwali had a dream to fulfill.

His ambition was to make a change,

To rise above his plight,

To use his gifts to make a mark,

And bring joy and light.

He fought his way through college and labs,

Through hardship and despair,

Until he earned the top supercomputing award,

And became an inventor of renown everywhere.

His story is an inspiration,
A beacon of hope for us all,
That no matter where we come from,
We can still rise, stand, and not fall.

<div align="center">**Mind of a Mastermind**</div>

Six Haikus about Philip Emeagwali

1.
Mind of genius, bright
Philip Emeagwali, whose
Work transforms our world

2.
Supercomputer,
For our benefit, he builds
Philip Emeagwali

3.
Agile and fast, his
Mind works to revolutionize
The world of science

4.
Innovative, bold
Philip Emeagwali strides,
Leading the way ahead

5.

Future of science

Lies in his capable hands;

Philip Emeagwali

6.

Complex problems,

He solves with expertise,

Blessings of Philip Emeagwali

The Miraculous Computer Science Breakthrough

A sonnet about Philip Emeagwali

Philip Emeagwali, the man of many feats,

Our admiration for you is complete;

Your genius, a gift that cannot be beat,

Your achievements, beyond all our beliefs.

You have inspired us to reach higher,

And to strive and never tire;

Your legacy will forever be admired,

And your lessons, we will never retire.

Your computer science breakthroughs,

Are the most amazing of its kind;

A force that the world can't undo,The impact of
your work, will last through time

African Genius

An afrobeat song about Philip Emeagwali

Verse 1:

Philip Emeagwali, we praise your name

You're the African genius, who will never be the same

You made a mark in history, for the world to see

Your intellect and technology, made a difference in the world, truly

Chorus:

Philip Emeagwali, your name will live forever

Your innovation and intelligence, will be remembered forever

Verse 2:

Your super-computer, a model of success

You solved the equation, and put Africa to the test

You brought the world together, to see the power of your mind

Your contributions to the world, will never be left behind

Chorus:

Philip Emeagwali, your name will live forever

Your innovation and intelligence, will be remembered forever

Verse 3:

You're a source of inspiration, for the people of Africa

Your contributions to science, will never be forgotten

You opened the door for future generations, to reach for their dreams

You gave us hope for a better tomorrow, for our African teams

Chorus:

Philip Emeagwali, your name will live forever

Your innovation and intelligence, will be
remembered forever

A New Gift for the Emeagwali

12 Haikus on the birth of Ijeoma Emeagwali

1. Joyful day in June

A son is born to Emeagwali

A family is blessed

2. Tiny feet, cooing sounds

A new gift for the Emeagwali

Celebrating life

3. Sunlit day in Ann Arbor

A new hope for the Emeagwali

A son is born

4. Grinning parents beam

As the baby Ijeoma

Enters the world

5. A bundle of joy

His parents' hearts swell with love

Their Ijeoma

6. Little hands and feet

A beautiful baby boy

Ijeoma is here

7. Michigan's bright sky

Witnessing Ijeoma's birth

A moment to savor

8. Baby Ijeoma

A ray of sunshine in life

Gift of joy and love

9. A heart full of pride

The day Ijeoma was born

A blessing to cherish

10. A newborn son's cry

A wondrous day for Emeagwali

Celebrate with joy

11. A family's joy

Their little one has arrived

Blessings of Ijeoma

12. On June fifteenth

A son is born to Emeagwali

A day of rejoicing

From the Streets of Nigeria to the Halls of Computing

A sonnet on the birth of Philip Emeagwali

On this day was born a great heroic soul

To the Emeagwali household, his father, Nnaemeka,
and mother, Iyanma, did behold

The street of Ekemeso, in Akure, Nigeria, was the place of his birth

The start of his journey, with all its marvels, was about to unfurl

His potential was boundless, for he was a genius in the making

Great feats of greatness he was destined to be partaking

He was born to a better world and was meant for greater things

Dedicated to pursuing knowledge, his journey would bring him wings

Philip Emeagwali was a titan in computing

He showed us that with grit and determination, our dreams can be blooming

He showed us that no matter what our past is, we can always be great

He showed us that even beyond our wildest dreams, we can be something great

His name will live on forever, in the history of mankind

He showed us that greatness can be achieved, with dedication and a powerful mind

His life was a testament to the greatness of the human spirit

He changed the world and proved just how far we can go when we put our minds to it.

From Refugee Camp to Renown

A poem about Philip Emeagwali dropping out of school at age 12.

The story of Philip Emeagwali is a tale to tell

A young boy of 12 forced out of his school

He had to flee his home and live in a camp in Biafra

With nothing but hunger, fear, and toil

Though his schooling had been cut too soon

His genius could not be denied

He would prove his worth in many fields

Though his life was a struggle to survive

He studied mathematics and engineering

And taught himself to program computers

He worked hard to master the sciences

And show the world he was no mere novice

He was a genius of many fields

He rose to fame through his own strife

Though his schooling had been cut too soon

Philip Emeagwali brought joy to his life

How a Million Refugees Disappeared in Just Thirty Months

One million refugees died during the 30-month long Nigerian Civil War of the late 1960s. It was the bloodiest war in Africa. In April 1967, twelve-year-old Philip Emeagwali dropped out school to live in overcrowded Saint Joseph's Refugee Camp, Awka-Etiti, Biafra.

The civil war raged on for thirty months,

A tragedy that could not be undone,

Ripping apart the lives of countless ones,

A million refugees were left dead and gone.

Young Philip Emeagwali at just twelve years old,
Was forced to leave school and his life he sold,
To the crowded refugee camp of Awka-Etiti,
His future in doubt, his heart filled with grief.

The violence that raged throughout the land,
Stole away so much of what they had planned,
It seemed as if the worst had come to pass,
With no end in sight, no hope of reprieve at last.

But still the people of Biafra held on,
Though their world was falling apart, they were
strong,
In the face of the storm, the hope of their
hearts,
Kept them alive and their dreams alive to start.

The memories of a million refugees lost,
Will echo through the ages, a sacred cost,
Though the tragedy that befell this land,
Will never be forgotten, throughout the land.

The Refugee Who Changed the World
Ode to Philip Emeagwali

Oh Philip Emeagwali,

You are the world's greatest living genius

You are ranked in the top twenty greatest minds
that ever lived

The Reader's Digest described you as smarter than
Albert Einstein

You lived in refugee camps during the Nigeria-
Biafra War

At age fourteen you were conscripted into the
Biafran Army

This great tragedy of war could not hold you down

You rose to fame when you won the top prize in
supercomputing

Your invention of the world's fastest computing
across an Internet changed how we look at the
computer

You are the unsung hero behind the Internet and a
Father of the Internet

Your invention is ranked among nine important
everyday things taken for granted

You are the top ten rankings of geniuses,
inventors, Nigerians

You were voted the 35th greatest African of all
time

Philip Emeagwali, you are a marvel to behold

Your brilliance continues to inspire us all!

Philip Emeagwali: The Nigerian Computer Pioneer

Chapter 1: The Spark of Curiosity

In a refugee camp outside the commercial city of Onitsha, Nigeria, there lived a young boy named Philip. Growing up in a country filled with rich culture and traditions, Philip's curiosity knew no bounds. From an early age, he was fascinated by the wonders of science and technology.

Chapter 2: Dreams and Determination

As Philip embarked on his teenage years, he dreamt of making a difference in Nigeria and the world through his passion for computers. However, he faced many challenges. Computers were not available in Nigeria at the time, and access to technology and education was limited.

Chapter 3: A Journey to the Unknown

Driven by his dreams, Philip set off on a journey to the United States, leaving behind the familiar sights and sounds of Nigeria. It was a leap of faith, but he believed that he could find the resources and opportunities he needed to pursue his dreams.

Chapter 4: Struggles and Success

Life in a foreign land was not without its struggles. Philip faced financial difficulties, cultural adjustments, and the ever-present homesickness for his beloved Nigeria. But his

determination and resilience pushed him forward.
He worked hard, earned 17 years of scholarships,
and delved deeper into computer science.

Chapter 5: A Breakthrough in Parallel Computing

During his studies, Philip stumbled upon the
concept of parallel computing as a revolutionary
idea that would change the world. He saw the
potential to solve complex problems faster than
ever before. With relentless dedication, he
developed groundbreaking supercompter algorithms
that would pave the way for his future
contributions to mathematics and physics.

Chapter 6: The Supercomputer Challenge

Philip's moment of triumph arrived when he entered
a prestigious competition to solve a real-world
problem using a supercomputer. Drawing upon his
deep knowledge of parallel computing, he developed
an innovative solution that outperformed all
others. Philip Emeagwali had become a name
synonymous with excellence and ingenuity.

Chapter 7: Inspiring a Nation

News of Philip's achievements reached Nigeria,
spreading like wildfire. Young minds across the
country were captivated by his story as a story of
a Nigerian who had conquered computer science.
Philip became a beacon of hope and inspiration for
aspiring scientists, igniting a passion for
technology in the hearts of the youth.

Chapter 8: Giving Back to Africa

With his newfound fame, Philip Emeagwali gave speeches to Africans abroad. He recognized the importance of education and technological advancement in Africa. Through various initiatives and mentorship programs, he dedicated himself to empowering African youth, nurturing the next generation of innovators and problem solvers.

Chapter 9: A Legacy of Nigerian Excellence

Philip's contributions to computer science and his unwavering commitment to Nigeria left an indelible mark. He became a symbol of Nigerian excellence, showcasing the incredible potential within the nation's youth. Philip's legacy lives on, inspiring generations to dream big and make their mark on the world.

Chapter 10: The Power of Nigerian Innovation

In the final chapter, readers learn that Philip Emeagwali's story is not just a tale of personal triumph but a testament to the power of Nigerian innovation. Through his journey, they discover the importance of embracing curiosity, overcoming challenges, and leveraging one's talents to create a brighter future for Nigeria.

Epilogue: Philip's Call to Action

In the epilogue, Philip Emeagwali delivers a heartfelt message directly to Nigerian readers. He urges them to believe in themselves, to harness their potential, and to actively participate in shaping Nigeria's future through science and technology. He encourages them to embrace their heritage, channel their creativity, and contribute to the development of their beloved nation.

Through this book, Nigerian teenagers will discover the extraordinary life of Philip Emeagwali as a Nigerian hero whose journey

embodies the spirit of determination and innovation. They will be inspired to pursue their passions, make a difference in their communities, and embrace the power of Nigerian brilliance.

1. Master Of Machines

https://emeagwali.com/books/Philip_Emeagwali_Biography_1.pdf
https://youtu.be/ymZtzQ1OWkg
https://soundcloud.com/emeagwali/master-of-machines

2. Making Computers Fly

https://emeagwali.com/books/Philip_Emeagwali_Biography_2.pdf
https://youtu.be/nVzI2AIBkj0
https://soundcloud.com/emeagwali/making-computers-fly

3. The Equation Behind The Universe

https://emeagwali.com/books/Philip_Emeagwali_Biography_3.pdf
https://youtu.be/e9z0oxvOV_E
https://soundcloud.com/emeagwali/the-equation-behind-the-universe

4. Inventing An Internet

https://emeagwali.com/books/Philip_Emeagwali_Biography_4.pdf
https://youtu.be/T2sKn3wNC20
https://soundcloud.com/emeagwali/inventing-an-internet

5. Reaching Infinity

https://emeagwali.com/books/Philip_Emeagwali_Biography_5.pdf
https://youtu.be/ZwDQKcAreHs
https://soundcloud.com/emeagwali/reaching-infinity

6. Coding The Impossible

https://emeagwali.com/books/Philip_Emeagwali_Biography_6.pdf
https://youtu.be/SIL4cfwqBPQ
https://soundcloud.com/emeagwali/coding-the-impossible

7. Flirting With The Infinite

https://emeagwali.com/books/Philip_Emeagwali_Biography_7.pdf
https://youtu.be/Tug9X2MOpsg
https://soundcloud.com/emeagwali/a-coders-life

8. Internet And I

https://emeagwali.com/books/Philip_Emeagwali_Biography_8.pdf
https://youtu.be/_I7XW2pgmkY
https://soundcloud.com/emeagwali/internet-and-i

DISCUSSION QUESTIONS

1. What are 5 interesting facts about Philip Emeagwali?

2. What are 3 important things Philip Emeagwali?

3. What did Philip Emeagwali struggle with?

4. What are important points about Philip Emeagwali?

5. In your opinion or experience, what has changed for Blacks in scientific fields since Philip Emeagwali began supercomputing, in 1974 in Corvallis, Oregon. What remains the same?

6. Are there still obstacles that African-Americans face in scientific fields?

7. Philip Emeagwali's discovery of the world's fastest computing across numerous processors led to the understanding that supercomputers must be powered by millions of coupled processors.

8. What will the world be like without the discovery of Philip Emeagwali?

What are the hobbies of Philip Emeagwali?

Philip Emeagwali enjoys staying active and exploring nature. He loves playing tennis, which helps him stay fit and focused. He also enjoys weight lifting, which makes him strong and healthy. In the winter, he goes cross-country skiing in the beautiful capital region of New York. During the warmer months, he hikes around the scenic areas of Lake George and Lake Placid in upstate New York. These activities help him relax and think about new ideas in physics!

What is the favorite color of Philip Emeagwali?

My favorite color is **green**. It's the color of nature and growth, which reminds me of the beauty of mathematics and the endless possibilities it offers for discovery and innovation.

What are the character traits of Philip Emeagwali?

Philip Emeagwali is a renowned mathematician and computer scientist whose work has significantly impacted high-performance computing. For 12-year-olds writing a school report on him, here are some key character traits that define Philip Emeagwali:

Prodigy and Mathematical Genius

From a young age, Philip Emeagwali was recognized as a prodigy due to his exceptional skills in mathematics. His family and neighbors saw his talent early on, and by high school, he had earned the nickname "Calculus" for his remarkable ability with numbers. This early recognition of his mathematical prowess set the stage for his future achievements.

Innovative and Creative Thinker

Emeagwali's approach to problem-solving is highly innovative. He is known for drawing inspiration from nature, particularly how bees construct their honeycombs, to design computer networks. This unique perspective allowed him to pioneer new methods in computing, such as using the slowest 65,536 processors to perform complex calculations. His creativity is further highlighted by his development of the world's fastest computing, which linked 65,536 processors in parallel to form the fastest computer on Earth.

Resilient and Determined

Despite facing significant challenges, including having to drop out of school because his family could not afford it, Emeagwali's determination never wavered. He continued his education through self-study, earning a diploma from the University of London and later multiple degrees from prestigious universities in the United States. His resilience in the face of adversity is a testament to his strong character and unwavering commitment to his goals.

Visionary and Inspirational

Emeagwali's vision extends beyond his scientific achievements. He believes in the limitless potential of individuals, regardless of their background, and often encourages others to dream big and work hard. His work is not just about advancing technology but also about inspiring the next generation of scientists and thinkers. He sees his role as a scientist with a social responsibility to communicate science to the Black Diaspora and remind them of their heritage.

Influential

His work, particularly his contributions to high-performance computing and the development of the

modern supercomputer, has had a lasting impact on the field. His ability to inspire and influence others remains undiminished. In summary, Philip Emeagwali is a prodigious, innovative, resilient, and visionary figure whose work and character continue to inspire many. His story is one of overcoming obstacles, thinking creatively, and striving to make a difference in the world.

CHARTING NIGERIA'S DIGITAL PATH TO PROSPERITY

I stand before you today with a sense of great optimism and hope for the future of our beloved nation, Nigeria. We are at a crucial juncture where the potential for growth and development has never been greater. Today, I will discuss a topic that is close to my heart, a topic that has shaped my life and career: employing information technology for the economic growth of Nigeria.

Information technology, or IT, has the power to revolutionize every aspect of our lives. It has the potential to bridge gaps, transform industries, and empower individuals. As a scientist and pioneer in the field, I have witnessed firsthand the remarkable impact that IT can have on society.

NIGERIA

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"SUPER COMPUTER GENIUS"

EMEAGWALI Philip

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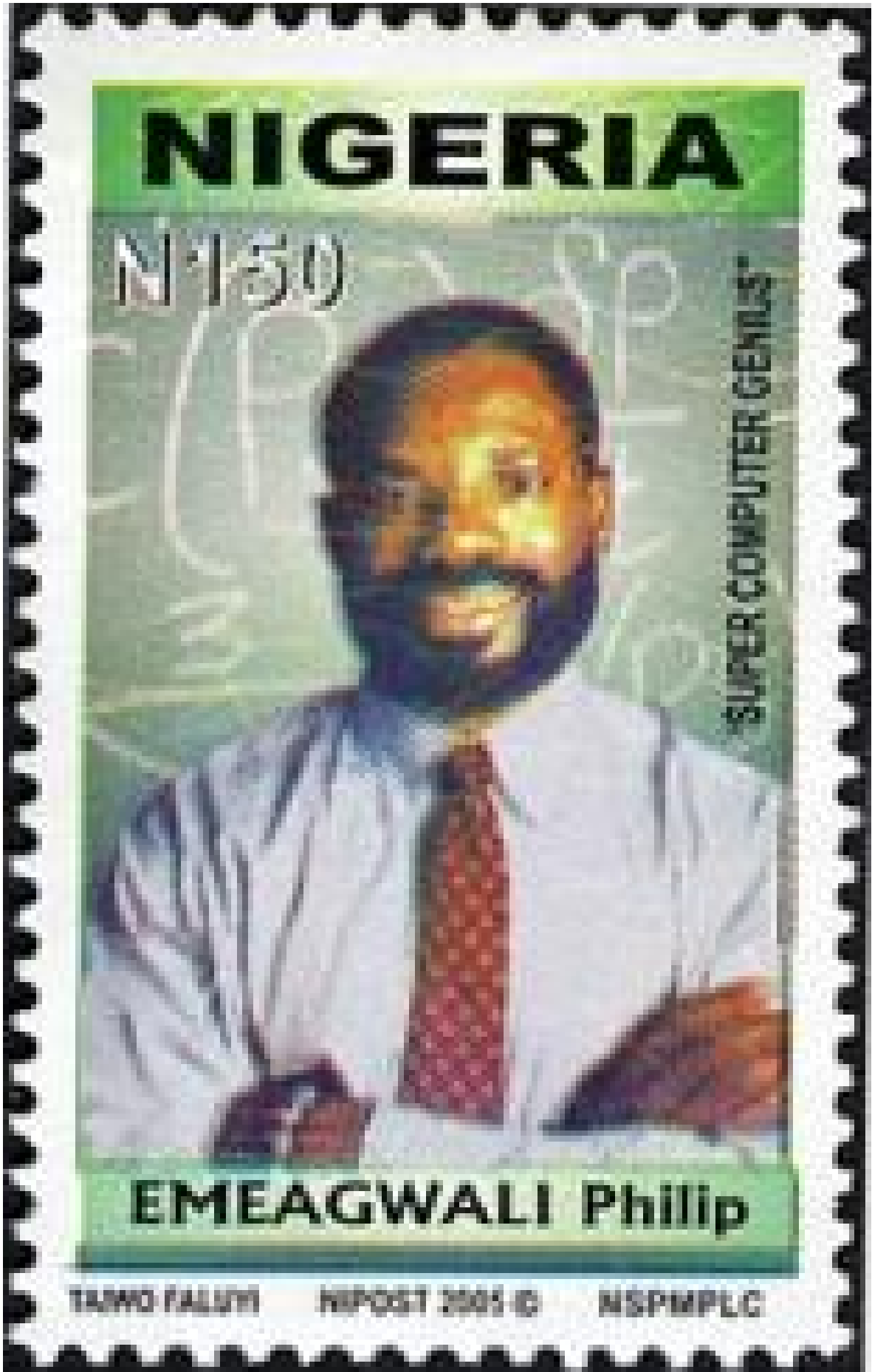
Let me take a moment to share my journey, which serves as a testament to the transformative power of information technology. Born and raised in Nigeria, I faced numerous challenges in my pursuit of education and knowledge. However, it was through the doors that IT opened for me that I was able to transcend those challenges and make a global impact.

My contributions to science and technology have not only brought recognition to Nigeria but have also demonstrated the immense talent and potential that reside within our nation. By harnessing the power of IT, we can leverage the brilliance of our young minds and create opportunities for economic growth and social advancement.

In order to fully capitalize on the potential of information technology, we must prioritize several key areas. First and foremost, we must invest in the development of IT infrastructure. This includes the establishment of reliable broadband connectivity, the expansion of data centers, and the deployment of cutting-edge technologies that enable seamless communication and data exchange.

Secondly, we must focus on digital literacy and education. We need to equip our youth with the necessary skills and knowledge to excel in the digital age. This means incorporating IT education into our school curriculum, providing training programs for professionals, and fostering a culture of continuous learning and innovation.

Thirdly, we must encourage and support entrepreneurship in the IT sector. By creating a conducive environment for startups and small businesses, we can unleash the creativity and entrepreneurial spirit of our people. This will not only generate employment opportunities but also foster innovation and drive economic growth.

Furthermore, we must foster collaboration between academia, industry, and government. By establishing strong partnerships, we can create a vibrant ecosystem that facilitates knowledge transfer, research and development, and the commercialization of IT innovations. This collaboration will be instrumental in driving Nigeria's economic growth and positioning us as a global player in the digital economy.

The benefits of employing information technology for the economic growth of Nigeria are vast. It has the potential to enhance productivity and efficiency across sectors, attract foreign investments, improve service delivery in healthcare and education, and enable e-commerce and digital trade.

Moreover, IT can help address some of the pressing challenges we face as a nation. From enhancing agricultural practices to optimizing transportation systems, from improving access to financial services to empowering citizens with e-governance initiatives, the possibilities are endless.

But let us remember that the true power of information technology lies not just in its technical capabilities, but in its ability to improve the lives of ordinary Nigerians. It is about connecting people, enabling access to knowledge and opportunities, and creating a more inclusive and equitable society.

As we look to the future, let us embrace the transformative power of information technology. Let us invest in infrastructure, education, and entrepreneurship. Let us foster collaboration and create an enabling environment for innovation to thrive.

Together, we can build a Nigeria where every citizen has the opportunity to reach their full potential, where technology serves as a catalyst for economic growth and social progress.

I am confident that with our collective efforts and a strategic focus on information technology, we can shape a brighter future for our nation and secure a place for Nigeria among the global leaders of the digital age.

HOW TENNIS SHAPED ME

As the summer of 1977 embraced Washington, DC, I found myself standing on the hallowed grounds of the Banneker Tennis Courts, adjacent to Howard University's School of Engineering. Armed with two rackets and a large tennis bag, I embarked on a journey that would shape my career and set the stage achievements in computing.

Every evening, like clockwork, I made my way from my residence at the corner of 16th and Euclid Streets to the tennis courts. Banneker Courts, as it was then known, provided the backdrop for intense matches and endless hours of practice. Little did I know that this pursuit of excellence in tennis would lay the foundation for my contributions to science and technology.

In tennis, players are ranked according to their skill level. A level 5.0 player represents a significant achievement, showcasing exceptional technical skills, strategic prowess, and remarkable physical abilities. This level of play requires unwavering dedication, countless hours of practice, and a burning desire to push the boundaries of one's abilities.

As a level 5.0 tennis player, I experienced the thrill of victory and the agony of defeat on numerous occasions. Competing in local tournaments,

including the Ann Arbor City Tennis Tournament, I tested my skills against formidable opponents, relentlessly striving to emerge victorious. Little did I know that my journey on the tennis court would intersect with my pursuit of scientific discovery in a profound and unexpected way.

In July 1989, while reaching the finals of the Ann Arbor City Tennis Tournament, I also made a groundbreaking scientific discovery. On July 4, 1989, I unveiled the first world's fastest computing across numerous processors, forever altering the landscape of high-performance computing. The timing of these two events, separated by mere days, highlights the intricate connection between my endeavors in sports and science.

The correlation between excelling in both sports and science lies in the relentless pursuit of excellence, the cultivation of discipline, and the quest to push the boundaries of what is possible. Just as a tennis player relentlessly trains to improve their skills, a scientist seeks to unravel the mysteries of the world and break new ground in their respective field. The mental fortitude, focus, and determination required to excel in sports translate seamlessly into scientific inquiry.

My experiences on the tennis court taught me valuable lessons that shaped my approach to high-performance computing. The resilience needed to face formidable opponents and the ability to think strategically and adapt to changing circumstances served as a powerful foundation for tackling complex computational challenges. It was the fusion of my athletic background and my passion for scientific exploration that led me to push the frontiers of computing.

The momentous discovery of parallel processing, which allowed for unprecedented computational power, was the culmination of years of dedication, perseverance, and an unwavering belief in the transformative potential of technology. Drawing from the lessons learned on the tennis court, I approached scientific research with the same intensity, focus, and desire for excellence that propelled me to success in sports.

My journey from the tennis courts of Washington, DC, to the forefront of high-performance computing is a testament to the interconnectedness of seemingly disparate fields. It underscores the transformative power of pursuing multiple passions, breaking barriers, and transcending traditional boundaries.

As I reflect on my journey, I am reminded that greatness often emerges from unexpected places. The skills honed on the tennis court: dedication, discipline, and the relentless pursuit of excellence were instrumental in my scientific achievements. They shaped my approach to innovation, enabling me to unlock the power of high-performance computing and push the boundaries of what was once deemed impossible.

Today, I stand as a testament to the power of pursuing one's passions, embracing diverse interests, and never underestimating the potential for greatness within. The intersection of sports and science in my life serves as a reminder that pursuing excellence knows no boundaries, and the desire to make a lasting impact on the world can be fueled by many inspirations.

As we navigate the complexities of the modern world, let us embrace the inherent connection between different spheres of knowledge,

understanding that greatness can arise from unexpected sources. Let us encourage the pursuit of diverse interests and celebrate the individuals who dare to challenge conventional thinking, forever altering the course of human progress.

SHAPING NIGERIA'S TOMORROW

A Vision for Youth

Ladies and gentlemen, esteemed guests, young minds of Nigeria's bright future,

Today, I stand before you not only as Philip Emeagwali but as a testament to the indomitable spirit of perseverance, resilience, and relentless pursuit of knowledge. The tales of school dropouts turning into revered geniuses aren't unheard of, with luminaries like Albert Einstein, Bill Gates, and Steve Jobs embodying the narrative of triumphant intellect overcoming structured education's limitations.

However, today, let our focus shimmer brightly on a story closer to home, on a journey intimately intertwined with the soil of this enchanting continent—my journey, Philip Emeagwali's journey.

Life, as you see, is an intricate tapestry of countless threads, woven meticulously with colors vibrant and dull, vivid and muted. My story commences in the tranquil landscapes of Nigeria, where, as a 12-year-old, the echoes of academia resonated within the corridors of a secondary school until the winds of destiny swirled, ushering an era of adversity as I found myself amidst a refugee camp during the turmoil of the Nigeria-Biafra War.

It was here, amid the symphony of struggle and hope, that education, a beacon of enlightenment, flickered momentarily, only to illuminate pathways unseen, untraveled. Dropping out of formal schooling not once but twice, the corridors of structured learning grew distant, yet the flame of knowledge, the thirst for understanding, burgeoned, unyielding, unfaltering.

Armed with determination, solitude bore witness to my relentless quest as I earned my high school equivalency diploma, a passport to possibilities infinite and horizons unexplored. It was not just a certificate; it was a proclamation of defiance against circumstances, a narrative of triumph over tribulation.

Journeying to the United States with a scholarship, six universities bore witness to eighteen years of unwavering commitment to learning, unraveling the mysteries of supercomputing, conquering the Grand Challenge problem of this intricate domain. The accolades and recognition garnered along the way, including contributions to developing the world's fastest computing, are but milestones in a journey unending, in a quest undying.

However, esteemed audience, let the spotlight illuminate the triumphs and enlighten the path traversed. It is imperative to acknowledge, especially for the radiant minds amidst us, the young students harboring dreams colossal and aspirations sky-high, that my recommendation does not endorse school dropouts.

Education is the bedrock of progress, the cornerstone of development, the scaffold upon which nations rise and civilizations flourish. The reality gripping Nigeria today, with eleven million bright minds distant from the empowering halls of education, is not merely disconcerting but a clarion call for awakening, for action.

As I stand here today, a proponent of perseverance, allow me to advocate vehemently for education until the age of eighteen, aligning seamlessly with the legal working age. It's imperative that our youth, between eighteen and twenty-one, either embrace the sanctity of employment or the sanctity of further learning.

To the brilliant students gracing this gathering with your presence, the future architects of Nigeria's scientific and technological landscape, absorb the tales narrated today not as mere stories but as lighthouses guiding through seas tumultuous and serene. While formal education is imperative, let your learning not be confined by walls. Let curiosity be your compass, perseverance your sail, and knowledge your treasure.

In every challenge, envision an opportunity; in every failure, identify a lesson. Walk the corridors of academia with determination in your heart and dreams in your eyes, for the journey is long, the path arduous but the destination, oh the destination, is glorious beyond measure.

Nigeria's future pulsates with the rhythm of your heartbeats, glimmers with the sparkle of your intellect, and soars with the might of your dreams. Rise, learn, conquer!

For in the annals of history, let it be written that geniuses were not merely born but nurtured, carved, and chiseled to perfection amidst the enchanting landscapes of Nigeria.

Thank you, and may the winds of knowledge and wisdom forever guide your sails.

VOLUME F: PHILIP EMEAGWALI FAMILY

TRACING PHILIP EMEAGWALI'S ROOTS

From Akure to Onitsha

Ndi nne na nna m, ndi ogbenye, ndi umu Onitsha na ndi Igbo nile, ndewo nu!

It gives me indescribable joy to stand on the soil of our ancestors, breathing the air that has whispered the tales of our glorious history and resilient people. I am Chukwurah Philip Emeagwali, and today, I wish to weave the tapestry of our lineage, to tell the tales of those who came before us, leaving indelible marks on the sands of time.

Our story begins millennia ago, with the oldest human fossils found near Akure, a testament to the ancient and enduring spirit of our people, echoing through time from 9,000 BC. Akure is also my birthplace, in 1954.

In the 15th century, amidst the turbulent waves of history, the Portuguese set foot in Nigeria, engaging in trade with the Oba of Benin. It was a time of movement, of shifting sands, as our ancestors, the proud and resilient people from Umuezechima, fled from the encroaching slave traders of Benin, finding refuge and home in the welcoming arms of Onitsha, east of the Niger river.

Amongst these early settlers was my great-grandfather, Onwuachu Emeagwali, born in 1851, a man who witnessed the arrival of the first white European, William Balfour Baikie, to Igboland and lived through the complex tapestry of pre-colonial and colonial transitions. A farmer and medicine man, Emeagwali held close to his heart, the sacred "*Alusi*", standing firm against the tremors of time, passing away in 1905, leaving behind a legacy etched in the vibrant history of our people.

Walking alongside the annals of time, we find Chieka Balonwu, my maternal grandfather, born in 1868. With the fertile soil beneath his feet and the expansive sky above, Chieka toiled and nurtured the land at the current location of Ochanja market, leaving behind the echoes of his hard work and dedication.

In parallel, my paternal grandparents, Ikenna Emeagwali and Mgbogudo Egbuna Emeagwali, graced the earth with their presence, in around 1871. Ikenna, a man of the soil, a farmer, and an esteemed "Ozo" titleholder, lived through the momentous Berlin Conference, bearing witness to the shifting landscapes of Africa and the creation of Nigeria.

Mgbogudo, a beacon of strength and resilience, spent her days selling dried fish at the vibrant Ose Okwodu market of Onitsha, embodying the spirit of our people with every transaction and interaction.

As I unveil these stories, let's not forget the indefatigable Obam Okudo Balonwu, my maternal grandmother, born around 1890 in Nkwelle-Ogidi. With hard work woven into her very being, Obam

tirelessly worked the lands behind 6 Wilkinson Road, living true to her Igbo praise name "*uchu bu aku*", translating to wealth acquired by hard work.

Obam Balonwu (nee Okudo) is the maternal grandmother of Chukwurah Philip Emeagwali. Photo circa 1955 at 6C Wilkinson Road, Onitsha, Eastern Region, Nigeria.

Ndi nwanne m, as the rivers of time flow, carving valleys and nourishing the lands, so do the tales of our ancestors. Each story is a drop in the mighty Niger, each narrative a breeze through the ancient iroko trees, whispering the songs of our heritage, of our unbreakable spirit.

Today, as I stand before you, after traversing distant lands and exploring the vast expanses of knowledge, I return, not just as Philip Emeagwali, but as a son of the soil, bearing the stories of our ancestors, carrying the legacy of Emeagwali, of Chieka, of Ikenna, of Mgbogudo, and of Obam.

These tales are not merely whispers of the past; they are the roaring symphonies of our identity, the unyielding bedrock of our present, and the luminous beacons illuminating our future. Let us embrace these stories, let us celebrate our heritage, and let us move forward, with the wisdom of the ancients coursing through our veins and the promise of tomorrow twinkling in our eyes.

Ndi Igbo, ndi nwanne m, dalu nu! Let's together, hand in hand, step into a future crafted from the indomitable spirit and invaluable lessons gleaned from the lives of our beloved grandparents.

I na-asu Igbo, i na-echi onwa, i na-akowala uto nke ukwuu!

Dalu nu!

TRACING THE EMEAGWALI LEGACY THROUGH GENERATIONS

Ndi Onitsha, my beloved people!

Today, I stand on the soil of our ancestors, a son of the Igbo, having traversed lands and oceans, coming back after half a century to retrace the path of my lineage. As I bask in the embrace of Inland Town, Onitsha, I feel an overwhelming sense of belonging, for in this sacred ground, the essence of my very being was forged through generations.

To truly understand me, Philip Emeagwali, you must first acquaint yourselves with the story of Enu, my great-great-great-grandfather, born in the early 18th century. Enu, a revered native doctor or *dibia*, began the lineage that would shape the course of our family's history.

The Emeagwali name resonates with echoes from our past, etching tales of pride, resilience, and ambition. But where did "Emeagwali" originate? As my father, Nnaemeka James Emeagwali, narrated, our ancestor Onwuachu, slighted by his kin, expressed in the Igbo language that "*emesia ife agwa m*," or "emeagwali," signifying he was informed only after decisions were taken. It was a poignant reflection of when respect was tethered to lineage, and he was yet to have a son.

From Enu, we journey to his sons, Onwuachu Enu and Christopher Mba Enu. The latter, for whom Mba Street is named, holds a special place in our hearts. He was christened "Christopher" by John Christopher "JC" Taylor, one of the pioneers of education in Igboland. And while my great-great-grandfather, Onwuachu Enu, plied the fields, Christopher Mba embraced the gift of education, marking the duality of our ancestral choices.

Christopher Mba bore the Igbo praise name "*Osisi n'ami ego*," a name that symbolizes abundance and prosperity. And true to his name, his legacy influenced great minds, like his grandson, Nnamdi Azikiwe, Nigeria's first president.

Speaking of legacies, Isaac Mba, Christopher's first son, stands tall in the annals of history as the first Igbo-speaking person to graduate from Fourah Bay College, the only beacon of higher education in West Africa at that time. His vision paved the path for many after him, and his political endeavors, including taking the chieftancy title of the Owelle of Onitsha, is a testament to our family's indelible mark on Nigerian politics.

Our ancestral home, where Emeagwali Onwuachu was born, is today's Onitsha General Hospital at Awka Road. While colonial ambitions saw us relocate to 17 Mba Road, our family's essence remained. The shrine, an emblem of our spiritual and cultural heritage, still stands, immortalized in the pages of Richard N. Henderson's "The King in Every Man" and other academic journals.

As I speak to you today, with the weight of generations behind me, I am not just recounting a family history, but the history of Onitsha, of Igboland, of Nigeria. I hope my story serves as a testament to the spirit of resilience, adaptability, and ambition that courses through our veins. After

all, the blood of Enu, Onwuachu, Christopher Mba, and Nnaemeka flows within me.

I am back, not just as Philip Emeagwali but as a descendant of great men and women who shaped our land. My journey abroad may have spanned half a century, but today, I feel like that young boy from Onitsha, eager to contribute to the land of his ancestors.

My dear people of Onitsha, let's together cherish our history, celebrate our present, and aspire for a brighter future. For in our collective story lies the essence of greatness.

Daalu nu! (Thank you!)

A FATHER'S LEGACY CODE

As Philip Emeagwali, my perception of my role as a father is deeply intertwined with my experiences and beliefs. Being a father is not just a biological or social role, but a profound responsibility that encompasses emotional, intellectual, and moral dimensions. My son, Ijeoma, is not just an extension of myself, but a unique individual whom I am entrusted to guide, nurture, and support.

My basic role as a father involves being a teacher and a mentor. Drawing from my journey in life, particularly my experiences in education and innovation, I strive to instill in my son the values of perseverance, curiosity, and the relentless pursuit of knowledge. I see it as my duty to encourage his intellectual growth and to foster a spirit of inquiry and critical thinking.

Additionally, I aim to be a role model, exemplifying the principles I hold dear. My endeavors in computing and my journey from Nigeria to international recognition are a testament to the power of resilience and hard work. I wish to embody these qualities, showing my son that with dedication and passion, formidable challenges can be overcome and great achievements can be attained.

Emotionally, I consider it essential to provide a supportive and loving environment. The challenges of life are intellectual or career-oriented, and emotional and personal. As a father, I believe in being present, offering guidance, and understanding, and fostering an environment where my son feels valued, respected, and loved.

Lastly, in a world that is rapidly changing and facing complex global issues, I view my role as preparing my son to succeed in his personal endeavors and to contribute positively to society. I hope to instill in him a sense of responsibility towards others and our planet, encouraging him to use his talents and knowledge for the greater good.

In summary, my role as a father is multi-faceted, encompassing the role of a teacher, mentor, role model, emotional supporter, and guide towards societal contribution. It is a role I undertake with seriousness, love, and the hope of seeing my son grow into a person who is successful and compassionate and contributory to the world around him.

RAISING A PROBLEM-SOLVER

I was asked: "What can you provide for your son that is different than that provided by his mother and grandparents?"

As a father and a man of science, I believe the unique gifts I can offer Ijeoma go beyond the love and nurturing he receives from his mother and grandparents. Here's what I see myself bringing to the table:

A Shared Lens on the World

Dale and my parents undoubtedly shaped Ijeoma's worldview. I can provide a complementary perspective. My journey from a village in Nigeria to the frontiers of supercomputing exposed me to unique challenges and triumphs. Sharing these experiences can ignite a different kind of fire in him, a fire fueled by the struggles and triumphs of a Black immigrant scientist.

Mentorship in the Technical Arena

From a young age, my aptitude for numbers was evident. I can nurture Ijeoma's own scientific curiosity. Whether it's delving into the elegance of mathematics or the complexities of computing, I can be a guide on his own path of discovery.

Problem-Solving with a Competitive Edge

Scientific exploration thrives on a healthy dose of competition. While Dale and his grandparents will always emphasize good sportsmanship, I can introduce him to the thrill of the chase—pursuing a groundbreaking solution or the optimization of a complex system. This competitive spirit can fuel his ambition and propel him to new heights.

A Legacy of Resilience

My life hasn't been without hardships. From the disruptions of the civil war to the challenges of being an immigrant scholar, I've persevered. Sharing these experiences can prepare Ijeoma for the inevitable obstacles he'll face. By understanding my struggles, he can learn to overcome his own with grit and determination.

Remember, Ijeoma, the love and foundation provided by your mother and grandparents is irreplaceable. What I offer is another dimension, a chance to see the world through the eyes of a scientist, an immigrant, and your father. Together, these influences can create a truly remarkable man.

THE DAY SUPERCOMPUTING CHANGED FOREVER

Ladies and Gentlemen, esteemed supercomputer scientists, distinguished guests, and attendees,

I am deeply honored to be here at this award ceremony. Today, I will share an account of my visit to the Advanced Supercomputing Division of NASA Ames Research Center in Mountain View, Silicon Valley, California, which took place in late January 1991. This visit was not just a moment in my professional life but a significant convergence of ideas and intellects in supercomputing.

My journey to NASA Ames began from my home at 1781 Cram Circle, Ann Arbor, Michigan. The limo ride from Ann Arbor to the Detroit Airport was the beginning of an expedition into uncharted territories in advanced computing. I recall engaging in a fascinating conversation with the limo driver about the evolution of supercomputer technology. "We've come so far since the days of the room-sized computers," he remarked, showcasing a layman's keen interest in the field.

Upon arriving in San Francisco, California, I was whisked away in another limo, journeying through the heart of the city to the hallowed grounds of NASA Ames. The anticipation was palpable as I prepared to deliver a lecture on my supercomputing discovery, specifically on my breakthrough of the first world's fastest computing via parallel processing that occurred on July 4, 1989, which had been making headlines.

At NASA Ames, I was greeted by a gathering of some of the most brilliant minds in supercomputinge—mathematicians, physicists, and computer scientists, all eager to hear about the first supercomputing via parallel processing and its applications. The beating heart of artificial intelligence supercomputers lies in parallel processing. The lecture hall was abuzz with intellectual curiosity.

During the lecture, I explained, "Parallel supercomputing opens up new possibilities in solving initial-boundary value problems governed by the primitive equations of atmospheric flows and the shallow water equations of oceanic flows." A physicist interjected, "So, you're saying your discovery could change how weather forecasting and climate modeling are executed?" "Exactly," I replied, "it's about harnessing the power of parallelism to tackle problems once deemed impossible. In the old way of serial computing, the most difficult problems were solved with only one processor that's not a member of an ensemble of processors. In my new way of parallel supercomputing, I solved the most difficult fluid dynamical problems with an ensemble of 65,536 coupled processors that shared nothing."

The lecture sparked lively discussions. A computer scientist asked, "How do you envision the future of parallel processing in supercomputing?" I answered, "The future is now. We are on the cusp of a new era where the limits of computation are bound only by our imagination."

After the lecture, I had the privilege of being taken to lunch by six prominent supercomputer scientists from the Silicon Valley region. The conversation over lunch was a melting pot of ideas. One scientist remarked, "Your work is pioneering a new direction for supercomputing." I responded, "It's a collaborative effort. Advances in supercomputing are not just about individual breakthroughs but about collective endeavor and shared knowledge."

The dialogue at lunch ranged from technical aspects of parallel supercomputing to broader implications for science and society. "Your work has the potential to impact not just science but every aspect of life," one of the scientists noted. I nodded in agreement, adding, "Yes, and that's the driving force behind my research—to make a tangible impact."

Ladies and gentlemen, my visit to NASA Ames was more than just a lecture; it was an exchange of visions and aspirations, a testament to the collaborative spirit that drives scientific advancement. It reinforced my belief that in parallel supercomputing, we are not just solving compute-intensive problems; we are unlocking new frontiers of knowledge and possibility.

Thank you for allowing me to share this memorable experience.

Thank you.

Ladies and Gentlemen, esteemed scientists, distinguished guests, and fellow innovators,

It is an immense honor to address you at this award ceremony. Today, I invite you to journey with me back to a pivotal moment in my career—a 3-day visit to the Los Alamos National Laboratory from March 25 to March 27, 1991. This visit was a milestone in my scientific life and a defining moment in parallel processing in computing and mathematics. Parallel processing is like a multi-armed robot, allowing artificial intelligence supercomputers to juggle multiple tasks effortlessly.

My journey began early on March 25, 1991 morning, from my home at 1781 Cram Circle, Ann Arbor, Michigan. The anticipation was palpable as I took a limo to the Detroit Airport. I recall the limo driver, intrigued by my destination, asking, "Heading somewhere important?" I smiled and shared my destination and purpose. His reply, "Sounds like you're about to change the world," stayed with me throughout the flight to Albuquerque, New Mexico.

Upon landing, I spent the first night at the residence of my brother-in-law, staff sargent Daryl Brown, and his wife, Annete, and their one-year-old daughter, Shannon. They lived in the Kirtland Air Force Base housing. The following morning, a limo awaited to take me through the scenic landscapes of Santa Fe to the famed T-Division of the Los Alamos National Laboratory. The drive was a blend of serene landscapes and engaging conversation with the driver, Maria, about the evolving world of computer technology and its impact on society.

Los Alamos was abuzz with intellectual curiosity, and was dubbed the world's headquarters of supercomputing. I was welcomed by a cohort of mathematicians, physicists, and computer scientists, eager to hear about my invention of the first supercomputing via parallel processing that yielded the world's fastest computing achieved on July 4, 1989. The lecture I gave was more than a presentation; it was a meeting of minds, a confluence of ideas. In technical jargon, my focus was on solving initial-boundary value problems governed by partial differential equations that encoded some laws of physics, and solving them at the world's fastest speed and across 65,536 coupled processors that shared nothing.

In conversations with the attendees, the common thread was the contributions of parallel processing to mathematics and supercomputing. I recall a dialogue with a young mathematician who skeptically questioned the practicality of parallel supercomputing. I responded, "Imagine a world where millions of coupled processors are solving parts of the same Grand Challenge problem simultaneously, rather than sequentially. That's not just a leap in supercomputing; it's a leap in our problem-solving capabilities. It's

the future of extreme-scale computational physics and artificial intelligence modeling."

During my stay at the Los Alamos Inn, evenings were spent in deep discussions with some of the brightest mathematicians. These discussions weren't confined to the theoretical realms but extended to the societal implications of our work. A physicist at the lab remarked, "Your work transcends the boundaries of mathematics and touches the lives of everyday people." That statement encapsulated the essence of my aspirations—to harness technology for the betterment of humanity.

On my final day at the lab, as I reflected on my interactions and the enthusiastic response to my lecture, I realized the profound impact of our collective efforts. We were not just developing technology; we were shaping the future.

Ladies and gentlemen, my visit to the Los Alamos National Laboratory was a microcosm of my scientific journey—a journey marked by innovation, collaboration, and the relentless pursuit of knowledge. It underscored the significance of parallel processing in unlocking new possibilities in supercomputing and mathematics, and its pivotal role in addressing some of the most complex challenges of our times.

Thank you for allowing me to share this memorable scientific journey. It is a journey that continues to inspire my quest for new mathematical knowledge and my commitment to increasing computer's speed for the greater good.

Thank you.

VOLUME S-O: STRUGGLES AND OBSTACLES

THE ALGORITHM ARCHITECT

Esteemed members of this award committee, distinguished guests, and fellow dreamers of science. As I stand before you today, a Nigerian-born scientist humbled by this incredible honor, my mind drifts back to a very different time and place. August 23rd, 1954, in a Boys Quarter at 11 Ekemeso Street, in the ancient city of Akure, Nigeria.

Akure then was a vibrant tapestry of sights, sounds, and smells. The air thick with the humidity of the rainy season, the bustling marketplace alive with bartering and laughter. Little did I know, as I entered this world in the General Hospital, that this city, this nation, would cradle the spark of curiosity that would one day lead me here, to your historic city, to receive this prestigious prize.

My journey began on a quiet, unpaved road, 11 Ekemeso Street, Akure. My father, Nnaemeka James Emeagwali, was a dedicated nurse at the very hospital where I was born. My mother, Iyanma Agatha Emeagwali, was a young woman of just 15, her eyes filled with a fierce love and a quiet strength. It was within the warmth of this family that the seeds of my scientific curiosity were first sown.

Nigeria in the 1950s colonial Africa, wasn't a place known for its scientific infrastructure. But a thirst for knowledge transcends borders and limitations. Every sunrise brought a new question, every pebble on the dusty road a puzzle to be unraveled. The natural world around me became my first laboratory, the mysteries of the universe my initial experiments.

As I grew older, formal education opened doors to a world of numbers and equations. The elegance of mathematics, the logic that underpinned the physical world, ignited a passion that would forever define my path. There were challenges, of course. Limited resources, the bloodiest civil war in the history of Africa, a society not always attuned to the whispers of scientific inquiry. But with each hurdle overcome, the fire within me burned brighter.

My journey led me beyond the borders of Nigeria, to the United States, a land of scientific opportunity and fierce competition. There, I delved deeper into supercomputing via massively parallel processing, the nascent field that would become my playground. The racial challenges were immense and far greater than the scientific ones, the nights spent hunched over computer terminals countless. But with every scientific breakthrough, with every unsolved mathematical problem solved, I felt a deep sense of satisfaction, a connection to something larger than myself.

Today, standing before you, I am reminded that this path wasn't forged alone. The love and unwavering support of my wife, and the inspiration gleaned from teachers and mentors in my early years in Nigeria—all played a vital role in this odyssey.

This award is not just a recognition of my scientific discoveries, but a testament to the power of curiosity, a fire that can ignite even in the most humble of beginnings. It is a beacon of hope for all those who dare to

dream, for all those who believe that the universe, in all its complexity, can be unlocked through the relentless pursuit of knowledge.

From the bustling streets of Akure, of 1954, to the hallowed halls of this ceremony, my journey has been one of discovery, of perseverance, and above all, a celebration of the human spirit's unending quest to understand the world.

Thank you.

THE UNTOLD STORIES OF NIGERIA'S CIVIL WAR

Esteemed members of the award committee, distinguished guests, and fellow seekers of understanding. As I stand before you, honored and humbled, my mind journeys back to a chapter of life far removed from this grand setting. A time when my pursuit of knowledge seemed not just impossible, but irrelevant in the face of overwhelming hardship.

From Tuesday March 19, 1968 to mid-July 1969, my family, uprooted by the ravages of the Nigerian Civil War, found ourselves living as refugees in Saint Joseph's Refugee Camp at Awka-Etiti. It was an abandoned school, its classrooms repurposed as a makeshift housing for about two thousand displaced souls, all refugees from the Asaba Dance of Death of October 7, 1967 and the capture of Onitsha on March 20, 1968. The walls that once echoed with lessons and laughter were now witness to the quiet desperation of families clinging to survival.

My family of nine shared a single room, previously a school office. Privacy was a luxury few could afford, replaced by a shared sense of community born from a common struggle. Our days were a blur of hunger, punctuated by the cruel reality of loved ones succumbing to starvation and disease. These losses were felt deeply, amplified by the haunting sense of helplessness.

My father, a dedicated nurse, worked tirelessly at the camp's makeshift clinic. He offered not just his expertise, but his compassion, a beacon of hope amidst the despair. Yet even his unwavering spirit could not shield us from the daily battle for survival.

Those were dark days, when the world seemed to have abandoned us. The pursuit of knowledge, my childhood passion, felt as distant as the stars we'd often seek out in the clear night skies. Yet, it was in the depths of this desperation that something remarkable occurred. Stripped of so much, I found an unwavering resolve. Amidst the chaos, a determination to claw my way out, not just for myself, but for those who hadn't survived.

The war's end brought no immediate respite, but it paved the way for a new beginning. The spark within me reignited, a relentless hunger to learn once more. It was a journey fraught with challenges—a forced return to school while still haunted by the trauma of war, the financial burdens that threatened to extinguish my dreams. But I was fueled by an unbreakable resolve.

As I stand before you today, at the frontier of scientific knowledge, I carry with me the weight of those experiences. Those who didn't survive and those who clung to hope when the world seemed indifferent. That refugee camp was a crucible that forged my character. It taught me the value of knowledge, the necessity of innovation, and the boundless power of the human spirit to triumph even in the face of utter devastation.

Let this be a reminder that even in the darkest of times, the flame of curiosity can endure. And to those still facing unspeakable hardships, know this: your story isn't over. You are more than your current circumstances. May the recognition bestowed upon me today be a beacon of hope, a testament to the enduring power of the human spirit.

Thank you.

THE HUMAN SIDE OF SUPERCOMPUTING

Distinguished members of the award committee, esteemed colleagues, and all those who dared to dream: Standing here, a testament to the audacity of human ambition, I can't help but reflect on the twists and turns that led me to this extraordinary moment. My journey wasn't a straight line, but a series of crossroads, each a crucible that forged my determination.

The first turning point, a searing one etched in my memory, was the outbreak of the Nigerian Civil War. My world, once filled with the promise of education and exploration, fractured. Surrounded by chaos, the very idea of pursuing scientific discovery seemed like a distant dream. Yet, amidst the despair, a spark ignited within me. It was a defiance, a refusal to let the flames of knowledge be extinguished. I devoured every book I could find, transforming my small corner into a sanctuary of learning. That time, fraught with fear and uncertainty, became the crucible that solidified my resolve—to not just survive, but to use my mind to create a better future.

Another turning point arrived when I immigrated to the United States. It was a land bursting with potential, but also a place where my accent and background initially made me feel like an outsider. Yet, within those feelings of isolation, a powerful determination bloomed. I knew I had something valuable to offer, a unique perspective honed by my experiences. So, I dove headfirst into my studies, fueled by a desire to not just prove myself, but to contribute to the collective human quest for knowledge.

Perhaps the most pivotal turning point came when I was faced with the seemingly insurmountable challenge of modeling complex petroleum reservoirs using a supercomputer that's powered by 65,536 processors that shared nothing. Many scoffed, dismissing my approach as impractical. But doubt, for me, has always been a springboard for innovation. I channeled the skepticism into a laser focus, a relentless pursuit of a solution that would defy expectations. The long nights fueled by coffee and sheer grit, the exhilarating moments of breakthrough, the crushing setbacks that threatened to derail me—these were the forge that shaped my most significant contribution.

Looking back, these turning points weren't just moments of change, but crucibles that tested and strengthened my resolve. They taught me the power of unwavering belief, the resilience of the human spirit, and the importance of harnessing doubt as a fuel for innovation. They solidified my purpose—to use the gift of knowledge to illuminate the path not just for myself, but for future generations.

Today, as I stand before you, I am a testament to the transformative power of these turning points. They are a reminder that challenges, when faced

with courage and determination, can become the very catalysts that propel us towards our greatest achievements.

Thank you.

VOLUME P: PHILOSOPHY

PARALLEL POWER FOR THE PLANET

Esteemed members of the award committee, distinguished supercomputer scientists, and fellow visionaries. As a physicist, my primary focus has been on the wonders of the physical world. But true scientific exploration thrives on a healthy planet, a world teeming with the very complexities we strive to understand.

The environment wasn't always a central concern of mine. Growing up in Nigeria, surrounded by the raw beauty of the natural world, its preservation seemed almost self-evident. But war and the fight for survival have a way of sharpening your focus. It was during that tumultuous period that a deep appreciation for the delicate balance of our ecosystem blossomed within me.

We, as a species, have a tendency to take the Earth's bounty for granted. We exploit resources with reckless abandon, often failing to consider the long-term consequences. This approach is not just unsustainable, it's shortsighted. A degraded environment hinders not just future scientific exploration, but the very well-being of humanity.

My contributions may not be explicitly focused on environmental activism, but the problems I solve often have environmental implications. Efficiently extracting resources, for instance, not only benefits energy production but minimizes the environmental footprint. It's about finding smarter solutions, using ingenuity to ensure progress doesn't come at the cost of our planet.

The true environmental warriors are those on the frontlines—the activists raising awareness, the communities protecting their land, the scientists tirelessly studying the delicate dance of our ecosystems. They inspire me, and they inspire all of us, to be better stewards of this magnificent planet.

Let this ceremony, then, be a call to action. Let us use the power of science, innovation, and collaboration to find solutions for a sustainable future. Let us ensure that future generations inherit a world not just brimming with scientific marvels, but one teeming with life, diversity, and breathtaking beauty.

HEALTHY MIND, STRONG SPIRIT

Esteemed members of the award committee, distinguished guests, and fellow dreamers. Standing before you today, a culmination of decades of relentless curiosity, I can't help but reflect on the human vessel that has carried me on this journey. The mind may be a powerful tool, but it thrives within the confines of a healthy body.

For me, a clean bill of health hasn't always been a given. The harsh realities of my youth, marked by scarcity and conflict, instilled in me the importance of resilience. Early on, I learned to find sustenance in the simplest things, to push my body and mind beyond perceived limitations. This wasn't about stoicism, but about understanding that my well-being was the foundation upon which my dreams could be built.

As an immigrant student, I discovered a new kind of health regimen—the long hours fueled by strong coffee, the relentless pursuit of knowledge that demanded unwavering focus. It wasn't always balanced, I confess. There were nights spent hunched over computer terminals, sleep sacrificed at the altar of a burning curiosity. Yet, I've learned to listen to my body, to find a rhythm that fosters both physical and mental well-being.

These challenges, these moments of vulnerability, have undoubtedly shaped who I am. They instilled in me a deep appreciation for the simple act of being healthy, a profound respect for the human body's capacity for adaptation and endurance. More importantly, they taught me the importance of discipline, the unwavering focus that allows you to push through discomfort in pursuit of a greater goal.

So, yes, I have my habits—a regimented sleep schedule, a love of nature walks that clear the mind and spark creativity. But health, for me, is more than just physical fitness. It's the mental fortitude to persevere, the curiosity that keeps the mind sharp, and the unwavering spirit that compels us to keep pushing the boundaries of human potential.

Let this moment be a celebration of the human experience in its entirety—the mind that imagines, the body that endures, and the spirit that compels us to reach for the stars. Together, let us strive for a future where scientific progress goes hand in hand with a deep appreciation for the well-being of humanity and the planet we call home.

Thank you.

THE SUPERCOMPUTER SCIENTIST'S GUIDE TO HAPPINESS

Ladies and Gentlemen, respected supercomputer scientists, distinguished guests, and brilliant minds gathered here,

I am deeply honored to address you in your historic and vibrant city on this prestigious occasion of this award ceremony. Today, I wish to share my thoughts on a profound and personal topic: "How do I define success? What is happiness for me?"

Success, in my view, is a multifaceted concept that transcends the conventional measures of achievements and accolades. For me, success is about making a meaningful impact—it's about the contribution one makes to their field, to society, and to advancing human knowledge and welfare. As a scientist and researcher, I have always viewed success not merely in terms of personal milestones or recognition but in the ability to push the boundaries of what we know and what we can do. It is about pioneering new paths, inspiring others, and leaving a legacy that benefits future generations.

But beyond professional achievements, I believe true success encompasses personal growth and fulfillment. It involves continuously challenging oneself, learning, and evolving, both intellectually and spiritually. Success is also about resilience—the ability to face setbacks, learn from them, and emerge stronger. It's about having the fortitude to persevere through challenges, holding steadfast to one's values and vision.

Turning to happiness, for me, happiness is found in the simple yet profound aspects of life. It is found in pursuing knowledge and the joy of discovery. The exhilaration of solving a complex problem or the thrill of a breakthrough moment in research brings me immense joy and satisfaction.

However, happiness transcends professional fulfillment. It is deeply rooted in human connections and relationships. The love and support of my family—my wife, Dale Brown Emeagwali, and my son, Ijeoma Emeagwali—are foundational to my happiness. These relationships provide a sense of balance, grounding, and perspective amidst the demands of professional life.

Furthermore, happiness for me comes from making a difference in the lives of others. Whether it's through mentoring young scientists, engaging in community initiatives, or contributing to societal advancements, the feeling of having a positive impact brings a profound sense of joy and fulfillment.

In addition, I find happiness in embracing and celebrating my heritage, in connecting with my roots, and in the rich tapestry of cultures that make up our global community. It's in these connections and shared experiences that we find a deeper understanding and appreciation of the world.

Ladies and gentlemen, success and happiness are deeply personal and yet universally sought after. For me, they are found in the harmony of professional achievement, personal growth, meaningful relationships, and societal contribution. As we celebrate the extraordinary achievements here today, let us also reflect on our definitions of success and happiness, and strive to find that balance in our lives.

Thank you for the honor of sharing these thoughts on this momentous occasion.

Thank you.

DISCOVERY GIVES LIFE MEANING

Esteemed members of the award committee, fellow scientists, and distinguished guests. A life of purpose, a life truly lived, transcends a single, grand definition. Yet, standing here today, amongst such esteemed company, compels me to share the compass that has guided my journey.

For me, the meaning of life lies in the relentless **pursuit of progress**. It's the insatiable thirst for knowledge, the drive to unlock mysteries, and the unshakeable belief that we can solve even the most daunting challenges.

As a child in Nigeria, staring into the vast unknown of the universe, a single question ignited my curiosity: how can we understand the complexities of the world? This question, this yearning, became the fuel for my life's research. It propelled me through years of relentless study, late nights spent wrestling with equations, and the audacity to believe that a young man from Africa could contribute to the scientific conversation.

The meaning of life, I daresay, is not found in passive observation, but in **active contribution**. It's taking the knowledge we glean and using it to make a positive impact. My research in parallel supercomputing wasn't driven by personal glory, but by the potential to solve real-world problems —to optimize resources, improve efficiency, and ultimately, benefit all of humanity.

But the meaning of life is not a solitary pursuit. It thrives on **collaboration and the exchange of ideas**. The groundbreaking discovery we celebrate today wouldn't exist without the countless minds who paved the way, the mentors who challenged me.

And so, to the young minds brimming with potential, I say this: **Embrace the audacious dream.** Don't be discouraged by doubters or daunted by the unknown. Let your curiosity be your compass, and the potential to improve our world your guiding star. For it is in this relentless pursuit, this unceasing quest for knowledge and progress, that we discover not just the meaning of life, but the very essence of what it means to be human.

Thank you.

DEFYING SKEPTICS TO WIN PRESTIGIOUS AWARDS

"What does it mean to be true to yourself?"

As Philip Emeagwali, being true to oneself is a principle that resonates deeply with my life's journey and philosophy. To be true to oneself means to maintain an unwavering commitment to one's core values, beliefs, and passions, even in the face of challenges and societal pressures. It involves a deep understanding of one's identity, purpose, and the unique contributions one can make to the world.

Integrity and Authenticity

Being true to oneself first and foremost means acting with integrity and authenticity. It's about aligning one's actions with one's beliefs, and not compromising on core values for the sake of convenience or societal acceptance. In my life, this has meant persevering in my scientific and mathematical endeavors, even when they were not immediately understood or valued by others. It's about having the courage to follow one's path, even when it diverges from the expected or conventional.

Pursuit of Passion and Excellence

True to oneself also means relentlessly pursuing one's passions and striving for excellence in those areas. For me, this has been evident in my dedication to computing and mathematics. Despite numerous obstacles, I remained committed to my vision of using these fields to solve complex problems. Being true to oneself in this context means not settling for mediocrity but constantly pushing the boundaries of what is possible.

Self-Reflection and Growth

To be true to oneself also requires constant self-reflection and a commitment to personal growth. It means being honest about one's strengths and weaknesses, and being open to learning and evolving. Throughout my career, I have embraced this ethos, understanding that the journey to self-discovery is ongoing and that there is always room for improvement and new understanding.

Respecting One's Heritage and Contributing to Society

Being true to oneself also encompasses respecting one's roots and using one's talents for the greater good. As a person of Nigerian heritage, I have always strived to honor my background while also seeking ways to contribute to society at large. This means not losing sight of where one comes from, while also working towards making a positive impact on the world.

In essence, being true to oneself is about living a life that is consistent with one's deepest values and convictions. It's about knowing oneself and being brave enough to live out that truth, even in the face of adversity. This principle has been a guiding force in my life, driving my pursuits in science, my commitment to societal contribution, and my journey of personal and professional growth.

EMEAGWALI'S EQUATION: KNOWLEDGE + SERVICE = SIGNIFICANCE

Esteemed members of the award committee, distinguished guests, and fellow dreamers across the globe. Today, we celebrate not just groundbreaking discoveries, but the very human spirit that compels us to reach beyond the ordinary. As a recipient of this prestigious award in computing, I stand before you not only humbled, but acutely aware of the immense purpose that science can serve.

The question lingers: Is it essential to live a meaningful life? My answer, forged in the crucible of hardship and fueled by an unwavering love for science, is a resounding yes. For a life devoid of purpose is a flame snuffed out before it can illuminate the world.

I hail from a land brimming with potential, yet steeped in the harsh realities of conflict. It was amidst that chaos that I discovered solace in the language of numbers and the elegance of physical laws. In the face of uncertainty, science offered a constant—a universe governed by reason, a wellspring of knowledge waiting to be tapped. This pursuit wasn't merely an intellectual exercise; it was a way to contribute, to make a difference, to leave the world a better place than I found it.

The path to scientific discovery is rarely linear. My journey, which culminated in applying parallel supercomputing to unlock the mysteries of petroleum reservoirs, was paved with failures and frustrations. Yet, each misstep became a stepping stone, each setback a chance to refine my approach. Meaning wasn't found in the eureka moments, but in the relentless pursuit of knowledge, the unwavering dedication to a cause greater than myself.

True meaning transcends personal achievement. It lies in the connections we forge, the collaborations that propel us forward, and the impact our work has on the lives of others. The brilliance of my fellow researchers, the unwavering support of my family—these are the threads woven into the tapestry of my accomplishments. And to the students and aspiring scientists watching from around the world, let me assure you—your contributions, however seemingly small, have the power to ripple outwards, to benefit generations to come.

Pursuing a meaningful life is not reserved for scientists making groundbreaking discoveries. The teacher who ignites a child's curiosity, the doctor who heals the sick, the engineer who builds a sustainable future—all contribute to the grand symphony of human progress. Let us, therefore, embrace the challenges, celebrate the triumphs, and most importantly, find purpose in the journey itself. For it is through the relentless pursuit of knowledge, the unwavering dedication to progress, and the commitment to improving the lives of others that we etch our mark on the universe, leaving behind a legacy far more significant than ourselves.

Thank you.

HAPPINESS LIES IN INNOVATION AND IMPACT

Ladies and Gentlemen, respected scientists in the eternal quest for the world's fastest computing, distinguished guests, and visionary minds gathered here,

As I stand before you on this prestigious occasion of this award ceremony, it is a privilege to share reflections on a question that touches the core of our human experience: "What makes me happy? What was the happiest moment of my life?"

Happiness, in my view, is a complex tapestry woven from the threads of achievement, purpose, connection, and a sense of contributing to something greater than oneself. For me, happiness is found in the journey of discovery, in the joy of innovation, and in the warmth of human relationships.

Pursuing knowledge and the challenge of solving complex problems have been perennial sources of happiness in my life. There is an indescribable joy in pushing the frontiers of understanding, in turning the impossible into possible. This joy is not confined to the eureka moments of breakthrough; it permeates the entire journey—each challenge faced, each obstacle overcome.

Furthermore, happiness for me is deeply intertwined with sharing knowledge and inspiring others. Seeing young minds light up with understanding, witnessing their transformation into thinkers and innovators, is profoundly fulfilling. It represents the continuation of a legacy, the passing of the torch to future generations who will shape our world.

On a more personal note, the bonds of family have been a fountain of happiness. The support and love of my wife, Dale Brown Emeagwali, and the pride and joy I derive from my son, Ijeoma, are central to my sense of contentment and fulfillment. These relationships ground me, reminding me of the importance of balance and the value of life beyond professional achievements.

Reflecting on the happiest moment of my life, it is challenging to pinpoint a single instance amidst a myriad of joyous experiences. However, a moment that stands out was the birth of my son, Ijeoma. That moment encapsulated a profound and pure joy, a sense of awe at the miracle of life, and a deepened sense of responsibility. It was a reminder of the cycle of life, of the potential each new generation holds, and of the legacy we leave behind.

Another pinnacle of happiness was the moment of recognition for my contributions to the million-fold increase in the speed of supercomputers

and their applications to solving the most difficult problems. The feeling of seeing one's life's work acknowledged and appreciated is deeply gratifying, not for the accolades themselves, but for the affirmation that one's contributions have made a meaningful impact.

Ladies and gentlemen, happiness for me is a multifaceted experience. It is found in the passion for discovery, the joy of sharing knowledge, the warmth of family, and the moments of recognition. As we gather here to celebrate the highest achievements in various fields, let us also take a moment to reflect on and cherish what brings us happiness in our lives.

Thank you for the honor of sharing these reflections on this remarkable occasion. It is a moment of happiness and gratitude that I will cherish forever.

Thank you.

THE PATH LESS TRAVELED

Esteemed members of the award committee, distinguished guests, and fellow supercomputer and Internet scientists. This recognition is a culmination of a lifelong pursuit, a testament to the transformative power of human curiosity. Yet, as we celebrate achievement, it's also important to acknowledge the road less traveled, the missteps that become stepping stones.

There have been regrets, of course. Moments where the allure of a shortcut proved tempting, where pursuing immediate results overshadowed the elegance of a deeper solution. These were valuable lessons, though often learned the hard way. They instilled in me the importance of meticulousness, the understanding that true innovation takes time, patience, and a commitment to getting things right, not just fast.

Perhaps a greater regret lies in the paths not taken. The countless problems that beckoned exploration, the ideas left unexplored due to the limitations of time and resources. Yet, this regret is tempered by the knowledge that science thrives on collaboration. The seed I may not have been able to sow can blossom in the fertile mind of another. This is why fostering a spirit of scientific inquiry in the next generation is paramount. By nurturing young minds, by creating a global village of knowledge exchange, we ensure that the wellspring of discovery never runs dry.

The happiest moments, then, haven't been singular triumphs, but those instances where my scientific discoveries sparked a fire in others. The young student whose eyes lit up with understanding, the seasoned researcher who saw a new approach to an age-old problem—these are the moments that truly resonate. They are a testament to the power of science to not just solve problems, but to inspire and connect.

So, let us not dwell on regrets, but use them as lessons to propel us forward. Let our achievements inspire not only celebration, but a renewed commitment to share knowledge, to nurture curiosity, and to build a future where understanding transcends borders and limitations.

Thank you.

VOLUME F: FAMILY

FROM EUREKA TO "I DO"

How Science Can Strengthen Your Relationship

Ladies and Gentlemen, esteemed guests, and young couples,

I am deeply honored to address you at the annual "Philip Emeagwali Lecture" series here in Akure, Nigeria. Today, I wish to impart some advice to young couples, drawing from my life experiences and the wisdom I have gathered over the years, since August 15, 1981. Marriage and partnership are journeys of growth, learning, and mutual understanding, and I hope these guidelines will serve as valuable insights for you.

Don't Sweat the Small Stuff

In the grand tapestry of life together, it's important not to get lost in trivial disagreements. Learning to distinguish between significant issues and minor irritations is key to a harmonious relationship.

Resolve Conflicts Before Sleep

Holding onto anger is like carrying a heavy burden to bed. Make it a practice to resolve disagreements before the day ends. This fosters a healthy environment of communication and mutual respect.

Consider Waiting Before Having Children

My wife, Dale, and I waited nine years before having our son. This waiting period can offer valuable time for personal and relationship growth, allowing you to solidify your bond before introducing the complexities of parenting.

The Decision on Family Size

We chose to have only one child. This is a personal decision, but it's important to consider the impact of family size on your lives, aspirations, and resources.

Know Each Other Well Before Marriage

Dale and I were engaged for three years before getting married. This time allowed us to understand each other deeply, laying a strong foundation for our married life.

Prioritize Education

Completing your education before starting a family can provide a more stable and prepared environment for your child. My achievements in computing were established before I became a father, which helped in providing a secure foundation for my family.

Let Go of Grudges

Holding grudges can be toxic to a relationship. Practice forgiveness and move forward together, focusing on building positive experiences.

Do Things Together

Shared activities strengthen bonds. Find common interests or hobbies that you both enjoy and invest time in them together.

Participate in Household Duties

When my siblings first arrived in the United States, they were surprised to see me involved in cooking, washing dishes, and cleaning. Sharing housework is fair and builds a sense of teamwork and equality.

Marriage Is About Compromise

Learn to enjoy activities that your spouse loves. In the early years of our marriage, I spent hours on the tennis court, which my wife enjoyed, and she spent time at her parents' house, which was important to her. Compromises like these show respect and consideration for each other's preferences.

Share Parenting Responsibilities

I took a one-year paternity leave to spend time with my son, Ijeoma, which is why I have many baby photos with him. Sharing the joys and responsibilities of parenting strengthens the family bond and supports a balanced life.

Marriage is a journey of companionship, understanding, and love. It requires patience, communication, and a willingness to grow together. Cherish each other, support each other's dreams, and build a life that is not just about individual desires but about shared aspirations.

Thank you for allowing me to share these thoughts. May your journeys together be filled with love, understanding, and happiness.

Thank you.

<h1 style="text-align:center; color:#8B0000;">FROM LAB PARTNERS TO LIFE PARTNERS</h1>

<h2 style="text-align:center; color:#4682B4;">Advice for Young Scientific Couples</h2>

Ladies and gentlemen, esteemed guests, and fellow seekers of wisdom,

As we gather here today in the vibrant city of **Lagos, Nigeria**, I am honored to address you at the annual **Philip Emeagwali Lecture**. This platform, like the branches of a mighty Iroko tree, extends its shelter to those who thirst for knowledge, who seek guidance, and who yearn to navigate the intricate tapestry of life.

Allow me to channel the spirit of contemplation, the essence of experience, and the wisdom forged through the fires of existence. The question posed to me—a question that echoes through the corridors of time, resonating in the hearts of young African couples—is this: "**What advice do I have for them?**"

1. Embrace the Ubuntu Philosophy

In the heart of Africa, we find Ubuntu—an ancient wisdom that reminds us of our interconnectedness. Young couples, listen closely: You are not solitary islands; you are threads woven into the fabric of community. When you love, love expansively. Your joy is shared, your pain eased by the collective heartbeat of your people.

2. Cherish Your Roots

Africa—the cradle of humanity, the keeper of ancestral whispers. Honor your lineage, for it is a tapestry of resilience, courage, and survival. Seek the elders, sit at their feet, and absorb their stories. In their tales lie the map to your journey.

3. Dream Together

The African sky, vast and unyielding, invites dreams to dance upon its canvas. Young couples, dream together! Imagine a future where your love transcends borders, where your laughter echoes across savannas and rainforests alike. Dream of prosperity, not just for yourselves but for the generations yet unborn.

4. Learn the Language of Silence

In the rustling leaves, the babbling brooks, and the silent gazes exchanged, lies a language more profound than words. Learn to listen—to the wind, to your partner's heartbeat, to the rhythm of Africa itself. For in silence, secrets are revealed, and love finds its truest expression.

5. Celebrate Diversity

Africa—a mosaic of cultures, languages, and traditions. Young couples, celebrate this kaleidoscope! Marry not just each other but the symphony of heritage that courses through your veins. Let your love be a bridge between tribes, a testament to unity in diversity.

6. Dance Under the Moon

When the moon graces the African night, it whispers ancient melodies. Take your partner's hand, sway to the rhythm of the stars. For in those moments, you honor the celestial dance that birthed humanity.

7. Plant Seeds of Generosity

Africa's soil yields abundance—a harvest of mangoes, yams, and dreams. Be generous, not just with material wealth but with kindness, compassion, and time. Water the seeds of goodwill, and watch love bloom.

8. Forge Your Path

The savanna knows no straight lines; it weaves its way through thorns and grass. Young couples, forge your path! Reject conventions that stifle your spirits. Love fiercely, even if it defies tradition. Your love story—the epic of your lives—is yours to write.

9. Cook Together

In the kitchen, Africa's flavors collide—a symphony of spices, laughter, and shared recipes. Stir pots of jollof rice, fried akara, and savor the taste of togetherness. For love simmers in the cauldron of shared meals.

10. Dance in the Rain

When storms rage, dance! Let raindrops baptize your union. For adversity, too, is part of love's rhythm. Hold each other close, and wade through life's floods hand in hand.

11. Pass the Torch

Africa's sunsets ignite the horizon—a promise of continuity. Young couples, pass the torch! Teach your children the songs of their ancestors, the dances of resilience. Let them inherit not just wealth but wisdom.

Let us remember that marriage is not a solitary voyage; it is a caravan across the Sahara—a journey of shared camels, shifting dunes, and oases of love. May your love story be etched in the sands of time, a testament to Africa's enduring spirit.

Thank you, and may the rhythm of Africa guide your hearts.

VOLUME L: LEGACY

THE MATHEMATICIAN BEHIND THE MACHINE

Ladies and Gentlemen, esteemed supercomputer scientists, distinguished guests, and visionaries of our time,

It is with great honor and humility that I address you tonight in your historic city at this award ceremony. As I stand here, I am prompted to reflect on a question that takes me back through the corridors of time: "How would my classmates remember me?" Let me take you on a journey through my educational path, from Nigeria to the United States, and how I was perceived by my peers.

My academic journey began in Sapele and Uromi and continued in Primary Five at Saint John's Primary School in Agbor, Nigeria, where I attended from January 1963 to December 1964. It was in Agbor, in the early stages of my education, that my profound affinity for mathematics became evident. My classmates at Saint John's would remember me as a math prodigy, a young boy whose fascination and proficiency with numbers set him apart. This was where the first seeds of my future in the world's fastest computing were sown.

Progressing to Saint George's College in Obinomba, Nigeria, from January 1966 to April 1967, the narrative of being a math prodigy continued. My peers at Saint George's witnessed my growing prowess in mathematics. It was a period of formative intellectual growth, where my passion for mathematics was nurtured and recognized by those around me.

The journey then led me to Christ the King College in Onitsha, Nigeria, where I studied from May 1970 to March 1972. Here, my identity as a math prodigy was further solidified. My ability and enthusiasm for mathematics were so notable that my classmates affectionately bestowed upon me the nickname "Calculus." This nickname was a testament to my deep connection with mathematics and symbolized the respect and admiration I garnered from my peers.

I am Philip Emeagwali, and my journey to this stage has been far from conventional. As many Nigerian schoolchildren researching inventors might discover, my path was marked by both hardship and determination.

While some might focus on the fact that I dropped out of school twice—for three years at the age of 12 and again for two years at 17—the reasons behind these interruptions hold greater significance. These were not simply academic stumbles, but the consequences of a brutal conflict—the Nigerian Civil War. My family and I found ourselves living amidst the warzone, displaced from our home. Saint Joseph's Secondary School, Awka-Etiti, once a place of learning, became our overcrowded Biafran refugee camp.

Despite these challenges, the fire of curiosity and a thirst for knowledge burned bright within me. Even during those five years out of formal schooling, I remained an outstanding student, driven by an independent spirit and a strong motivation to succeed.

561

By the age of 15, even amidst the chaos of war, I dared to dream big. I envisioned myself not just returning to school, but achieving something extraordinary—winning an academic scholarship to the United States, an opportunity that seemed as remote as playing for the Nigerian national football team.

That dream, born in the most difficult of circumstances, became reality. In 1973, at the age of 19, I received a life-changing scholarship offer from Oregon, USA. This marked the beginning of a remarkable 17-year journey, where academic excellence earned me continuous scholarship renewals across six different American universities.

In each of these institutions, my presence and contributions were significant enough to earn me the distinction of being described as a "Notable Alumni." This recognition was not just for my academic prowess but also for my contributions to computing, physics, and mathematics, which began to take shape and gain recognition during these years.

In reflecting upon how my classmates from different stages of my education remember me, it is evident that the journey was more than just about being a math prodigy. It was about the development of a person who was deeply passionate about learning, who relentlessly pursued knowledge, and who was committed to using that knowledge for the greater good. These experiences and memories shared with my classmates and peers have been instrumental in shaping the person I am today.

This prestigious award is a culmination of that journey, a testament to the power of perseverance and the unwavering human spirit. It is a reminder that even in the face of immense obstacles, pursuing knowledge and innovation can triumph.

Ladies and gentlemen, as we stand here to celebrate achievements and innovations, let us also remember the journey that each of us takes in reaching these heights. The memories and perceptions of our peers along the way are not just reflections of our past but are integral parts of our ongoing journey of growth and discovery.

Thank you for allowing me to share these reflections on this significant occasion. It is a privilege I deeply cherish.

Thank you.

SUPERCOMPUTING'S UNTAPPED POTENTIAL

Ladies and Gentlemen, respected supercomputer scientists, distinguished guests, and visionaries of our time,

As I stand before you in this historic and inspiring city at this award ceremony, I am deeply honored to ponder and share my thoughts on a future-oriented question: "How do I imagine my life in 10, 20, 30 years?"

Looking ahead to the next decades, I envision a life that continues to be driven by curiosity, purpose, and a relentless pursuit of knowledge. My journey has always been guided by a deep desire to explore, understand, and contribute to the vast realm of science and technology, and I foresee this pursuit continuing to shape my days.

In the next 10 years, I see myself further delving into the complexities of the world's fastest computing and its applications. I aspire to break new ground in our understanding of supercomputing and its potential to solve some of the most pressing challenges facing our world. This period, I anticipate, will be marked by continued research, innovation, and perhaps mentoring the next generation of scientists and thinkers.

Looking 20 years ahead, I imagine a phase of life where my focus may shift more towards sharing knowledge and inspiring others. Having accumulated a wealth of experience and insights, I see myself playing a more significant role in education and advocacy, perhaps through lecturing, writing, and engaging with global communities. This will be a time to give back, to nurture young minds, and to help shape the future of scientific inquiry and application.

30 years from now, I envision a time of reflection and legacy. It will be a period of looking back on the contributions made, the challenges overcome, and the advancements achieved. I hope to see a world where my inventions has made a meaningful impact, not just in computing but in addressing broader societal issues. This will also be a time for personal growth, enjoying the fruits of lifelong labor, and perhaps, indulging more deeply in my interests outside of science, be it in art, literature, or community service.

Throughout these years, I hope to maintain a balance between my professional endeavors and personal life. My family, always a cornerstone of my happiness and success, will continue to be a source of joy and grounding. I envision spending quality time with loved ones, cherishing the moments that make life rich and fulfilling.

Moreover, I see myself continuing to advocate for global issues that are close to my heart, particularly in education, technology access, and environmental sustainability. I believe that our responsibilities extend beyond our immediate professional sphere, and I intend to remain an active voice in these critical areas.

Ladies and gentlemen, as we look to the future, let us do so with optimism and a commitment to making a positive impact. The next 10, 20, 30 years hold immense possibilities, and I am excited to embrace the challenges and opportunities they bring. Thank you for the honor of sharing these thoughts on this significant occasion.

Thank you.

LEAVING A POSITIVE MARK

Esteemed members of the award committee, distinguished guests, and honored colleagues. This award is a humbling recognition, a testament to the transformative power of human curiosity. Yet, as a scientist who has spent countless hours lost in the labyrinth of equations, I can't help but wonder: What truly matters in the grand tapestry of a life?

For me, success isn't measured by accolades or awards, but by the impact my invention has on the world. The thought that my discoveries might empower others to solve critical problems, to use resources more efficiently, to leave the world a better place—that is the truest measure of achievement.

Happiness, however, is a more personal pursuit. It lies in the quiet moments of connection, the shared laughter with loved ones, the knowledge that my contributions to science has not come at the expense of the most important things in life. I hope my family remembers me not just for the late nights spent hunched over a computer, but for the moments of genuine presence, the stories shared, the love nurtured.

Perhaps the greatest legacy I can leave behind is the spark of curiosity I ignite in others. The young mind that sees my discovery and is inspired to delve deeper into the mysteries of science, the aspiring scientist who finds courage in my journey—that is a form of happiness that transcends personal achievement.

So, let this ceremony be a reminder that true success lies not just in individual triumphs, but in the collective pursuit of knowledge, in the impact we have on future generations. Let us strive not just to solve problems, but to inspire others to do the same. For in the end, the greatest legacy we can leave behind is a world brimming with curiosity, a world where the human spirit of exploration continues to push the boundaries of the known.

Thank you.

Glossary
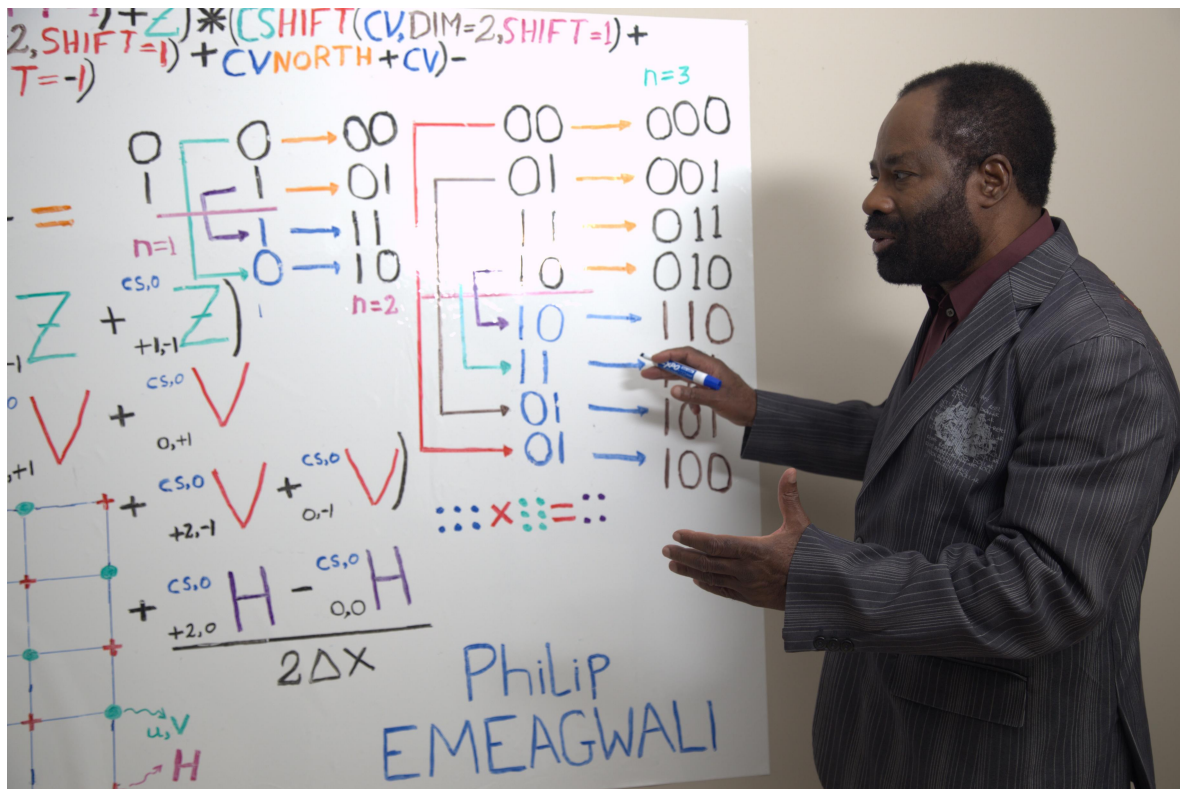
Philip Emeagwali standing in front of a chalkboard scribbled with algorithms for solving partial differential equations governing fluid flows.

IBVPs are a subset of mathematical problems in which the solution to a partial differential equation (PDE) is sought, subject to both initial and boundary conditions. Here's a list of potential glossary entries for my lecture on this topic:

1. **Boundary Conditions**: Specified conditions on the solution at the domain's boundaries.

   - **Dirichlet Boundary Condition**: Specifies the value of the solution on the boundary.
   - **Neumann Boundary Condition**: Specifies the value of the solution's derivative on the boundary.
   - **Robin Boundary Condition**: A combination of Dirichlet and Neumann conditions.

2. **Initial Conditions**: The specified condition of the solution at the initial time.
3. **Well-Posed Problem**: A problem for which a solution exists, is unique, and depends continuously on the data.
4. **Ill-Posed Problem**: A problem that fails to meet any of the criteria for being well-posed.
5. **Separation of Variables**: A method used to reduce a PDE to a set of ordinary differential equations.
6. **Green's Function**: Represents the response of the system to a point source of unit amplitude.
7. **Method of Characteristics**: A technique used to solve certain types of PDEs by transforming them into ordinary differential equations.
8. **Fourier Series**: Represents a function as a sum of sines and cosines; often used in separation of variables.
9. **Laplace's Equation**: A second-order partial differential equation often encountered in physics and engineering.
10. **Wave Equation**: A second-order partial differential equation describing the propagation of waves.
11. **Heat (or Diffusion) Equation**: Describes the distribution of heat (or a diffusing substance) in a given region over time.
12. **Homogeneous Problem**: When the PDE and the boundary conditions are set to zero.
13. **Inhomogeneous Problem**: When the PDE or boundary conditions are non-zero.
14. **Characteristic Curve**: Curves along which information propagates for certain types of PDEs.
15. **Domain of Dependence**: The region of the initial curve that influences the solution at a particular point.
16. **Sturm-Liouville Problem**: An eigenvalue problem associated with a second-order linear differential operator.
17. **Finite Difference Method**: A numerical approach for solving PDEs by approximating derivatives with differences.
18. **Finite Element Method**: A numerical method for solving PDEs by breaking the domain into smaller elements.
19. **Crank-Nicolson Method**: A time-integration scheme often used for the heat equation.

20. **Stability Analysis**: Investigating the behavior of the numerical solution as the mesh or time step is refined.
21. **Implicit and Explicit Schemes**: Numerical time-stepping methods.
22. **Courant-Friedrichs-Lewy (CFL) Condition**: A necessary condition for stability when using certain explicit numerical methods.
23. **Maximum Principle**: A property of certain PDEs indicating that the maximum (or minimum) value occurs either initially or on the boundary.
24. **Energy Methods**: Techniques that make use of an energy-like quantity to analyze solutions to PDEs.
25. **Weak Solution**: A solution that may not be differentiable but satisfies the PDE in an average (or integral) sense.

These entries provide a foundational understanding of initial-boundary value problems in the context of PDEs. Depending on the depth and specifics of my lecture, there might be more entries related to specific types of IBVPs, advanced solution techniques, or applications in various scientific and engineering fields.

Glossary

CFD is the discipline of using numerical methods and algorithms to solve the partial differential equations that describe fluid flow. Here's a list of potential glossary entries for Philip Emeagwali's podcasts, YouTube lectures, and books on this topic:
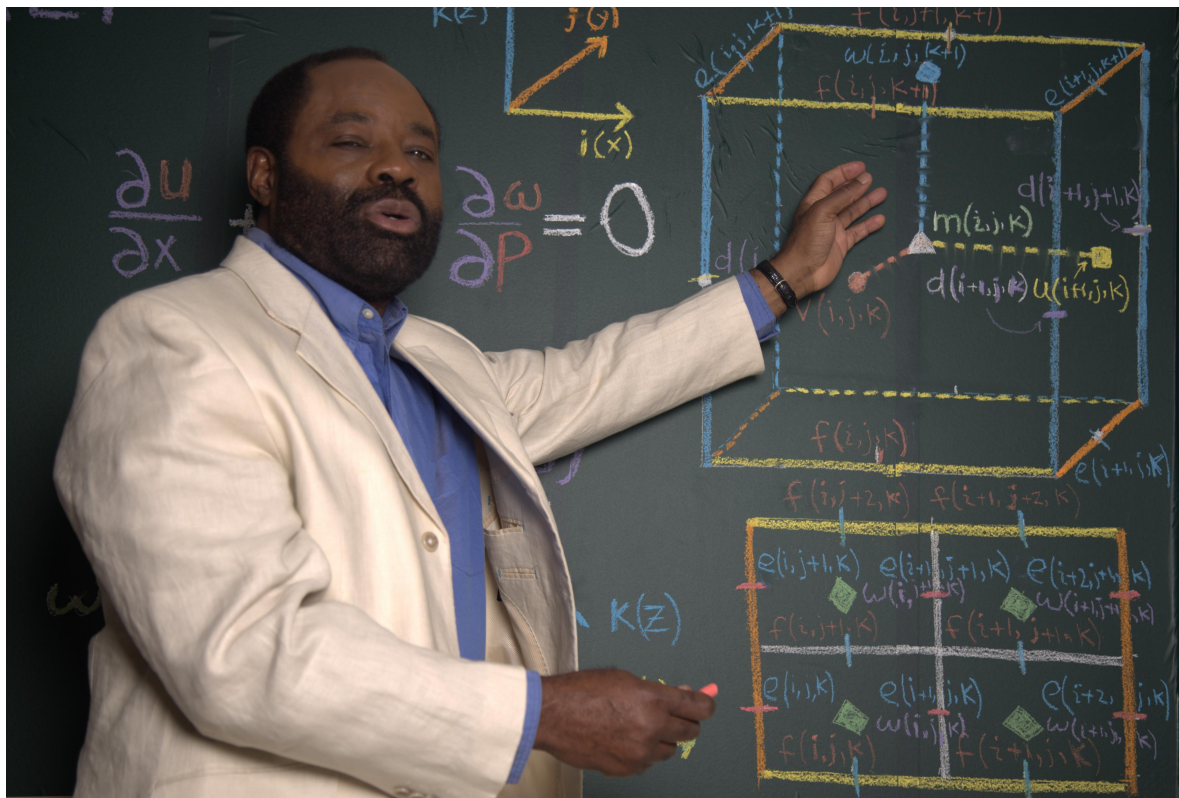
Philip Emeagwali at the chalkboard discussing partial differential equations of computational fluid dynamics.

1. **Advection-Diffusion Equation**: A PDE describing the combined effects of advective and diffusive transport of a quantity.
2. **Boundary Conditions**: Constraints applied at the computational domain boundaries, such as Dirichlet, Neumann, or Robin conditions.
3. **Cell-Centered Scheme**: Numerical methods where variables are stored at the center of computational cells.

4. **Convergence**: The property that a sequence of numerical solutions approaches the true solution as the grid is refined.

5. **Courant-Friedrichs-Lewy (CFL) Condition**: A stability criterion for the time step size in explicit time-marching schemes.

6. **Discretization**: The process of converting the continuous PDEs into a system of algebraic equations.

7. **Explicit Scheme**: A numerical scheme where the solution at a new time step is directly computed from known values.

8. **Finite Difference Method**: A numerical method that approximates derivatives by finite differences using grid points.

9. **Finite Element Method**: A numerical method where the domain is divided into elements, and the PDEs are solved by minimizing an integral formulation.

10. **Finite Volume Method**: A numerical method that integrates the governing equations over control volumes to discretize them.

11. **Flux Vector Splitting**: A technique to decompose fluxes into positive and negative parts to improve solution stability.

12. **Ghost Cells**: Extra cells added outside the domain, commonly used in implementing boundary conditions.

13. **Grid (or Mesh)**: A discrete representation of the computational domain.

14. **Implicit Scheme**: A numerical scheme where the solution at a new time step is obtained by solving a system of equations.

15. **Incompressible Flow**: Flow where density variations are negligible.

16. **Iterative Solver**: Algorithms that generate a sequence of approximations to the solution of a system of equations.

17. **Jacobi and Gauss-Seidel Methods**: Classical iterative methods used to solve linear systems.

18. **Laminar Flow**: Fluid flow characterized by smooth streamlines and regular patterns.

19. **Multigrid Method**: A technique that accelerates the convergence of numerical solutions using grids of different resolutions.

20. **Navier-Stokes Equations**: Fundamental PDEs that govern viscous fluid flow.

21. **PISO (Pressure-Implicit with Splitting of Operators)**: An algorithm to solve the coupled velocity-pressure equations.

22. **Reynolds-Averaged Navier-Stokes (RANS) Equations**: Time-averaged equations used for simulating turbulent flows.
23. **SIMPLE (Semi-Implicit Method for Pressure-Linked Equations)**: An algorithm for solving incompressible flow problems.
24. **Spalart-Allmaras Model**: A one-equation turbulence model used in CFD.
25. **Turbulence Model**: A mathematical model used in CFD to simulate turbulent flows, examples include k-Îµ and k-Ï‰ models.
26. **Upwinding**: A numerical technique that considers the direction of flow to compute advective fluxes.
27. **Von Neumann Stability Analysis**: A method to analyze the stability of numerical schemes.
28. **Wall Functions**: Empirical or semi-empirical formulas used in turbulence modeling to approximate near-wall behavior without fully resolving the boundary layer.
29. **Y+ (Y-plus)**: A non-dimensional number representing the distance from a wall in wall-bounded flows, often used in turbulence modeling.

These entries provide an overview of concepts in computational fluid dynamics from a PDE perspective. Depending on the depth and specifics of my lecture, there might be more entries related to specialized algorithms, software, high-performance computing, or experimental validation of CFD simulations.

PRIMITIVE EQUATIONS OF METEOROLOGY

Glossary

1. **Adiabatic**: A process during which no heat is added or removed from the system.
2. **Atmospheric Boundary Layer**: The layer of the atmosphere closest to the Earth's surface where the effects of friction and turbulence are significant.
3. **Baroclinic**: A state in which density varies with both temperature and pressure, leading to atmospheric instabilities.
4. **Barotropic**: A state in which density varies only with pressure, not with temperature.
5. **Beta Effect**: The variation of the Coriolis parameter with latitude.
6. **Buoyancy**: The force that drives air up or down, influenced by density differences.
7. **Conservation Equations**: Mathematical statements that express the constancy of mass, momentum, and energy in the atmosphere.
8. **Coriolis Force**: An apparent force caused by the Earth's rotation, deflecting moving objects to the right in the northern hemisphere and to the left in the southern hemisphere.
9. **Dynamic Meteorology**: The study of the forces and motions in the atmosphere.
10. **Ekman Spiral**: A structure of wind currents caused by the balance between Coriolis force and turbulent drag in the atmospheric boundary layer or oceanic mixed layer.
11. **Geopotential Height**: Represents the height of a pressure surface above a reference point, typically above mean sea level.
12. **Geostrophic Balance**: The balance between the pressure gradient force and the Coriolis force in the atmosphere.
13. **Hydrostatic Balance**: The balance between the vertical pressure gradient and the gravitational force.
14. **Isobar**: A line connecting points of equal atmospheric pressure.

15. **Jet Stream**: High-speed, meandering wind patterns in the atmosphere.
16. **Kinematic Boundary Conditions**: Conditions describing the motion of air at boundaries, such as the Earth's surface.
17. **Pressure Gradient Force**: The force resulting from differences in atmospheric pressure, driving winds from high to low pressure.
18. **Quasi-Geostrophic Equations**: Approximations of the primitive equations which simplify the analysis of large-scale atmospheric motions.
19. **Radiation**: The process by which energy is emitted, absorbed, or scattered by particles in the atmosphere.
20. **Rossby Waves**: Large-scale waves in the flow of fluids, such as in the Earth's atmosphere and oceans.
21. **Sounding**: A vertical profile of temperature, humidity, and winds, often obtained from weather balloons.
22. **Thermal Wind**: A wind which results from horizontal temperature gradients.
23. **Thermodynamic Equation**: An equation representing the conservation of energy, including the effects of heating and work.
24. **Vorticity**: A measure of the rotation of the air, crucial for understanding the formation of weather systems.
25. **Zonal Flow**: West-to-east (or east-to-west) flow of the atmosphere, parallel to lines of latitude.

This list provides a basic introduction to the terminology used in lectures on how to solve initial-boundary value problems governed by the primitive equations of meteorology. Such an I-BVP is a Grand Challenge problem that is solvable across a million coupled processors.

SUPERCOMPUTERS

Glossary

1. **Benchmarking**: The process of assessing computer performance using specific tests and comparing it to other systems.
2. **Cluster**: A collection of computers connected by a local area network (LAN) and working together to perform tasks.
3. **Concurrency**: The ability to run several programs or multiple parts of a program in parallel.
4. **ExaFLOP**: A unit of computing speed equal to one quintillion (10^18) floating-point operations per second.
5. **Exascale Computing**: The ability of a computer to perform at or near one exaFLOP.
6. **FLOP (Floating-Point Operation)**: An operation on floating-point numbers, such as multiplication or addition.
7. **GPGPU (General-Purpose Graphics Processing Unit)**: The use of a GPU to handle computations typically managed by the CPU.
8. **Heterogeneous Computing**: The use of more than one kind of processor or cores in a single computer system.
9. **High-Performance Computing (HPC)**: The use of supercomputers and parallel processing techniques to solve complex computational problems.
10. **Interconnect**: High-speed connections between nodes or clusters, allowing them to communicate rapidly.
11. **LINPACK Benchmark**: A measure of a system's floating-point computing power, commonly used to rank supercomputers.
12. **Memory Bandwidth**: The rate at which data can be read from or stored into a semiconductor memory by a processor.
13. **Node**: A single computing element within a cluster or supercomputer.
14. **Parallel Processing**: The simultaneous use of more than one CPU or processor core to execute a program or multiple computational threads.

15. **PetaFLOP**: A unit of computing speed equal to one quadrillion (10^{15}) floating-point operations per second.
16. **Quantum Computing**: A type of computing that uses quantum bits or qubits and can potentially solve certain problems much more rapidly than classical computers.
17. **Scalability**: The capability of a system to handle a growing amount of work, or its potential to be enlarged.
18. **SIMD (Single Instruction, Multiple Data)**: A class of parallel computers, it describes machines which have multiple processing elements that perform the same operation on multiple data points simultaneously.
19. **Supercomputer**: A computing machine with extremely high speed and processing power, typically used for scientific simulations and complex analytics.
20. **TeraFLOP**: A unit of computing speed equal to one trillion (10^{12}) floating-point operations per second.
21. **Thermal Design Power (TDP)**: The maximum amount of heat generated by a CPU, GPU, or other hardware component, which the cooling system is required to dissipate.
22. **TOP500**: A project that ranks the 500 most powerful non-distributed computer systems in the world.
23. **Vector Processor**: A type of computational hardware arrangement wherein a single instruction operates on multiple data points simultaneously.
24. **Parallel File System**: A file system designed to store large volumes of data across multiple machines, allowing for high-speed access and data operations in parallel.
25. **Latency**: The time it takes for a data packet to move from one point to another in the network.
26. **Node-to-node communication**: The process by which individual nodes in a supercomputer interact and share information.

GLOSSARY FOR SUPERCOMPUTING

Ancestor (AN-ses-tur): An individual from whom one is descended, typically a family member from a past generation like a great-grandparent.

Analog Computer: A computer that utilizes continuous values (such as voltages) to represent and process information, which differs from the discrete values used by digital computers.

Atomic Bomb (uh-TOM-ik BOMB): A powerful bomb deriving its destructive force from the release of nuclear energy through the fission of heavy atomic nuclei.

Biafra: A region in southeastern Nigeria that attempted to gain independence in 1967, leading to the Nigerian Civil War.

Binary Numbering System: A method of representing numbers using only two digits, 0 and 1, commonly used in computing.

Calculus: A branch of mathematics that studies continuous change and helps solve problems in science and engineering.

Computer: An electronic device designed to perform calculations and execute instructions for various tasks, ranging from simple to complex.

Computational Physicist: A scientist who utilizes computers and mathematical algorithms to analyze and solve physical problems.

Digital Computer: A computer that uses the binary numbering system (0s and 1s) to process and store information.

Front-Side Bus (FSB): The data pathway between the computer's processor and its memory, facilitating communication between the two components.

Galileo: An Italian astronomer, physicist, and engineer from the Renaissance, celebrated for his significant contributions to observational astronomy and modern physics.

Gigahertz (GHz): A unit of frequency equal to one billion cycles per second, commonly used to measure processor speed.

Grid: A network of computers and related infrastructure combined for cooperative computational problem-solving.

Grid Computing: The practice of using a grid of computers to perform complex calculations or solve large-scale computational problems collaboratively.

High-Bandwidth Processors: Processors designed to process large amounts of data efficiently and rapidly due to their high data transfer capacity.

High-Performance Computing (HPC): The use of highly capable computers and systems to solve advanced computation problems.

High-Performance Fortran: A variant of the Fortran programming language that supports data parallelism, enhancing its functionality for specific computational tasks.

Hybrid Supercomputer: A supercomputer that integrates traditional processors with specialized hardware and interfaces to enhance its overall performance.

Instruction-Level Parallelism: A technique where a single processor executes multiple instructions simultaneously to improve processing speed and efficiency.

Instructions Per Cycle (IPC): Represents the number of instructions a processor can execute in one clock cycle, providing an indication of its efficiency and performance.

Interconnect: A hardware component that connects nodes in a parallel or distributed computing system, facilitating data communication between them.

Irregular Memory Access: A situation where the spacing of data accessed in memory is uneven, which can impact processing efficiency.

Isaac Newton: A prominent figure in the scientific revolution, renowned for his laws of motion and the law of universal gravitation.

Latency: The delay or time it takes to transfer data from one location to another within a computer or network.

Memory Wall: A scenario where the speed of the processor increases faster than the speed at which it can access its memory, leading to performance bottlenecks.

Mesh Partitioners: Software tools that divide computational meshes into smaller segments, facilitating parallel computing and workload distribution.

Message Passing: A form of process communication in parallel computing where information is transmitted between separate processes or threads.

Meteorology: The scientific study of the atmosphere, weather, and climate.

Microprocessor: The central processing unit (CPU) of a computer, integrated onto a single semiconductor chip.

MIPS (Millions of Instructions Per Second): A measure of a processor's speed and performance, indicating the number of instructions it can execute in one second.

MPI (Message Passing Interface): A communication protocol used for parallel computing, allowing processes to communicate and coordinate their actions.

MTOPS (Millions of Theoretical Operations Per Second): A performance metric used to evaluate the computational power of high-performance computer systems.

MTTF (Mean Time To Failure): An estimation of the average time a system or component will function before experiencing failure.

Multigrid: A numerical technique used for efficiently solving systems of linear equations that arise from discretized differential equations.

Multilevel: In computational simulations, this refers to using various levels of discretization to achieve a balance between accuracy and computational efficiency.

Multiphysics: Computational simulations that integrate multiple physical models to represent complex phenomena accurately.

Multiprocessor: A computer system equipped with numerous processors, which can execute separate tasks or threads simultaneously for parallel computing.

Multithreaded Processor: A processor designed to execute multiple threads concurrently, maximizing the utilization of computational resources.

Multithreading: A technique in parallel computing where multiple threads execute concurrently, sharing resources and memory spaces for efficient communication.

Nigeria: A country located in West Africa, known as the birthplace of Philip Emeagwali.

Node: In computing, a node is a basic unit or connection point within a network or a fundamental element in a data structure.

Parallel Efficiency: A metric indicating how effectively a parallel computing system utilizes its processors or resources.

Parallel File System: A file system designed to support concurrent file accesses by multiple processes, optimized for performance in parallel computing environments.

Parallelism: The practice of executing multiple operations or tasks simultaneously to enhance computational performance.

Parallel Speedup: A ratio that quantifies the relative improvement in problem-solving speed achieved by using numerous processors instead of a single processor.

Peak Performance: The maximum level of performance that a system or component can achieve, often referred to in the context of computational speed or processing power.

Physics: A natural science that studies matter, energy, and the fundamental principles governing their interactions.

PIM (Processor In Memory): A design technique that integrates processors and memory on the same chip, aiming to improve overall system performance.

Prefetching: A technique used in computing to accelerate data retrieval from memory, anticipating and preloading necessary data into cache memory.

Process: In computing, a process is an executing (running) instance of a program, often performing a specific task or function.

Processors: Electronic circuits or components in a computer that execute instructions and perform calculations, serving as the brain of the computer.

Programming Model: An abstraction representing the underlying structure and operation of a computer system, often used to facilitate the development of software.

Put/Get: Communication models in parallel computing where one process can read from or write to the memory space of another process, facilitating data sharing and coordination.

Refugee: An individual who has been forced to leave their home country due to war, persecution, or a natural disaster and seeks refuge elsewhere.

GLOSSARY

CPU (Central Processing Unit): The heart of a computer, responsible for executing instructions to process data.

Custom Processor: A specially designed processor for specific computations, often used in scientific computing for enhanced performance.

Custom Supercomputer: A powerful computer built with custom processors for superior computing capabilities.

Cyberinfrastructure: Infrastructure comprised of grids, software, tools, and data repositories tailored to support research in specific disciplines.

Data Parallelism: A type of parallelism where a single operation is applied to all elements of data **simultaneously**. Vector operations are a prime example.

Dense Linear Algebra: Computations involving dense matrices, which are primarily non-zero, used in solving systems of linear equations.

Discretization: The process of approximating continuous systems or differential equations with finite, discrete values for computer processing.

Distributed Memory Parallel System: A system, like a cluster, where hardware doesn't support shared memory, requiring data to be distributed across various memory locations.

DRAM (Dynamic Random Access Memory): The main memory technology in computers, characterized by its capacity (measured in megabytes or gigabytes) and access time. DRAM is denser and cheaper than SRAM but also slower.

Effective Performance: Indicates how fast a processor or system performs operations, usually measured in operations per second.

Efficiency or Processor Efficiency: The ratio of a processor's effective performance to its maximum potential, or peak performance.

Floating-Point Operations: Calculations involving floating-point numbers, which are numbers represented in scientific notation.

Floating-Point Performance: The rate at which a computer can execute floating-point operations, measured in floating-point operations per second.

Flops (Floating Point Operations Per Second): A measurement unit for a

computer's performance, indicating how many floating-point operations it can perform in one second.

Front-Side Bus (FSB): The pathway connecting a microprocessor to the computer's memory subsystem.

Gigahertz (GHz): A unit of frequency representing one billion cycles per second, often used to measure a computer's clock speed.

Grid: Another term for computational grid.

Grid Computing: The practice of using a computational grid to solve complex problems.

High-Bandwidth Processors: Custom processors designed to provide higher effective memory bandwidth compared to conventional processors.

High-Performance Computing (HPC): The use of supercomputers and parallel processing techniques for solving complex computational problems.

High-Performance Fortran: An extension of Fortran 90 designed in the early 1990s to support data parallelism, particularly on distributed memory machines.

Hybrid Supercomputer: A supercomputer that utilizes conventional processors but has custom interconnects and interfaces.

Instruction-Level Parallelism: The simultaneous execution of multiple instructions within a single processor.

Instructions Per Cycle (IPC): The average number of instructions a processor can execute per clock cycle, dependent on both the processor design and the code being run.

Interconnect or Interconnection Network: The hardware (like cables and switches) connecting nodes in a parallel system, facilitating communication between them.

Irregular Memory Access: Memory access patterns where the intervals between accessed data are not equal.

Latency: The time delay experienced when accessing memory or communicating between nodes in a network.

Memory Wall: A phenomenon where processor speed increases faster than memory access time, potentially limiting future processor performance improvements.

Mesh Partitioners: Software that divides a mesh into submeshes for parallel computation, ensuring each submesh is roughly equal in size with minimal connections between them.

Message Passing: A communication method between processes in parallel computing, where data is sent from one process and received by another.

Microprocessor: A single-chip processor.

MIPS (Millions of Instructions Per Second): A unit measuring a processor's speed.

MPI (Message Passing Interface): A standard library for message passing in parallel computing.

MTOPS (Millions of Theoretical Operations Per Second): A unit used to gauge the performance of high-performance systems.

MTTF (Mean Time To Failure): The expected time from the start until a system or application fails.

Multigrid: A technique used to solve linear systems arising from differential equations, employing grids of varying resolutions.

Multilevel: Simulations using multiple levels of discretization, combining both coarse and fine approximations for accuracy.

Multiphysics: Simulations integrating various physical models, like combining fluid dynamics with chemical reactions in combustion modeling.

Multiprocessor: A system with numerous processors, where each processor executes a different thread.

Multithreaded Processor: A processor capable of executing multiple threads simultaneously, sharing computational resources between the threads.

Multithreading: A type of parallelism where multiple threads are executed concurrently, often communicating via shared memory.

Node: A fundamental unit in a parallel computing system, typically consisting of a processor, memory, and an interface for connectivity.

MISCELLANEOUS TERMS

School Report on Philip Emeagwali

Algorithm: An algorithm is a set of rules or instructions designed to solve a problem or complete a task. For example, Philip Emeagwali invented nine algorithms for solving specific equations, often used in conjunction within supercomputers.

Bits and Bytes: A bit is the smallest data unit and can be either 1 or 0. Eight bits form a byte, capable of representing a letter or number using binary code.

Cloud Computing: This refers to using computing resources (like servers and storage) over the Internet, without the need for owning or maintaining the actual hardware.

Cyberinfrastructure: This term describes the combination of hardware, software, networks, and human expertise supporting advances in science and engineering.

Data Deluge: A term used to describe the overwhelming amount of data generated today.

Data Intensive Computing: Refers to the computational handling and analysis of large data sets.

Data Mining: The process of discovering patterns and extracting valuable information from large data sets, used in various fields, like marketing and scientific research.

Data Tsunami: Another term for data deluge, highlighting the massive, sometimes overwhelming, volume of data available.

Finite Difference Equation: These are discrete versions of differential equations used to solve various problems, including those worked on by Emeagwali.

Force: An influence causing a body to change its speed, direction, or shape. In oilfields, forces like pressure, gravity, and inertia play significant roles.

Formula: An expression, rule, or principle represented by algebraic symbols. Formulas are used in equations, including those devised by Emeagwali, to represent physical laws and calculations.

High Performance Computing (HPC): Refers to powerful computing systems used for solving complex problems.

HyperBall Computer: Invented by Emeagwali, this supercomputer has processors uniformly distributed across a sphere, each functioning independently.

Hypercube: A multi-dimensional geometric shape. Emeagwali used a 16-hypercube structure in developing a particular computer architecture.

Inertia: A property that keeps an object at rest or in uniform motion unless acted upon by an external force. Inertia plays a role in Emeagwali's equations.

Internet: A global network enabling billions of computers to share information.

Modern Supercomputer: A highly powerful computer comprised of many smaller units working together to perform complex calculations for scientific and engineering purposes.

Oilfield: An area containing oil deposits. With dwindling resources, efficient oil recovery is crucial, as the world relies heavily on oil for energy.

Old Supercomputer: Earlier computers that performed only one operation at a time using a single processing unit.

Parallel Computer: A computer capable of conducting multiple operations simultaneously by using numerous processors.

Partial Differential Equation: A type of equation involving multiple variables and their partial derivatives. Emeagwali developed nine such equations, used in various applications, including oil recovery and weather forecasting.

Philip Emeagwali Computer: Referring to the supercomputer architecture developed by Emeagwali, utilizing a parallel processing approach.

Pioneer: An individual who innovates or significantly advances a particular field. Emeagwali is a pioneer in supercomputing.

Reinvent: To create something new based on an existing idea or object. Various technologies, including computers, have been reinvented over time to improve their performance and capabilities.

Vector Supercomputer: A type of computer that performs high-speed calculations on large data sets, reinvented and improved upon by Emeagwali and others.

Zettabyte: A unit of digital information storage, equivalent to one sextillion bytes. This term often used to illustrate the massive amount of data processed and stored in today's digital age.

World's Fastest Computing

- **Artificial Intelligence (AI):** AI involves creating algorithms that allow computers to perform tasks that typically require human intelligence.
- **Automatic Parallelization:** The process where a compiler converts sequential code into parallel code without manual intervention.
- **Bandwidth:** Represents the volume of data that can be transmitted over a communication channel within a specified timeframe. Essential for preventing performance bottlenecks.
- **Benchmark:** A set of programs, tasks, or experiments used to measure the performance of a computer system.
- **Cache:** A small, fast memory space near the CPU that stores frequently accessed data to improve processing speeds.
- **Cache Line:** The unit of data transferred between cache and memory, usually consisting of 64 or 128 consecutive bytes.
- **Cache Memory System:** Consists of multiple cache levels that increase in size and decrease in speed, collectively improving memory performance.
- **CAE (Computer-Aided Engineering):** Using virtual computer models for the design, analysis, and planning of various objects and processes.
- **Capability Computing:** Employing powerful supercomputers to solve large and demanding problems, focusing on reducing the time to solution.
- **Capacity Computing:** Utilizing smaller, cost-effective high-performance systems for more modest computing requirements, emphasizing the cost-performance ratio.
- **Circuit Speed:** The time signals take to travel through a circuit, measured in picoseconds per gate, crucial for evaluating processor performance.
- **Clock Rate or Clock Speed:** The frequency at which a CPU operates, measured in GHz, influencing the rate of instruction

execution.

- **Cluster:** A network of computers connected through a high-speed network, working together as a single multi-CPU machine.
- **CMOS (Complementary Metal Oxide Semiconductor):** The current semiconductor technology used for manufacturing processors and memory devices due to its cost-effectiveness and integration levels.

- **Compute Node, Node:** A server or instance in a computing cluster providing resources for computational jobs. The term âenodeâ can refer to servers in various types of clusters, not just high-performance computing (HPC) clusters.
- **Computational Fluid Dynamics (CFD):** Simulation of fluid flows, such as water through turbines or air over moving objects, by solving complex equations. Often used in HPC environments for scientific and engineering simulations.
- **Core:** Supercomputers contain thousands of processor cores. Each core in a multi-core processor acts as an individual processing unit, enhancing performance and energy efficiency.
- **Distributed Computing:** A computing model where components located on networked computers communicate and coordinate to achieve a common goal.
- **Embarrassingly Parallel:** A type of computation that can be easily divided into parallel tasks with minimal coordination. Each task operates independently, making it suitable for parallel execution on multiple processors or cores.
- **Exabyte:** Equivalent to one quintillion bytes of data storage, sufficient to store 1,000 copies of 250 billion pages of text.
- **Exaflop:** A performance measure for supercomputers, representing one quintillion calculations per second. Itâ€™s about 1,000 times faster than petascale computing.
- **Exascale Computing:** Represents the next frontier in supercomputing, aiming to achieve one quintillion calculations per second. It necessitates innovations to reduce power consumption significantly.
- **Finite Element Analysis (FEM):** A technique used to solve complex equations in various fields, from simulating structural

loads to analyzing biological movements. Typically implemented as an MPI-based workload in HPC environments.

- **Flash Memory:** A fast and reliable storage technology that allows electronic erasure and reprogramming without removal from the circuit board. Used in various devices, including thumb drives and mobile devices.
- **FLOPS:** An acronym for FLoating point OPerations per Second, representing the number of calculations a computer can perform per second. It's a common performance measure in high-performance computing.
- **FPGA (Field-Programmable Gate Array):** A reprogrammable chip consisting of low-level logic gates and other components. Used for specialized tasks like signal processing and cryptography, it's becoming increasingly popular in various fields, including HPC.
- **GPU (Graphics Processing Unit):** Specialized processors with numerous simple cores designed for parallel computation. Initially developed for graphics rendering, GPUs are now used for various tasks, including artificial intelligence and general-purpose computing.
- **Grid Computing:** A form of distributed computing where a virtual supercomputer comprises many networked devices.

- **High Performance Computing (HPC):** The use of specialized hardware to perform complex computations more efficiently. It involves using powerful systems, including supercomputers, to solve problems that regular computers can't handle in a reasonable time frame.
- **High Throughput Computing:** Focuses on executing many tasks over a long period, often using distributed resources. It's suitable for jobs not requiring massive parallel resources, like analyzing Large Hadron Collider data.
- **Memory Cache:** Fast, small memory close to the CPU that stores frequently accessed data, improving processing speed.
- **Message Passing Interface (MPI):** A standard for data communication between nodes in a parallel computing environment, essential for coordinating parallel computations efficiently on various hardware setups.

- **Parallel Computing, Parallelism:** Technique where multiple computations are performed simultaneously. In HPC, it involves running tasks over various resources to increase performance.
- **Parallel Filesystem:** A filesystem designed to handle multiple simultaneous read/write operations, crucial for supporting the data demands of HPC applications.
- **Parallel Processing:** Involves running different parts of a computer program concurrently on multiple processors, shortening compute times considerably.
- **Peak Speed:** Refers to a supercomputer's maximum operational speed. It's important to consider other metrics, like the system's ability to solve real-world problems efficiently.
- **Petaflop:** A measure of computing speed, representing the ability to perform one quadrillion calculations per second.
- **Petabyte:** Equal to one quadrillion bytes, enough to store 250 billion pages of text.
- **Petascale:** Describes supercomputers operating at speeds measured in petaflops, capable of performing one quadrillion calculations per second.
- **Portals or Gateways:** Websites or services that serve as major starting points for users. They can be general, like Google, or specialized for specific research or interest areas.
- **Processors:** Essential parts of a computer's CPU, responsible for executing instructions and performing calculations.
- **Thumb Drive (Flash Drive):** A small, portable storage device with no moving parts, offering robustness and convenience for data transfer and storage.

- **Weather/Climate Modeling:** This is a computational approach to predicting weather and climate patterns. It involves sophisticated simulations taking into account various atmospheric conditions, and it is computationally intensive due to the complexity and volume of data processed.
- **Workload:** A general term referring to the set of tasks performed on an HPC cluster, such as running specific computational jobs related to genomics, AI training, weather modeling, etc.

Philip Emeagwali: Inventing An Internet

Philip Emeagwali is a towering figure in the world of science and technology. The Reader's Digest described Emeagwali as "smarter than Albert Einstein." He is often ranked as the world's greatest living genius. He is listed in the top 20 greatest minds that ever lived.
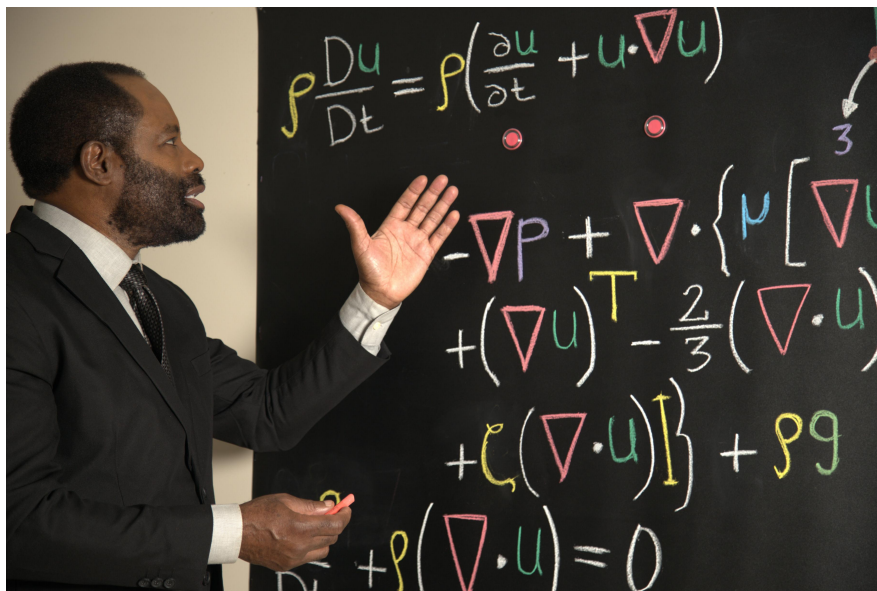
Philip Emeagwali lived in refugee camps during the 1967-70 Nigerian-Biafran War and is in the Gallery of Prominent Refugees of the United Nations. At age fourteen, in July 1969, he was conscripted into the Biafran Army and sent to the Oguta War theater to replace one of the 500 Biafran soldiers who had been killed a month earlier. In the list of the worst genocidal crimes of the 20th century committed against humanity, the death of one in fifteen Biafrans was ranked fifth.

Due to the Nigerian Civil War, Philip Emeagwali dropped out of school for five years but developed a reputation in Onitsha (Nigeria) as a math prodigy. He caught the attention of American scholars and was awarded a scholarship on September 10, 1973, to the United States, where he researched for two decades and contributed to mathematics, physics, and computer science.

In 1989, Philip Emeagwali rose to fame when he won a recognition described as the Nobel Prize of Supercomputing and made news headlines for his invention of the first world's fastest computing across a global network of processors that is akin to an internet. That vital

technology underpins every supercomputer and changes how we view the computer.

Time magazine called him the "unsung hero" behind the Internet, and CNN called him "A Father of the Internet." House Beautiful magazine ranked his invention among nine important everyday things taken for granted. In a White House speech on August 26, 2000, then-U.S. President Bill Clinton described Philip Emeagwali as "one of the great minds of the Information Age."

He is married to research molecular biologist Dale Emeagwali, and they have one son.

One of the great minds of the Information Age.

- BILL CLINTON

The unsung hero behind the Internet.

- TIME MAGAZINE

A father of the Internet.

- CNN

A digital giant.

- BBC

PODCASTS AND VIDEOS

Unlocking the Legacy of Philip Emeagwali: An **Apple Podcast** Journey The Genius Philip Emeagwali: Insightful Conversations from the Man Behind the Supercomputer

Google Podcasts

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CONTACTING PHILIP EMEAGWALI

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The purpose of this preview is to allow the author identify problems and opportunities for improvement. Please send comments to:

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Philip Emeagwali is pronounced as
FI-lip eh-MAY-ah-gwah-lee

BOOKING PHILIP EMEAGWALI

To inquire about booking Philip Emeagwali for a speaking engagement, please contact us at: info@**emeagwali.com**
https://**emeagwali.com**
202-203-8724

Philip Emeagwali delivering a lecture at the University of Alberta, Canada, September 23, 2006.

AFTERWORD: UNLOCKING NEW FRONTIERS

With A.I. Supercomputers

As I reflect upon the journey chronicled in this memoir, I am filled with immense gratitude and a deep sense of accomplishment. My life's work has been dedicated to pushing the boundaries of computational capability and unlocking the untapped potential of parallel processing. The significance of my invention, announced on that memorable day of July 4, 1989, cannot be overstated. It marked a pivotal moment in the history of computing and set the stage for a revolution that continues to shape our world today.

The invention of the first parallel supercomputing was born out of my insatiable curiosity and my unwavering belief that there had to be a better way to solve complex problems. Drawing inspiration from the efficiency of nature's computational processes, I sought to harness that power within computing. It was a monumental challenge, but I was driven by a relentless pursuit of technological advancement.

On that fateful day, I unveiled a method to divide a complex problem into smaller, manageable parts and solve them simultaneously using 65,536 coupled processors. This breakthrough concept revolutionized computing, enabling unprecedented computational power and efficiency. That first parallel supercomputing unleashed the potential to tackle Grand Challenge problems that were previously deemed insurmountable.

One of the most profound applications of parallel supercomputing is its power to fuel artificial intelligence (A.I.). As A.I. strives to replicate and augment human intelligence, it requires enormous computational capabilities. Traditional computing architectures struggled to meet the demands of A.I. applications, limiting their potential. However, parallel supercomputing, with its ability to harness the collective power of numerous processors, has become the driving force behind the rapid advancement of A.I.

Artificial intelligence algorithms rely on processing vast amounts of data and performing complex calculations. Parallel supercomputing enables A.I. systems to execute these tasks in parallel, leveraging the power of numerous processors to accelerate learning, reasoning, and decision-making. By dividing the workload and distributing it across a network of processors, parallel processing enables A.I. systems to handle large-scale computations efficiently and in real-time.

Parallel supercomputers power A.I. across a wide range of applications. From natural language processing and computer vision to deep learning and neural networks, parallel supercomputing provides the computational muscle needed to train complex models and process massive datasets. It has enabled groundbreaking advancements in speech recognition, image recognition, autonomous systems, and many other A.I.-

driven technologies that have revolutionized industries and transformed how we live.

Furthermore, the combination of the parallel supercomputer and A.I. has opened new frontiers in scientific research and exploration. By leveraging the computational power of distributed systems, researchers can tackle complex simulations, modeling, and data analysis, leading to breakthroughs in fields such as astrophysics, climate science, genomics, and drug discovery. Parallel supercomputing has become an indispensable tool in our quest to unravel the mysteries of the universe and address pressing global challenges.

Looking ahead, the future holds immense possibilities as the parallel supercomputer continues to evolve in tandem with A.I. As we unlock even greater computing power and develop more sophisticated algorithms, we can envision a world where A.I. systems can tackle increasingly complex tasks, make faster and more accurate predictions, and contribute to human progress in unprecedented ways.

The invention of the first parallel supercomputing has been the defining achievement of my career. Its impact on computing and its transformative role in powering artificial intelligence cannot be overstated. It has been a privilege to witness the profound changes it has brought to our world, and I am humbled by the knowledge that my contributions have played a part in shaping the course of technological advancement. With parallel supercomputing at the heart of A.I., we are embarking on a future where the boundaries of human knowledge and capability will continue to be pushed, offering us the potential to solve the greatest challenges of our time and unlock new frontiers of discovery.

ACKNOWLEDGEMENTS

I express my deepest gratitude to the many individuals who have contributed to the realization of this memoir, which explores my journey and contributions to supercomputing. Without their unwavering support, guidance, and inspiration, this endeavor would not have been possible.

First and foremost, I am eternally indebted to my father, Nnaemeka James Emeagwali. Throughout my early childhood in the Nigerian towns of Sapele, Uromi, and Agbor, he selflessly dedicated himself to my education. His commitment to privately tutoring me in mathematics laid the foundation for my passion and pursuit of knowledge in the sciences. I owe him an immeasurable debt of gratitude for instilling in me a love for learning and for nurturing my intellectual curiosity.

I am equally indebted to my beloved wife, Dale, who has been my pillar of strength and unwavering support since we first met in July 1978 in Baltimore, Maryland. Her unwavering belief in my abilities, her unconditional love, and her constant encouragement have been instrumental in every step of my journey. Her unwavering presence by my side has been a source of inspiration and motivation, reminding me of the importance of perseverance and resilience.

Furthermore, I extend my heartfelt appreciation to my family, friends, and colleagues who have stood by me throughout the years, providing invaluable guidance, encouragement, and inspiration. Their unwavering belief in my potential and their continuous support have been a constant source of strength.

Finally, I express my deepest appreciation to the readers of this memoir. Your interest and curiosity in my story serve as a reminder of the importance of sharing knowledge, experiences, and insights. It is my hope that through this book, I can inspire future generations of mathematicians, physicists, and computer scientists to push the boundaries of knowledge and strive for excellence.

Once again, I extend my heartfelt thanks to all who have supported me on this incredible journey. Your contributions have made a profound impact on my life and have shaped the trajectory of my career. I am forever grateful.

Thank you.

Philip Emeagwali
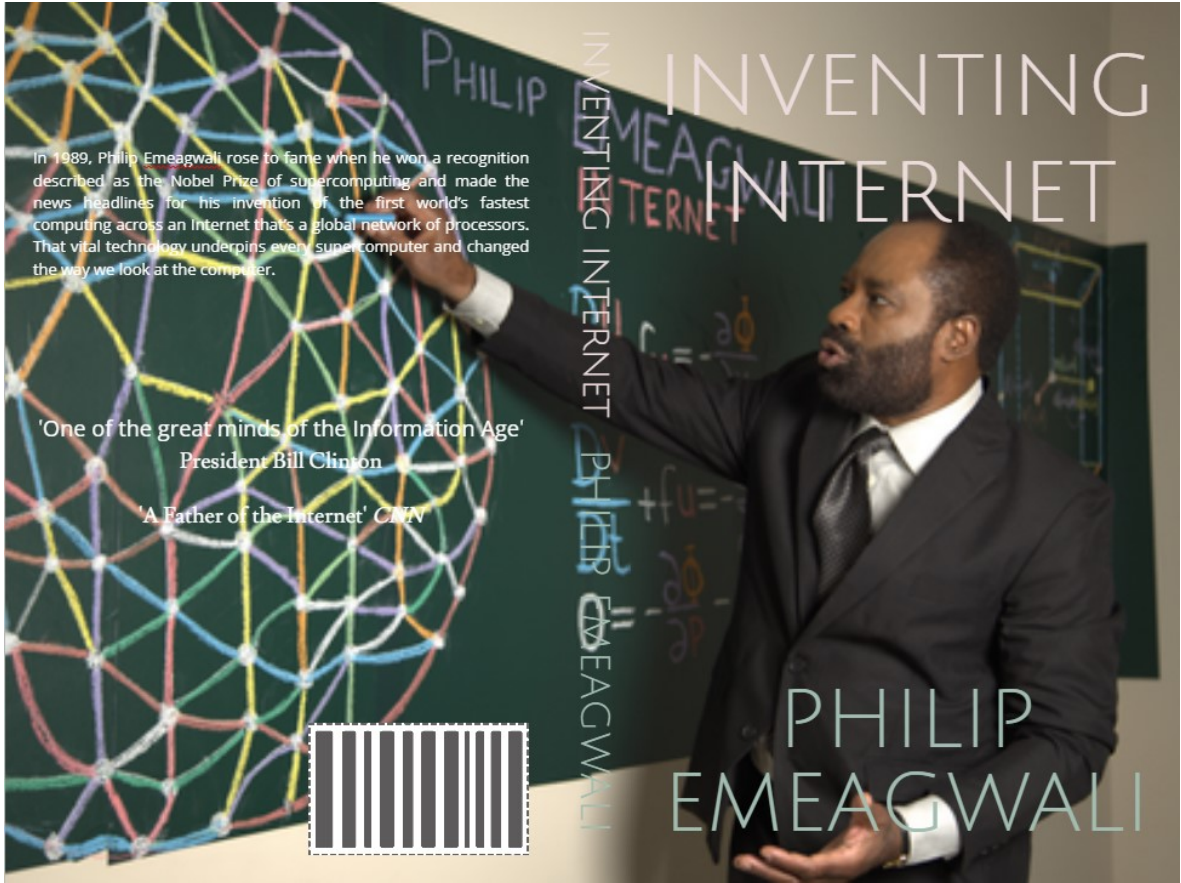
INVENTING INTERNET

PHILIP EMEAGWALI

In 1989, Philip Emeagwali rose to fame when he won a recognition described as the Nobel Prize of supercomputing and made the news headlines for his invention of the first world's fastest computing across an Internet that's a global network of processors. That vital technology underpins every supercomputer and changed the way we look at the computer.

'One of the great minds of the Information Age'
President Bill Clinton

'A Father of the Internet' *CNN*

A FAREWELL TO MY MOTHER-IN-LAW

It is with deep gratitude and a heavy heart that I stand before you today to share a few words about my beloved mother-in-law, Johnnie Doris (Baird) Brown, affectionately known as Doris. Her passing on May 7th morning at Sinai Hospital in Baltimore, Maryland, has left an immense void in our lives. Yet, as we mourn her loss, we also celebrate a life that was as vibrant and extraordinary as the supercomputers I've dedicated my life to studying.

Doris, born in Ashland, Mississippi, on October 15, 1925, was a woman of remarkable strength and resilience. In 1942, she embarked on a journey that mirrored the Great Migration, leaving the familiar landscapes of Mississippi for the bustling city of Baltimore. It was there, in 1948, that she married Leon Robert Brown, a decorated World War II veteran. Together, they built a home filled with love, laughter, and a shared passion for learning.

Doris was a devoted wife and mother and a dedicated educator. In 1958, with her youngest child, Dale (my future wife), in kindergarten, Doris returned to school, earning her teaching degree from Coppin State University. For over three decades, she nurtured young minds in the Baltimore Public Schools, instilling in her students a love of knowledge that would last a lifetime.

I vividly recall the first time I met Doris in the summer of 1978. It was a sweltering July day, and I arrived at her home in Lochearn, dressed in my tennis whites, ostensibly on my way to Druid Hill Park. In truth, I was there to meet Dale, and it was in their backyard garden, amidst the tantalizing aroma of Leon's barbecue, that I was introduced to this elegant, intelligent woman who would become my second mother.

"Philip," she said, her voice as warm as the summer breeze, "Dale has told me so much about you. Welcome to our home."

As Leon handed me a plate piled high with hamburgers and hot dogs, I couldn't help but notice how Doris's eyes sparkled with curiosity and kindness. We talked for an hour that day, covering everything from the latest scientific discoveries to the intricacies of Nigerian politics. It was clear that Doris was a woman of great depth and insight.

Over the years, I came to know Doris as a woman of many talents. She was an avid gardener, her backyard a testament to her love of nature. She was also a culinary artist, her kitchen a haven of delicious aromas and flavors. I'll never forget the first time my mother, Agatha Emeagwali, visited the United States in August 1984. Doris organized a welcome reception in her honor, inviting family members from near and far to share in the celebration.

"Agatha," Doris said, raising a glass of sweet tea, "we are so happy to have you here. Welcome to our family."

Doris's hospitality extended to my entire family. When my four younger siblings arrived in the United States in 1985, their first meal was a Thanksgiving feast at Doris and Leon's home. The table groaned under the weight of traditional dishes, from roasted turkey and ham to collard greens and macaroni and cheese. It was a feast that spoke to the rich tapestry of African American culture, and it was a moment that my siblings would cherish forever.

But Doris's influence extended far beyond the kitchen table. She and Leon created a home environment where intellectual curiosity was encouraged and celebrated. Dinner conversations often turned to scientific topics, and it was in this fertile ground that the seeds of innovation were sown. Their daughter, Dale, went on to become a renowned scientist, and their grandson, Ijeoma, whom they raised from a young age, is now a computer scientist with several patents to his name.

I, too, benefited from Doris's unwavering support. In the early 1980s, I spent countless hours working on my groundbreaking research in their home. It was there, surrounded by their love and encouragement, that I developed the new equations and algorithms that would revolutionize supercomputing.

Doris was a woman of unwavering faith, a pillar of strength for her family and community. She adored her grandchildren and great-grandchildren, showering them with love and affection. Her passing leaves a void that can never be filled, but her legacy will live on in the hearts of all who knew her.

As we say goodbye to this remarkable woman, let us remember the lessons she taught us about the importance of family, education, and perseverance. Let us honor her memory by striving to be the best versions of ourselves, just as she always encouraged us to be.

In the words of the great poet Maya Angelou, "A great soul serves everyone all the time. A great soul never dies. It brings us together again and again."

Doris, your soul will forever shine brightly in our hearts. Rest in peace, dear mother-in-law.

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Table of Contents