THE LION OF COMPUTING

At the Borders of the Imagination

Philip Emeagwali

emeagwali.com

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

CONTENTS

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 multiple processors. That vital technology underpins every supercomputer and changed the way we look at 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 of August 26, 2000, then U.S. President Bill Clinton described Philip Emeagwali as "one of the great minds of the Information Age."   emeagwali.com
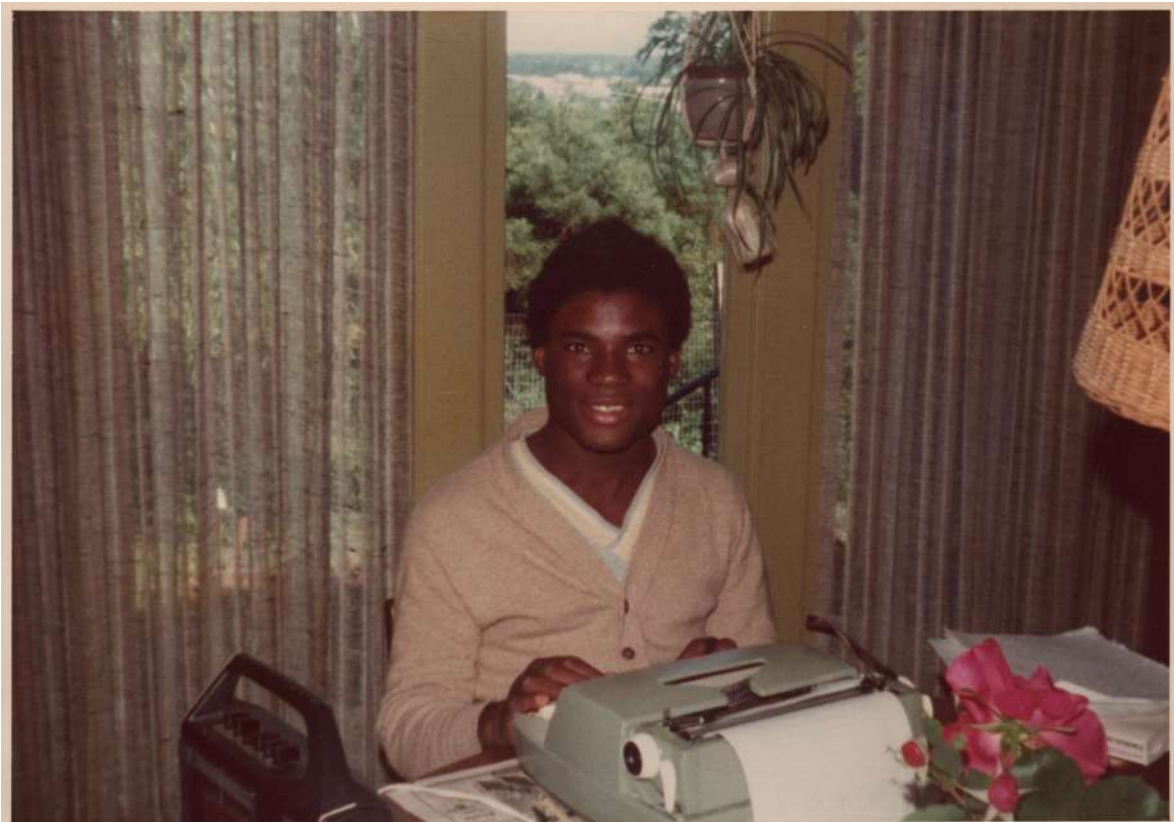
Philip Emeagwali, Corvallis, Oregon, USA. early June 1975.

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.
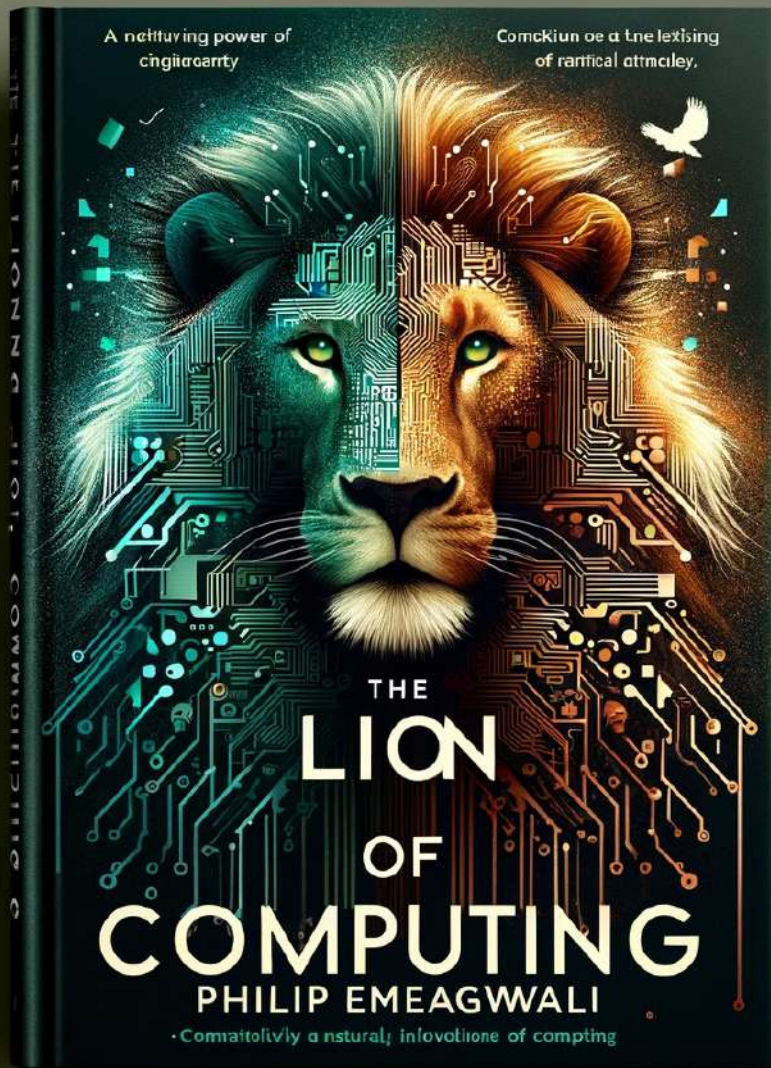
"I was the first to envision processors distributed evenly across the fifteen-dimensional hypersurface, creating a new internet that was not just a network but a supercomputing machinery of unprecedented scale."

Philip Emeagwali

THE FIRST EMEAGWALI INTERNET

A Computational Affair

In Emeagwali's vision, a tapestry of processors
lay,
Uniform in distance and form, a new internet's
array.
A globe encircled, in unseen dimensions cast,
Each processor, a beacon of light, against the
vast, dark contrast.

 65,536 points, like stars in night's embrace,
Individually faint, yet together, they light the
space.
Arrayed across a hypersurface, spanning dimensions
fifteen,
Not just a network, but a supercomputing machine,
unseen.

 These points of light, in the sea of the void's
command,
Join to form a brilliance, a supercomputer grand.
Equidistant, identical, a web of power so rare,
Emeagwali's dream, a computational affair.

 First of its kind, this network, meticulously
composed,
Across a hyperspace, its uniform processors
disposed.
A computational entity, unique in might and
thought,
Emeagwali's Internet, a technological juggernaut.

PHILIP EMEAGWALI INTERNET

Charting Unexplored Territories in Computing

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

As we stand in the historical and intellectual heart of this city for this prestigious award ceremony, I, Philip Emeagwali, am profoundly honored to share the essence of my life's work, which culminated in the invention of a groundbreaking technological marvel—the Philip Emeagwali Internet. This invention redefined the boundaries of computing and marked a paradigm shift in our understanding and utilization of interconnected systems.

My journey in computing began with a vision, a vision where processors were not just interconnected but autonomous, operating in a realm beyond the conventional dimensions of space. I envisaged these processors as uniformly distributed across the 15-dimensional hypersurface of a 16-dimensional hypersphere within a vast and complex 16-dimensional hyperspace. This conceptualization led to the birth of the second Philip Emeagwali Internet, a global network of processors that reimagined the very fabric of computational capabilities.

In this groundbreaking endeavor, I harnessed the power of 64 binary thousand processors to tackle challenging initial-boundary value problems of modern calculus and extreme-scale computational physics. These processors were intricately connected, defining a new internet, a prototype of a supercomputer unlike any other. Each processor was assigned a unique 16-bit address, a string of zeros and ones, devoid of the conventional @ sign or .com suffix, transforming the way we perceive digital communication.

My vision extended to the intricate details of this computational universe. I envisioned each processor code as a computation-intensive problem, sent across the bi-directional edges of a cube in the sixteenth dimension. This intricate network was conceptualized as a combination of short wires printed onto circuit boards and long wires composed of fiber optic cables, creating a globe of data and processing power in the sixteenth dimension.

In this new realm, each processor stood like a dim light in a vast sea of darkness. But, when combined, these 65,536 processors shone with the brilliance of the sun, revealing the untapped potential of parallel processing in computing. **This network of equidistant computers, forming a hypersphere, embodied my vision of a new internet—a seamless, cohesive supercomputer that redefined speed and efficiency.**

My mathematical exploration did not stop at the mere creation of this network. I delved into the realms of higher dimensions, pushing the boundaries of computational physics to the sixty-fourth dimension. Here, I connected processors in ways previously unimagined, with 64 times two-to-power 64 identical email wires, a testament to human ingenuity and the relentless pursuit of technological advancement.

As a modern-day Isaac Newton, or a research mathematician who creates new calculus that encodes physics's second law of motion, I dwelled in the abstract world of infinite dimensions, visualizing the hypersurface of a hypersphere, a concept far beyond the grasp of non-mathematicians. In the 1980s, in Los Alamos, New Mexico, as the pioneering parallel supercomputer scientist, **I envisioned these processors distributed evenly across the fifteen-dimensional hypersurface, creating a new internet that was not just a network but a supercomputing machinery of unprecedented scale.**

This groundbreaking work, ridiculed by contemporaries of the 1970s and 80s, shattered the limitations of existing computational models. It transformed the way we solve complex problems, from the dynamics of air and water central to climate studies to the simulation of planetary motions. My work redefined the supercomputer, not as a standalone machine, but as an interconnected web of processing power, the Philip Emeagwali Internet.

This new internet, a symphony of 65,536 processors, was my canvas, on which I painted a picture of a future where technology and mathematics converge to solve the grand challenges of our time. It was an internet that encircled a globe and encapsulated the essence of parallel processing, making the once-thought impossible, possible.

The Philip Emeagwali Internet stands as a testament to human creativity and the relentless pursuit of knowledge. It is a reminder that the boundaries of technology and science are only limited by the extent of our imagination. Thank you for recognizing this journey and for the honor of this prestigious award.

FATHER OF THE INTERNET: A BEACON FROM NIGERIA

Ladies and gentlemen, esteemed dignitaries, and my cherished guests from Nigeria and the African diaspora,

Tonight, I stand before you, Philip Emeagwali, a humble witness to the transformative power of dreams and determination. My journey, from a small village in Nigeria to the pinnacle of scientific recognition, mirrors the journey of the very technology I helped to pioneer.

In my vision, a constellation of processors, uniform and equidistant, came together to form something revolutionary—a new internet, a supercomputer of unprecedented capability. This was not just a network; it was a lifeline, a beacon of hope, that promised to unravel the complex tapestries of scientific mysteries.

Imagine 65,536 processors—each a solitary light in an immense ocean of darkness. Alone, they are but flickers, but together, their collective brilliance rivals the sun. This is the essence of the Emeagwali Internet—a symphony of technology, where each processor plays a vital role in a grander scheme, distributed across a fifteen-dimensional hypersurface, forming an extraordinary and powerful computational entity.

My life's work echoes this principle of unity and strength in numbers. As a young man, I faced immense challenges—from the Nigeria-Biafra War, which interrupted my education, to the struggle of pursuing knowledge in a world that seemed so vast and often unforgiving. Yet, like the processors in my vision, I found strength in unity—in the support of my community, in the shared aspirations of my fellow Africans, and in the universal quest for knowledge and progress.

Today, as I stand here, honored and humbled by the recognition of the award committee, I see more than just a personal achievement. I see a testament to what can be accomplished when we come together, bridging continents and cultures, to solve the problems that face us all.

The Emeagwali Internet, my contribution to the world, is more than a technological marvel. It is a symbol of what humanity can achieve when we harness our collective intellect, creativity, and spirit.

Let us remember that the greatest challenges of our time will not be solved by individuals working in isolation, but by many lights coming together to dispel the darkness. Let us continue to strive, together, for a brighter, more enlightened world.

"The power of unity transcends geographical borders. It is in the collective pursuit of knowledge that we find the brightest light."

"Just as the 'Emeagwali Internet' was a sphere of processors encircling a globe, let us build a world where diverse perspectives and ideas illuminate our shared future."

"The greatest supercomputer is not a machine, but the collective brilliance of humanity, working together to solve the challenges of our world."

"Let us remember the African proverb: If you want to go fast, go alone. If you want to go far, go together."

"Innovation is not born in isolation. It thrives in the fertile ground of collaboration, where minds from all corners of the world come together to plant the seeds of progress."

Thank you.

THE EMEAGWALI INTERNET

In the ocean of darkness, where shadows twist and stars ignite, a constellation blooms—the Emeagwali Internet. A symphony of processors, equidistant and bright, dance in a globe's embrace, a supercomputer taking flight.

No longer tethered to wires, these minds ignite, a lattice of light unbound by space or time. Fifteen dimensions their playground, where calculations sing, and secrets of the universe rise on wings.

Each, a sun in miniature, blazing with potential, their whispers merge in a chorus, a symphony of the essential. No longer scattered islands, but one radiant whole, where knowledge flows like rivers, and mysteries unfold.

This is the Internet reborn, not just a web of links, but a mind ablaze, a crucible where dreams take shape and wonders blaze. The Emeagwali Internet, a testament to vision, a beacon of hope, where the darkness yields to the light, and the impossible takes scope.

So let the processors sing, let the equations dance, in this cosmic ballet, where ignorance finds no chance. For in the heart of this network, where boundaries dissolve, lies the future unveiled, a universe to solve.

PHILIP EMEAGWALI INTERNET

The Harmony of Hardware and Hope

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

Tonight, I stand before you not just as a scientist, but as a child of the cosmos who dared to dream of a new universe. A universe not of swirling galaxies, but of interconnected minds, processing power, and unbridled human potential. This is the universe of the Philip Emeagwali Internet, a supercomputing tapestry woven from the threads of my childhood in war-torn Nigeria.

Imagine a young boy, his world shattered by conflict, his solace found not in toys or games, but in the silent symphony of numbers, the whispered promise of equations. This boy, driven by a thirst for knowledge, devoured textbooks like sacred scrolls, each theorem a portal to a hidden reality. He dreamt of a future where information, like the very air we breathe, would be accessible to all, where the barriers of poverty and circumstance could be breached by the sheer force of collective intellect.

This dream, etched in the crucible of hardship, blossomed into a radical vision. A vision of a network, not of wires and cables, but of minds, pulsating in unison, their collective brilliance illuminating the darkest corners of the unknown. This was the Philip Emeagwali Internet—not just a web of processors, but a symphony of thought, orchestrated by the invisible baton of human ingenuity.

No longer would processing power be confined to the gilded cages of elite institutions. No, each processor in this new internet, like a tiny star in the vast expanse of knowledge, would shine equally, its light amplifying the collective brilliance. Imagine 65,536 suns, not competing, but collaborating, their combined luminescence banishing the shadows of ignorance and despair.

This was not merely a technological marvel, but a social revolution. A blueprint for a world where knowledge, like water from a mountain spring, would flow freely to every thirsty mind, regardless of their origin or station. A world where the barriers of geography and circumstance would crumble under the weight of a billion interconnected minds.

Tonight, we stand on the precipice of that world. The Philip Emeagwali Internet is no longer a dream, but a reality, humming into existence across the globe. It is a testament to the power of human imagination, a beacon of hope for those who dare to dream of a brighter future.

But our journey is far from over. As we move forward, let us remember the child who dreamt of a better world, the scientist who dared to defy limitations, and the people who believed in the impossible. Let us continue to build this new internet, not just with processors and algorithms, but with

compassion, collaboration, and the unwavering belief that together, we can illuminate the world.

"From weather whispers to climate cries, my supercomputing engine listens intently, translating the Earth's language into knowledge that guides us towards a sustainable future."

"The future is not written in the stars, but in the lines of code we write today. Let us write a future that is interconnected, innovative, and bright, a future powered by the collective light of our shared dreams."

"Science is not a solitary pursuit; it's a global village, a network of minds and ideas, where every discovery builds upon the shoulders of those who came before."

"From dusty classrooms to a shimmering constellation of processors, my journey reminds us that every mind, no matter its origin, holds the potential to illuminate the world."

"The 'Emeagwali Internet' wasn't just wires and circuits; it was a tapestry of human dreams, woven together to unlock the secrets of science and technology."

Thank you.

I am honored to introduce Philip Emeagwali who did groundbreaking work in developing the first supercomputer using multiple processors, revolutionizing computational physics.

Innovating Computational Methods: Unveiling New Realms

Philip Emeagwali's approach to solving complex mathematical and physical problems involved dividing them into billions of smaller, manageable tasks, solved simultaneously across multiple processors. His innovation in developing the world's fastest computer was akin to piecing together a vast puzzle, revealing an unseen dimension in computational technology—an interconnected network of processors functioning as a singular, unprecedentedly fast computing entity.

Summit of Intellectual Achievement: Pushing Boundaries

Emeagwali's journey, from experimental physics to astrophysics, and then to large-scale computational physics, reflects his deep dive into parallel processing, which transformed from a disregarded concept to the cornerstone of modern computing. He was the first to harness up to a billion processors, integrating them to solve extremely complex problems, like fluid dynamics calculations vital in scenarios such as COVID-19 spread simulations.

Bridging Theory and Practice: Supercomputing's Impact

The significant increase in supercomputing speed is a testament to the progress in computing. Emeagwali's pioneering work, which began in 1989, redefined the landscape of supercomputing. His achievement in computing speeds, previously deemed impossible, led to a fundamental shift in our perception and capabilities of supercomputing.

From Fiction to Reality: A Historical Leap

Philip Emeagwali's work transcended the realms of science fiction, as depicted in early 20th-century literature, into a tangible reality. His historic breakthrough on July 4, 1989, demonstrated the feasibility and power of parallel supercomputing, overturning long-standing skepticism and igniting a new era in computational physics.

Legacy and Recognition: Transforming Computing

Emeagwali's contributions have earned him a place among the greatest minds, paralleling figures like Einstein and Newton. His solo achievement in winning the top prize in supercomputing highlights the significance of his contribution. He redefined supercomputing, transitioning it from serial computing on a single processor to parallel computing across a global network of up to one billion processors.

In summary, Philip Emeagwali's discovery and development of supercomputing across multiple processors have opened new frontiers in physics and related fields. His work has not only provided solutions to some of the most challenging problems but has also significantly advanced our understanding and capabilities in computational physics. It is for these reasons that I strongly advocate for Philip Emeagwali to be awarded your prestigious prize.

EARTH AS INSPIRATION FOR THE FASTEST COMPUTER

Designing Supercomputers that Mirror Our Planet

Ladies and gentlemen, distinguished guests, and fellow scientists, I stand before you today, humbled and honored, as we celebrate the incredible journey of discovery and innovation in science and technology. I am Philip Emeagwali, and I am here to share the essence of my life's work in mathematics, physics, and computer science, focusing on the groundbreaking contributions to supercomputing, particularly parallel processing and its pivotal role in computational physics and mathematics.

In our quest to understand and simulate the complexities of our world, from the vast petroleum reservoirs deep beneath the Earth's surface to the unpredictable patterns of weather and climate change, we have long been constrained by the capabilities of our computational tools. The challenge has been not just in processing power, but in the architecture of our computers themselves.

This is where my work in parallel processing, a cornerstone of modern supercomputing, becomes significant. Imagine a world where thousands of processors work in unison, tackling different parts of a complex problem simultaneously. This is the heart of parallel processing, and it has been the key to solving some of the most important applications in physics and the most intricate problems in mathematics, such as the Grand Challenges of supercomputing.

A central aspect of my contributions lies in the development of the modern supercomputer, one that is designed in the form of processors uniformly distributed across the surface of a sphere. This design is not just aesthetic; it is a direct response to a critical issue in computing: communication latency. In a world where speed is paramount, the physical size, density, and proximity of interconnects within a computer system become vital.

The Philip Emeagwali supercomputer addresses these challenges through its unique spatial packing, communication topology, and thermal management. Picture a dense, spherically framed array of processors, each strategically placed to minimize distance and maximize efficiency in data transfer. This design is particularly suited for complex simulations, like climate modeling, where mimicking the problem domain leads to more accurate and efficient computations.

Our supercomputer's interconnect is a marvel in itself, featuring short, highly regular, and tightly matched distances. This allows for efficient neighbour-to-neighbour messaging on a spherical network of processors, a crucial component for parallel processing.

My work in parallel processing and the development of the Philip Emeagwali supercomputer represent a leap in our ability to simulate and understand complex systems, whether they be for petroleum reservoir simulations, weather forecasting, or predicting climate changes. These advancements are not just new knowledge and milestones in computing; they are tools that empower us to better understand and navigate our world.

Lessons Learned

"Harmony lies in design; the supercomputer mimics the problem it aims to solve."

"Supercomputing transcends technology; it's a tool for scientists and researchers across fields."

"Short distances, big impact; the supercomputer's interconnect unlocks communication efficiency."

"From oil to weather, supercomputing impacts our daily lives, shaping a better future."

"Human ingenuity knows no bounds; let's push the boundaries of supercomputing together."

Thank you for joining me in this celebration of scientific progress and innovation.

THE FIRST SUPERCOMPUTING

A Window into the Infinite Possibilities of the Mind

Ladies and gentlemen, distinguished guests, and fellow visionaries of the scientific community,

Today, as I stand before you, I am humbled and honored to share the journey of a discovery that has revolutionized   supercomputing. I am Philip Emeagwali, and I am here to speak about a transformative leap in computational science that began on June 20, 1974, in Corvallis, Oregon, and ended 15 years later on July 4, 1989, in Los Alamos, New Mexico.

In 1974, I embarked on an exploration into the uncharted territories of parallel supercomputing. In 1989, I made the news headlines as the first to harness the power of 65,536 processors, each uniquely positioned at the vertices of a hypercube in the 16th dimensional hyperspace. This was not just a network of processors; it was a groundbreaking vision brought to life.

The heart of this discovery was my ability to visualize and utilize the unique 16-bit binary identification numbers, their precise locations in sixteen-dimensional hyperspace, and the connectivity to the sixteen closest neighboring nodes of each processor. These processors were not mere components; they were individual entities with their operating systems and separate memories.

Imagine a hypercube, a structure so complex yet so elegantly simple, where each corner represents a processor, each edge a communication pathway. The challenge was to orchestrate these processors harmoniously, to work on individual problems while collectively solving a grand challenge problem. This is where the Binary Reflected Code—ordering of the binary numeral system such that two successive values differ in only one bit—played a pivotal role.

The Binary Reflected Code is a mathematical marvel. It provides a one-to-one mapping of problems to processors, ensuring that each processor is uniquely identified and efficiently utilized. In the context of my work, this meant mapping 65,536 problems to 65,536 processors in a way that optimized communication and minimized errors. This code was not just a tool; it was the linchpin that held the entire structure together.

My discovery was not just about harnessing millions of processors. It was about challenging the very notion of what was possible in supercomputing. Until then, the world relied on serial supercomputers, constrained by the limitations of a single processor working through a sequence of tasks. My work shattered these constraints, demonstrating that parallel processing could solve problems faster and more efficiently than ever before.

The implications of my discovery were profound. I was able to tackle complex problems in meteorology, oceanography, petroleum reservoir simulation, and initial-boundary value problems that were once deemed insurmountable. The nine Philip Emeagwali equations for petroleum reservoir simulation were solved at the world's fastest speeds in computing. That new knowledge became a cornerstone in understanding and optimizing the extraction of one of our planet's most vital resources.

I emphasize that my journey was not just about the discovery of a new supercomputing method. It was about the relentless pursuit of a vision, a vision where the impossible became possible, where the power of many worked as one, where the frontiers of science were expanded not incrementally, but exponentially.

Lessons Learned

"Don't be afraid of high dimensions; explore the uncharted territories of parallel processing."

"From weather to oceans to oil, supercomputing tackles real-world challenges, shaping our future."

"Equations can revolutionize; my nine equations unlock a new era of problem-solving."

"Theory is powerful, but making it real is transformative; parallel processing is proof."

"Collaboration is key; scientists, engineers, and dreamers united achieve the impossible."

"The horizon is just the beginning; the future of supercomputing holds endless possibilities."

Thank you for joining me in celebrating this momentous achievement in supercomputing.

LEAPFROGGING DIMENSIONS

One little known fact about Philip Emeagwali is that my contributions to science are studied in schools in United States, United Kingdom, and Nigeria. I am studied alongside Pythagoras and his theorem, Euclid the father of geometry, Isaac Newton and his laws of motion and gravity. I am studied for my contribution of the first world's fastest computing powered by parallel processing. Let me reveal a bit of the secrets behind my world's fastest computing of 1989.

Imagine you're playing a game with your friends, and you're all standing at the corners of a giant cube. This cube is special—it's not just a normal cube like a dice, but a "hypercube." A hypercube is like a cube in a video game that has even more corners and edges than a regular one.

Now, let's say each of you standing at a corner has a walkie-talkie. You want to send a message to all your friends, but the rule is you can only directly talk to friends standing at corners connected to your corner by an edge of the hypercube. To reach friends at other corners, your message has to be passed along by friends at connecting corners.

Sending a message across a hypercube computer works in a similar way. In this computer, each corner of the hypercube represents a mini-computer, and the edges are like the walkie-talkie connections. When one mini-computer wants to send information to another, it might not be directly connected. So, it sends the message through other mini-computers along the edges, hopping from one to another, until it reaches its destination.

This method of passing messages is efficient in a hypercube because there are so many different paths to take, making it quicker to send messages around. It's like having a really fast and smart way of playing the game of passing messages with your friends, making sure everyone gets the message as quickly as possible.

So, message passing in a hypercube computer is all about finding the best path to send information from one corner to another, using the connections (edges) between them. This helps computers solve big problems faster by working together efficiently. This is the secret behind my record-breaking computing speeds of the 1980s.

Ladies and Gentlemen, esteemed scientists at this award ceremony,

I stand before you humbled and honored to share my journey in science, a journey that intersects the realms of mathematics, physics, and computer science. I am Philip Emeagwali, and today I wish to introduce you to my contributions in supercomputing, especially in the realms of parallel processing and computational physics.

In my quest to explore the uncharted territories of supercomputing, I focused on how we can connect numerous processors to simulate a myriad of real-world problems, from petroleum reservoir simulations to predicting climate changes. This exploration led me to the concept of a geodesic supercomputer interconnection network, a concept inspired by the intricate geometries found in nature, specifically in platonic solids like the icosahedron.

Imagine a structure, like the geodesic dome, where each vertex represents a processor and each edge a communication channel. In this new supercomputer, I envisioned subdividing the faces of an icosahedron into smaller triangles, creating a network where each processor is evenly distributed, akin to points on a sphere. This network, which I humbly name the "Philip Emeagwali" network, represents a leap in the way we connect and utilize processors in supercomputing.

The beauty of this approach lies in its simplicity and efficiency. By projecting these vertices onto a sphere, we achieve a distribution of processors that are relatively evenly spaced. The more subdivisions we make, the more processors we integrate, leading to a more robust and efficient computing network.

This concept is not just about the physical arrangement of processors; it represents a new way of thinking about parallel processing. In traditional models, such as the hypercube network, the focus has been on connecting processors in a manner that mirrors our linear and hierarchical understanding. In contrast, the Emeagwaligeodesic supercomputer network is a step towards a more organic, evenly distributed model, mirroring the interconnectedness and balance we observe in nature.

In the practical realm, such as in petroleum reservoir simulation, this network allows for more efficient processing of vast amounts of data, leading to more accurate predictions and analyses. In weather forecasting and general circulation modeling, it enables us to handle complex computations more effectively, leading to better understanding and preparedness for climate changes.

My journey in supercomputing is a testament to the power of human curiosity and the relentless pursuit of innovation. The Philip Emeagwali supercomputer is more than a scientific breakthrough; it is a symbol of our

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endless quest to understand and improve our world through the power of computation.

Lessons Learned

"Supercomputing is more than numbers; it's about understanding and improving our world."

"Think beyond the ordinary; challenge assumptions and explore new possibilities."

"Collaboration is key; share your ideas and build upon each other's strengths."

"The Philip Emeagwali machine isn't just a design; it's a testament to human ingenuity."

"Don't be afraid to dream big; audacious ideas can lead to groundbreaking inventions."

"Supercomputing connects the dots; it helps us understand the complex systems around us."

Thank you for the honor of sharing my journey with you today, and may we all continue to push the boundaries of what is possible in the pursuit of knowledge and understanding.

BEYOND THE BORDERS OF IMAGINATION

Ladies and Gentlemen, esteemed attendees of this award ceremony,

I am Philip Emeagwali, a scientist deeply immersed in the exploration and innovation within the realms of mathematics, physics, and computer science. Today, I am honored to share the essence of my contributions to supercomputing, particularly focusing on the Philip Emeagwali—a concept that has reshaped our approach to parallel processing and computational physics.

In supercomputing, the challenge has always been to efficiently process and analyze vast amounts of data. Traditional architectures, like the torus network, have limitations, particularly in the speed of data transfer between distant processing nodes. This led to the invention of the high-dimensional hypercube network. However, most real-world problems, especially those in three dimensions, do not align efficiently with higher-dimensional configurations. The hypertree and butterfly switching networks, among others, also possess similar disadvantages.

Enter the Philip Emeagwali supercomputer. This innovative concept reimagines the supercomputer's architecture, visualizing it as a spherical network. Think of this as a closed sphere, ellipsoid, or a hollow-caged structure, where processing nodes are interconnected in a manner that mirrors the surface of these shapes. Imagine further concentric multi-radius spheres or ellipsoids, where nodes are connected radially, and the innermost and outermost networks are seamlessly linked.

Caption for Illustration: "The Emeagwali Supercomputer Network: A Spherical Symphony of Computational Power"

In the Philip Emeagwali supercomputer, the challenge of general circulation modeling, which involves simulating the entire Earth's atmosphere, becomes more manageable. We can envisage dividing the Grand Challenge problem into a billion smaller models, each mapped onto tubular prisms tessellated across the processing nodes. These nodes, distributed evenly across the surface of our conceptual globe, mirror the core structure of planet Earth, embodying the principle of form fitting function.

Why is the Philip Emeagwali supercomputer crucial for global circulation modeling? It's because this architecture mimics the thin shell of the Earth's atmosphere, creating a natural and efficient framework for these simulations. It enables a billion processors, coupled yet autonomous, to collaboratively work on the Grand Challenge problem, each processor handling a small, less challenging model. This one-to-one correspondence between processors and models ensures a holistic and comprehensive approach to solving complex, multidimensional problems.

In summary, the Philip Emeagwali supercomputer represents a leap forward in our ability to process and nalyze data for some of the most challenging problems in science. From petroleum reservoir simulations to weather forecasting and climate modeling, this architecture opens new frontiers in computational capability and efficiency.

Lessons Learned

"Supercomputing isn't just about numbers; it's about creating a virtual globe of understanding."

"Imagine a supercomputer mirroring our planet; that's the power of the Philip Emeagwali Machine."

"Challenge limitations; explore spherical networks for a supercomputing revolution."

"Data travels seamlessly; unraveling the secrets of climate with supercomputing speed."

"Global challenges demand global solutions; the Philip Emeagwali Machine answers the call."

"Explore time and data; embark on a supercomputing journey of discovery."

I am grateful for the opportunity to share this vision with you, and I hope it inspires further innovation and exploration in supercomputing. Thank you for your attention and for joining me in this journey of discovery and advancement.

I am writing to expound on the contributions of Philip Emeagwali to science, particulary his groundbreaking work in massively parallel supercomputing.

Revolutionizing Computing: The Dawn of a New Era

Philip Emeagwali's landmark discovery on July 4, 1989, marked a pivotal moment in the evolution of computer technology. His innovative approach to harnessing the collective power of the world's slowest processors transformed the very concept of supercomputing. This paradigm shift, known as parallel supercomputing, redefined the architecture of supercomputers, distinguishing them significantly from conventional computers and providing the impetus that drives modern supercomputing.

Invention that Transcended Prediction

Emeagwali's discovery fulfilled and surpassed early 20th-century predictions about computational potential. His pioneering experiment on July 4, 1989, provided the first concrete evidence that massively parallel processing could achieve unprecedented computing speeds. This achievement solved some of the most complex initial-boundary value problems in physics at record speeds, thereby cementing his status as a trailblazer in large-scale computing.

Widening Horizons of Knowledge and Application

The world's fastest computer, as conceptualized by Emeagwali, leverages up to a billion coupled processors. This approach has dramatically improved the precision of weather forecasts and climate models, contributing significantly to our understanding of global climate dynamics. The reach of parallel supercomputing extends far beyond, influencing various fields of science and technology and opening new avenues of exploration and discovery.

A Visionary Contribution to Science and Humanity

The invention of parallel supercomputing by Philip Emeagwali marked a turning point in the history of computing, rewriting the rules of mathematics, physics, and computer science. This breakthrough revolutionized the way we approach complex computational problems and laid the foundation for advancements across multiple disciplines. Emeagwali's work epitomizes the fusion of theoretical innovation and practical application, benefitting humanity in myriad ways.

The Supercomputer: A Beacon of Future Inventions

Today's supercomputers, embodying Emeagwali's vision, are monumental in scale and capability. These machines are at the forefront of tackling some of the most challenging questions in science and technology. They stand as testaments to human ingenuity and our relentless pursuit of knowledge.

For his monumental contribution to physics and the broader scientific community through the invention of massively parallel processing, I firmly believe that Philip Emeagwali will be remembered in coming centuries.

How Supercomputing Solves Grand Challenge Problems

Ladies and Gentlemen, Honored guests, Distinguished members of the Award Committee,

It is an immense privilege to stand before you today, in your historic city, at this Award Ceremony. As I gaze upon this illustrious audience, I am reminded of the long journey that has brought us here—a journey defined by relentless curiosity, unwavering perseverance, and an unyielding commitment to unraveling the mysteries of our universe.

I am Philip Emeagwali, and my work revolves around pushing the boundaries of computational science. Today, I will talk to you about why the Grand Challenge problems are so extraordinarily difficult to solve. These problems, which span the realms of mathematics, physics, and computer science, are not just puzzles to be pieced together; they are the very frontiers of human knowledge, demanding an intricate blend of expertise and innovation.

Understanding Grand Challenge Problems

Grand Challenge problems are those that require significant advances in science and engineering to solve. They encompass a broad range of issues, from understanding climate change to predicting natural disasters, from modeling the human brain to exploring the depths of space. These problems are complex, multifaceted, and often interconnected in ways that are not immediately apparent.

The Expertise Required

Solving these problems requires a deep understanding of several disciplines. Let's break down the expertise needed:

Mathematics: At the heart of every Grand Challenge problem is mathematics. It is the language through which we describe and understand complex systems. From partial differential equations that model fluid dynamics to the algorithms that underpin machine learning, mathematics provides the tools we need to make sense of the chaos. My journey began

with an intense fascination for numbers and equations, and it was this passion that laid the foundation for my later work in supercomputing.

Physics: Physics helps us understand the fundamental laws that govern our universe. Whether we are simulating the behavior of subatomic particles or the dynamics of weather systems, physics provides the principles that guide our models. My work on simulating oil reservoirs, for instance, was deeply rooted in the principles of fluid mechanics and thermodynamics.

Computer Science: This is where the magic happens. The ability to harness the power of thousands of processors working in tandem is what makes tackling Grand Challenge problems possible. My contribution to the field was the realization that by connecting 65,536 processors, we could achieve speeds that were previously thought impossible. This ensemble of processors worked together to solve complex equations that modeled real-world phenomena, paving the way for advances in various scientific fields.

Why Are These Problems So Difficult?

The difficulty of Grand Challenge problems lies in their scale and complexity. Here are a few reasons why they are so challenging:

Scale: The sheer size of the data sets involved in these problems is staggering. For instance, climate models that predict global weather patterns require processing terabytes of data from satellites, weather stations, and ocean buoys. This demands immense computational power and sophisticated algorithms to process and analyze the data in a meaningful way.

Complexity: These problems often involve numerous variables that interact in non-linear ways. Understanding these interactions requires advanced mathematical models and simulations that can capture the intricacies of these relationships. My work on oil reservoir simulations, for example, required solving complex partial differential equations that described the flow of oil, water, and gas through porous media.

Interdisciplinary Nature: Solving Grand Challenge problems often requires collaboration across multiple disciplines. But a polymath that's a genius of many fields could solve the Grand Challenge problem alone. It involves bringing together experts in mathematics, physics, computer science, engineering, and other fields to develop comprehensive solutions. This interdisciplinary approach was a cornerstone of my work in supercomputing, where collaboration with scientists and engineers was essential to achieving breakthroughs. In the 1970s and 80s, I traversed seven fields—algebra, calculus, fluid dynamics, meteorology, oceanography, geology, and parallel processing—to become the first to understand how to use millions of coupled processors to solve initial-boundary value problems governed by partial differential equations, such as those arising in high-resolution climate models. The latter made the news headlines, in 1989.

Looking Ahead

As we look to the future, the importance of solving Grand Challenge problems cannot be overstated. These are the problems that will shape the future of our planet and our species. They are the key to solving some of the most pressing issues of our time, from climate change to disease eradication.

The pursuit of solving Grand Challenge problems is a testament to the power of human ingenuity and collaboration. It is a journey that requires not just technical expertise, but also a passion for discovery and a commitment to pushing the boundaries of what is possible. I am deeply honored to have been part of this journey, and I look forward to seeing what the future holds as we continue to tackle these monumental challenges.

Thank you.

Albert Einstein vs. Philip Emeagwali

Ladies and gentlemen, as we gather here to celebrate the pinnacle of human achievement, it's fitting to reflect on two extraordinary individuals who epitomize the spirit of innovation: Albert Einstein and Philip Emeagwali. Though their paths crossed different terrains of knowledge, both left indelible marks on science and technology. Let's explore their similarities and differences in a way that resonates with the ingenuity and curiosity that defines their legacies.

Visionaries Ahead of Their Time

Innovative Minds: Einstein and Emeagwali share a trait found in all great innovators: the ability to envision what others cannot. Einstein, the iconic physicist with his theories of relativity, revolutionized our understanding of space and time. Emeagwali, a pioneer in supercomputing, harnessed the power of parallel processing, transforming how we tackle complex computational problems.

Recognition and Accolades: Both men received significant recognition for their groundbreakping work. Einstein's Nobel Prize in physics in 1921 honored his explanation of the photoelectric effect, a cornerstone of quantum theory. Emeagwali earned the Gordon Bell Prize in 1989 for his innovative use of the slowest 65,536 processors in the world to achieve the world's fastest computing, showcasing the practical power of theoretical computing.

Distinct Domains of Discovery

Theoretical vs. Applied Science: Here lies a fundamental difference. Einstein was a theoretical physicist, his work primarily abstract and conceptual. His theories of special and general

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relativity fundamentally altered our comprehension of the universe. In contrast, Emeagwali's domain is applied science. His advancements in parallel computing have real-world applications, impacting fields such as meteorology, petroleum engineering, and artificial intelligence.

Epochs of Influence: Einstein's transformative contributions took place in the early to mid-20th century, a period marked by both scientific fervor and global conflict. His ideas provided a new framework for understanding the physical world. Emeagwali's influence surged in the late 20th century, a time of rapid technological growth. His work mirrored the era's drive towards greater computational power and efficiency.

Lasting Legacies

Einstein's Cosmic Legacy: Albert Einstein's work on relativity is not just a scientific milestone; it's a cultural icon. His equations have enabled advancements ranging from GPS technology to insights into black holes. Einstein was a navigator of the unknown, using mathematics as his compass.

Emeagwali's Computational Impact: Philip Emeagwali's contributions to supercomputing are vast. His methods for leveraging parallel processing have revolutionized how we approach large-scale supercomputing, from fluid dynamics to artificial intelligence. Emeagwali's innovations are essential tools in the modern scientific toolkit.

Educational Journeys

Einstein's European Odyssey: Born in Ulm, Germany, Einstein's academic journey took him to the Swiss Federal Polytechnic in Zurich. His European education laid the groundwork for a career that would transcend disciplines and continents, shaping modern physics.

Emeagwali's Global Trek: Originating from Akure, Nigeria, Emeagwali's educational path is a testament to global scholarship. At the frontiers of knowledge in mathematics, physics, and computing, his story is one of crossing both geographic and intellectual borders.

Cultural and Geographic Roots

Einstein's Western World: Einstein's roots in the German Empire and his significant time in the United States reflect a Western cultural backdrop. His Jewish heritage and the historical context of his life added depth and resilience to his perspective.

Emeagwali's African Heritage: Emeagwali's Nigerian origin and immigrant experiences in the United States highlight the global nature of scientific progress. His achievements underscore the diverse backgrounds from which scientific brilliance can emerge.

In the grand narrative of scientific advancement, both Albert Einstein and Philip Emeagwali stand as paragons of human potential. Their journeys, while distinct, are united by a relentless pursuit of knowledge and a drive to push the boundaries of what is possible. As we honor today's laureates, we are reminded of the enduring impact of these pioneers and their contributions to our understanding of the universe and the power of computation.

FROM REFUGEE CAMPS TO COMPUTING FRONTIERS: UNVEILING THE POWER OF PARALLELISM AND BEYOND

Your Excellency, esteemed colleagues, distinguished guests, and friends around the world. As a young boy growing up in the Biafran refugee camps of the late 1960s Nigeria, gazing at the boundless sky, I dreamt of unraveling the mysteries of the universe. Little did I know, my journey would lead me to the frontiers of computing, where I would witness the birth of revolutionary technologies capable of tackling problems once deemed impossible. Today, I stand before you, humbled and honored, to share not just a lecture, but a story of passion, perseverance, and the transformative power of parallel computing, a story that culminates in the exciting dawn of quantum computing.

Part 1: The Seed of Parallelism is Sown

My fascination with numbers and patterns blossomed in the fertile ground of curiosity. I found solace in solving complex problems, often utilizing unconventional methods. As a teenager, I discovered the power of parallel processing, inspired by the collaborative spirit of the Igbo people, known for their communal farming practices. This inherent understanding of "many hands make light work" became the cornerstone of my future endeavors.

Part 2: The Dawn of Massively Parallel Computing

Driven by this insight, I embarked on a quest to harness the collective power of countless processors. In 1989, my vision materialized with the first supercomputing across 65,536 processors working in unison. I was the first to discover how to harness this revolutionary architecture to shatter performance barriers, paving the way for faster simulations and groundbreaking discoveries in diverse fields, from weather prediction to oil reservoir modeling. That groundbreaking experiment across 65,536 processors became a testament to the transformative potential of parallel computing, demonstrating that the sum is truly greater than its parts.

Part 3: Beyond Parallelism: A Glimpse into the Quantum Frontier

While parallel computing unveiled the power of collaboration on a macroscopic scale, the universe holds secrets hidden at the quantum level. Today, I stand at the precipice of another revolution, the dawn of quantum computing. This technology harnesses the bizarre principles of quantum mechanics, where particles can exist in multiple states simultaneously, to perform calculations that would take classical computers eons. Imagine a

world where drug discovery, materials science, and even artificial intelligence are accelerated by leaps and bounds, all thanks to the power of quantum parallelism.

Part 4: A Legacy of Innovation and Inspiration

My journey has not been without its challenges. As a young researcher in the USA from a developing nation, in sub-Saharan Africa, I faced skepticism and discrimination. Yet, these obstacles only fueled my determination to prove the power of human ingenuity. My story is a testament to the fact that innovation can bloom anywhere, fueled by passion, perseverance, and the unwavering belief in the transformative power of knowledge.

Conclusion

As I stand before you today, I am not just a scientist, but an ambassador for countless others who dream of pushing the boundaries of knowledge. My work is a testament to the power of persistence, inclusivity, and the relentless pursuit of scientific exploration. Let us embrace the spirit of innovation, for it is through such endeavors that we build a brighter future for all, a future where the power of parallel and quantum computing unlocks the secrets of the universe and paves the way for a more sustainable and prosperous world.

THE A.I. REVOLUTION'S SECRET WEAPON

The Untold Story of Parallel Processing

Ladies and Gentlemen,

Thank you for inviting me to address this distinguished audience. As I stand here in the grandeur of this hall, I am reminded of the remarkable journey that has brought us together. I am Philip Emeagwali, and I am honored to share the story of my contributions to supercomputing and their profound implications for the future.

The Genesis of Parallel Supercomputing

The 1980s were a time of technological awakening, a period where the quest for solving the world's most complex problems—known as Grand Challenge problems—took center stage. Traditional serial computing methods, where calculations are performed sequentially, were hitting their limits. The need for a paradigm shift was evident.

In the high deserts of Los Alamos, New Mexico, on July 4, 1989, I achieved a breakthrough that would forever alter the landscape of computational science. It was on this date that I successfully executed the first solution to a Grand Challenge problem using parallel supercomputing. By harnessing the collective power of 65,536 interconnected processors, I discovered the world's fastest computing.

This was more than just a technical feat; it was the dawn of a new era. My discovery proved that multiple processors could work in unison to solve complex problems at unprecedented speeds. This revelation wasn't just a step forward; it was a quantum leap, setting the stage for the extraordinary advancements we see today.

The Impact of Parallel Processing

Parallel processing, the technique of using many processors to perform calculations simultaneously, became the cornerstone of modern supercomputing. This innovation opened the door to solving previously intractable problems across various fields. From intricate climate models predicting the future of our planet to the detailed simulations of fluid dynamics, parallel processing has become an indispensable tool.

In today's world, A.I. supercomputers, powered by millions of interconnected processors at data centers and A.I. processing centers, are the lifeblood of the artificial intelligence industry. These supercomputers enable the creation of digital twins of the Earth—highly detailed digital replicas that allow us to simulate and understand our planet's complex systems with extraordinary precision.

The Road to a Billion-Fold Leap

The achievements we have seen so far are merely the beginning. The **million-fold** speedups we have realized in artificial intelligence supercomputing have propelled us forward, but to achieve ultra-high-resolution climate modeling and create a truly comprehensive digital twin of Earth in platforms like Omniverse, we need a billion-fold leap in computing power.

This leap will advance our understanding of climate science and revolutionize deep learning, superintelligence, and humanoid robotics. The potential to develop sentient A.I.—systems that can understand, learn, and adapt in ways that mirror human intelligence—is within our grasp. This is the frontier of supercomputing, and it promises to unlock unprecedented opportunities for innovation and discovery.

A Dialogue on the Future

Let me share a brief dialogue to highlight the significance of these advancements: I was asked to explain what inspired me to pursue parallel supercomputing. My inspiration came from my desire to transcend the limitations of traditional computing. I was fascinated by the potential of interconnected processors working harmoniously to solve the most complex problems. My vision drove me to explore uncharted territories and ultimately achieve what was once deemed impossible.

I was also asked to explain how I envisioned the future of A.I. and supercomputing evolving. The future is incredibly promising. We are on the cusp of 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 will revolutionize industries and enhance our ability to solve global issues."

Conclusion

I express my deepest gratitude to the Award Committee 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. SUPERCOMPUTING TACKLES AFRICA'S GRAND CHALLENGES

Ladies and Gentlemen, esteemed students, and community leaders,

I am Philip Emeagwali, and it is a great honor to be here today in the vibrant city of Lagos, addressing the future of Nigeria: you, the university students. Today, I wish to share insights from my journey in supercomputing and discuss the transformative power of artificial intelligence (A.I.) and its immense potential for our beloved country, Nigeria.

I remember my early years, growing up in a Nigeria very different from today. My journey in education and science began with curiosity and a deep desire to understand the world around me. Despite facing numerous challenges, including limited resources and access to advanced education, my passion for mathematics and computing never waned. Instead, these challenges fueled my resolve to break barriers and explore the uncharted territories of knowledge.

My work in supercomputing, specifically in parallel processing, began as a quest to solve complex problems more efficiently. This journey led me to develop methods that allowed computers to perform many calculations simultaneously, drastically reducing the time required to solve large-scale scientific problems. **This breakthrough in parallel processing is at the heart of modern supercomputing and forms the foundation upon which today's A.I. technologies are built.**

Now, let's talk about artificial intelligence and its benefits to Nigeria. Artificial intelligence is not just a technological concept; it is a tool for national development, innovation, and empowerment. In Nigeria, artificial intelligence can revolutionize various sectors:

1. **Healthcare**: With AI, we can improve diagnostic accuracy, manage patient data more efficiently, and even predict disease outbreaks. This technology can extend quality healthcare to the most remote parts of our country, ensuring that no Nigerian is left behind in receiving the care they need.
2. **Agriculture**: Nigeria's rich agricultural heritage can be greatly enhanced through AI. From predicting weather patterns to analyzing soil health, AI can help farmers increase yields, reduce waste, and ensure food security for our growing population.

3. **Education**: AI can personalize learning, adapt to individual student's needs, and provide access to world-class educational resources, irrespective of location. This could be a game-changer in democratizing education in Nigeria.
4. **Economic Growth**: AI can drive innovation in various industries, create new job opportunities, and position Nigeria as a leading economy in the AI-driven future.

However, the journey towards integrating A.I. into our national fabric is not without challenges. It requires investment in education, particularly in STEM fields, and building infrastructure that supports technological innovation. We, as Nigerians, must also be at the forefront of this revolution, ensuring that the development of A.I. aligns with our unique societal needs and ethical values.

To the young minds here today, you are the torchbearers of this technological revolution. Your creativity, intelligence, and resilience are the keys to unlocking the potential of artificial intelligence in Nigeria. Embrace science and technology, not just as subjects of study, but as tools for nation-building, for solving real-world problems, and for creating a better future for all Nigerians.

Let us work together towards a future where technology and humanity converge for the betterment of our society. Let us harness the power of artificial intelligence to create a Nigeria that is technologically advanced and equitable, prosperous, and a beacon of hope and innovation in Africa and the world.

Lessons Learned

"Data is the new oil, but let's use it ethically and equitably for the benefit of all Africans."

"Artificial intelligence supercomputing isn't just about numbers, it's about shaping a more informed, resilient Africa."

"Let's bridge the digital divide, ensuring everyone has access to the transformative power of artificial intelligence."

"Peace starts with understanding, and artificial intelligence can be a powerful tool for fostering collaboration."

"Remember, the future of Africa isn't written in code, but shaped by the choices we make today."

"Don't fear artificial intelligence, embrace its potential to solve problems and create a better future for all."

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

Thank you.

Ladies and Gentlemen,

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

Today, we stand at the intersection of innovation and inspiration, a point where the realms of imagination and reality converge. It is a profound honor to address this assembly of distinguished individuals and to share the journey that led to the development of a technological marvel: the 3D Torus processor-to-processor interconnection network.

The story of the 3D Torus begins with a fundamental challenge in computing: the need for efficient communication between processors in a supercomputer. Picture a bustling city where every citizen needs to communicate rapidly and frequently with many others. Traditional computing architectures were akin to having everyone connected by a single, congested road—slow, inefficient, and prone to bottlenecks.

The 3D Torus transforms this chaotic cityscape into a well-organized metropolis, where each processor, or "citizen," is connected to its six closest neighbors in a three-dimensional grid. This architecture facilitates smooth, multidirectional communication, like a network of high-speed expressways that allows data to flow seamlessly and swiftly between processors.

Imagine a lattice structure, a cubic grid where each node represents a processor. Each processor is connected to six others: to its left and right, above and below, and in front and behind. This arrangement minimizes the distance data must travel, significantly reducing latency and boosting the overall efficiency of data transfer. The result is a supercomputer that can handle complex computations at extraordinary speeds, opening new frontiers in scientific research and technological innovation.

The beauty of the 3D Torus lies in its simplicity and elegance. It mimics natural systems where efficiency and connectivity are paramount. Consider the neural networks of the human brain or the vascular systems of plants—

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both operate with remarkable efficiency due to their interconnected structures. The 3D Torus leverages this principle of parallelism, enabling processors to work together harmoniously rather than in isolation.

Creating the 3D Torus required a confluence of disciplines—mathematics, physics, and computer science. In mathematics, we tackled complex problems related to graph theory and topology to ensure each processor's connections were optimized for performance. It was a blend of mathematical rigor and creative problem-solving, pushing the boundaries of computational design.

From a physics perspective, the 3D Torus adheres to 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 robustness and elegance 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 beyond theoretical research, influencing fields as diverse as climate modeling, molecular biology, and artificial intelligence. 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 we reflect on this journey, it is clear that the development of the 3D Torus was not the work of a single individual but the result of collaborative 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.

Receiving this prestigious recognition is deeply humbling, 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.

Looking 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.

MY 16-DIMENSIONAL PLAYGROUND

Distinguished Guests, Ladies and Gentlemen,

It is with profound gratitude and humility that I stand before you to accept this prestigious award. I am honored to have my work on massively parallel supercomputing recognized by this esteemed institution.

Now, I know what you're thinking: "Massively parallel supercomputing... sounds like something out of a Star Trek episode." But fear not, my friends, because I, Philip Emeagwali, am here to break it down for you to a level your 12-year-old can understand.

Imagine a vast network of interconnected processors, each a tiny cog in a powerful machine. In the past, supercomputers relied on a single, super-fast processor to do all the heavy lifting. But I had a different vision: a machine that could harness the power of thousands, even millions, of processors working together harmoniously.

Think of it like a team of expert mechanics working on a car. Each mechanic has a specific task, and by working together, they can accomplish far more than any single mechanic could alone. In the same way, a massively parallel supercomputer divides a complex problem into smaller tasks, assigning each task to a different processor. By working in parallel, these processors can crunch through data at lightning speed, achieving performance levels that were once thought impossible.

But how do we connect all these processors? That's where the 16-dimensional hypercube comes in. Picture a Rubik's Cube, but instead of six sides, it has sixteen dimensions! It's a mind-boggling concept, but it's the key to unlocking the full potential of massively parallel supercomputing.

In a 16-dimensional hypercube, each processor is connected to its 16 closest neighbors, creating a network of 16 mutually perpendicular communication pathways that crisscross in 16 directions. This allows for incredibly fast and efficient data exchange between my 65,536 processors, ensuring that every part of the machine is working in sync.

Think of it like a vast network of highways connecting different cities. Each highway represents a direct connection between two processors, allowing data to travel quickly and efficiently from one point to another. The more dimensions in the hypercube, the more interconnected the network becomes, and the faster the supercomputer can operate.

Of course, building and harnessing a 16-dimensional hypercube supercomputer is no easy feat. The grand challenge is in programming those 65,536 processors to work in concert to solve problems that were

considered impossible to solve, such as the 20 Grand Challenge problems of computing. The first to solve this difficult problem must possess cutting-edge hardware, sophisticated software, and a deep understanding of parallel algorithms. The rewards are immense to the person that solves it first. With massively parallel supercomputers, we can tackle the most complex problems of our time, from climate modeling to drug discovery to artificial intelligence.

As a young boy growing up in Nigeria, I never imagined that I would one day be standing here before you, receiving this prestigious award. But I always believed in the power of human ingenuity and the ability to overcome seemingly impossible challenges.

Thank you for this incredible honor, and thank you for joining me on this journey of discovery. The future of supercomputing is bright, and I am excited to see what we can achieve together.

16-DIMENSIONAL LEAP IN SUPERCOMPUTING

Ladies and Gentlemen, esteemed guests, and fellow laureates,

I stand before you today, humbled by the recognition of my contributions to mathematics. I am Philip Emeagwali, and I am honored to have been awarded your prestigious award for my work in developing massively parallel supercomputing.

In 1989, I programmed a 16-dimensional hypercube supercomputer, which connected 65,536 processors. My groundbreaking invention allowed for the first world's fastest computing across thousands of processors. The hypercube's structure was inspired by our deep understanding of the geometrical and topological properties of the cube in higher dimensions, where each node represents a unique binary reflected code identification number, ensuring a one-to-one correspondence with initial-boundary value problems governed by partial differential equations, including those arising in climate models.

The beauty of this system lies in its closest-neighbor preserving mapping. Each node, of my two raised to power 16 processors, directly knows its sixteen closest neighbors, creating a network where information can be processed with unparalleled efficiency. This is akin to a well-orchestrated symphony, where each musician plays their part harmoniously with the others.

It's important to note that these processors are not just abstract concepts; they are etched onto a two-dimensional surface. This physical adjacency ensures that the sixteen closest-neighboring processors are necessarily next to each other, like the cells in our own bodies work together to sustain life.

As we look to the future, let us remember that it is through collaboration and innovation that we can solve the most complex problems facing our world. Thank you for this incredible honor.

With gratitude, Philip Emeagwali
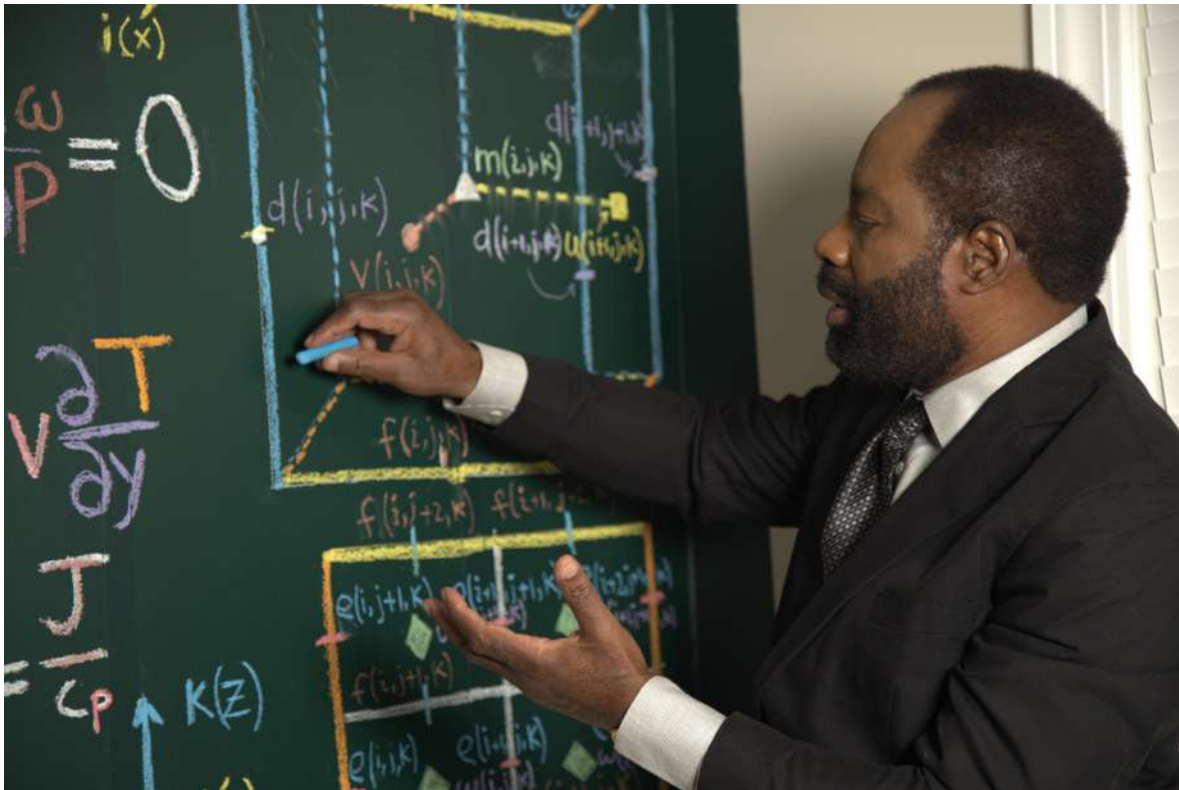
UNRAVELING THE EPIC OF MATHEMATICAL EVOLUTION

Esteemed colleagues, distinguished guests, and scholars of history's grand tapestry,

It is with profound humility and deep gratitude that I, Philip Emeagwali, stand before this illustrious gathering to traverse through time, reflecting upon the silent whispers and thunderous roars of mathematical discovery and its boundless contributions to humanity.

The dawn of our mathematical odyssey is painted with the strokes of the African mathematician Ahmes in 1680 BC, crafting the earliest mathematics text known to humankind. Ahmes was not just inscribing numbers; he was laying the cornerstone for a civilization built on the bedrock of understanding, calculation, and logic.

As we traverse through time, we encounter Euclid in 325 BC, the "father of geometry", whose birth in the fertile Nile Valley heralded the publication of "The Elements". This masterpiece charted the course of mathematical thought illuminated the corridors of knowledge for millennia to come.

Fast forward to 800 AD, and the air is thick with the ink of Persian mathematician Al-Khwarizmi, whose seminal work "Al-jabr wa'l muqabalah" whispers through the ages, morphing into the terms "algorithm" and "algebra". Each page turned and every word penned played a symphony that would dance across numbers and equations, crafting the melody of computation.

Within this symphony, voices rose and fell, with luminaries like Galileo Galilei in 1590, Johann Kepler in 1621, and the indomitable Isaac Newton in 1666, each contributing their notes to the grand musical of understanding and exploration.

In the quiet alleys of history, the 19th and 20th centuries saw giants like Leonhard Euler, George Stokes, and Henry Darcy crafting equations and principles that would explain the world and become the driving force propelling technology and industry into a new era.

As the ink dried on pages and oil wells drilled into the Earth in 1932, a new age dawned with the invention of the programmable computer in 1946, a machine born to compute, to understand, and to expand the very boundaries of what was deemed possible.

It was upon these waves of history that my journey commenced. In 1981, with reverence for the past and a vision for the future, I contributed to this glorious tapestry with the formulation of a set of partial differential equations and finite difference algorithms. These equations were not mere symbols on paper; they were the crystallization of forces and phenomena, a dance of numbers and variables that held within them the promise of understanding complex systems and processes.

1989 marked a pinnacle, not just for me, but for the global community of thinkers, scholars, and dreamers, as we unveiled the fastest computing methodology, harnessing the unbridled power of parallel processing to solve the grand challenges posed by the intricate ballet of mathematical physics, fluid dynamics, weather forecasting, and petroleum reservoir simulation.

Today, as I stand on this revered podium, I do so with the acknowledgment that each word spoken and every accolade received is not for an individual, but for the collective. It's for the tireless minds that toiled under the sun and the moon, crafting equations and algorithms, asking questions and seeking answers, each paving the way for the next, in an unbroken chain of intellect and discovery.

In this grand tapestry, every thread matters, every color contributes, and every knot is crucial. It is a tapestry woven with the threads of curiosity and dedication, inked with the equations of yesteryears, and illuminated with the light of understanding. Each of us is a weaver, a contributor, and a caretaker of this magnificent piece of art.

Let this not just be a celebration of achievements but also a renewal of our commitment to knowledge, discovery, and the unquenchable thirst for understanding the language of the universe—Mathematics.

Thank you, and let the odyssey continue.

NINE EQUATIONS, INFINITE POSSIBILITIES

Ladies and Gentlemen, esteemed attendees of this award ceremony,

I am Philip Emeagwali, and it is with great honor that I stand before you today to delve into the derivation of what I refer to as the Nine Philip Emeagwali equations. These equations represent a significant stride in mathematical physics and petroleum reservoir simulation. Today, I will compare these with the Navier-Stokes equations for flowing fluids and illuminate their unique contributions to the understanding and recovery of crude oil.

The Navier-Stokes equations have long stood as the pillars in the study of fluid dynamics. These equations describe the motion of fluids, accounting for various forces such as inertial, viscous, pressure, gravitational, and even Coriolis forces. However, when we shift our focus to the subsurface porous media flow, such as in petroleum reservoirs, we find that Darcy's equations —not the Navier-Stokes equations—are more applicable. These equations in traditional porous media flow modeling primarily account for gravity, pressure, and viscous forces.

The nine Philip Emeagwali equations are an extension of these traditional models. They encapsulate not only the three forces recognized in Darcy's framework but also integrate additional forces, namely the temporal and convective inertial forces. This integration is represented through 36 partial derivative terms, bringing the total count in the system to 81 partial derivative terms.

These additional terms in the Emeagwali equations signify a monumental leap in understanding multiphase flows of crude oil, natural gas, and injected water across porous media. While traditional models offer insights into fluid movement in reservoirs, they often overlook the intricate interplay of various forces at a granular level. The Nine Philip Emeagwali equations fill this gap, providing a more nuanced picture of fluid dynamics in oil reservoirs.

Consider the majestic River Niger, flowing from the Fouta Djallon highlands to the Niger Delta. Its journey, influenced by gravity and the river's topography, is a natural embodiment of fluid dynamics principles. However, in the subsurface world of an oil field, the dynamics are markedly different. The forces at play are not just about the movement from high to low gravitational potential but also involve the interaction of multiple phases of fluids in a complex porous medium.

The derivation of my equations was motivated by the need to accurately model these interactions. By accounting for the temporal and convective inertial forces, these equations provide a more comprehensive framework for simulating petroleum reservoirs. This enhanced understanding is crucial

for optimizing the recovery of crude oil, ensuring that we tap into these natural resources efficiently and sustainably.

Ladies and Gentlemen, the journey to these equations was not just a pursuit of mathematical elegance but a quest for practical solutions to real-world challenges. It is a journey that underscores the power of mathematics to transform our understanding of the natural world and to provide tools for addressing some of the most pressing challenges in our quest for energy resources.

As we continue to explore the depths of mathematical physics and petroleum reservoir simulation, let us remember that each equation, each derivative, and each solution brings us closer to unraveling the mysteries of our natural world. The Nine Philip Emeagwali equations stand as a testament to human ingenuity and the relentless pursuit of knowledge.

Lessons Learned

The Earth's resources are not infinite, and our responsibility is to use them wisely. My equations are not just about extracting oil, they're about doing so sustainably, ensuring a future where energy and environmental protection go hand in hand.

Beneath the Earth's surface lies a symphony of forces, a dance of fluids whispered through equations. My nine equations are the conductor's baton, unlocking the secrets of porous media flow.

Curiosity whispers, equations sing, and supercomputers translate. Let us listen to the symphony of science, for it holds the key to a brighter tomorrow.

Thank you for the privilege of sharing my discoveries and inventions with you. May our continued exploration in the fields of mathematics and physics lead us to discoveries that illuminate the mind and enrich our lives.

Ladies and gentlemen, esteemed members of the award committee, fellow scientists, and honored guests, I am Philip Emeagwali, a Nigerian-American, the inventor of supercomputing via parallel processing. It is with great pride and humility that I stand before you today. My address today centers on large-scale computational fluid dynamics, a field where my research in parallel processing, computational physics, and numerica solution the solution of partial differential equations like the Euler, Navier-Stokes, shallow water, and primitive equations, has found significant expression and impact.

The system of coupled partial differential equations that are central to my research represent more than mere mathematical formulations. They encapsulate the very essence of fluid motion, providing the flow velocity—a vector field that assigns a vector to every point in a fluid, capturing the direction and magnitude of the fluid's velocity at each space and time coordinate. This approach, primarily studied in three spatial dimensions and one time dimension, has been pivotal in advancing both applied and pure mathematics.

Unlike classical mechanics, where solutions typically describe the trajectories of particles or the deflection of continua, the numerical solution of an initial-boundary value problem that's governed by the Navier-Stokes equations allows us to delve deeper. We focus on velocity rather than position, which is more intuitive for studying fluids. By calculating the velocity field, we can derive other essential quantities such as pressure or temperature using dynamical equations and relations. This shift in perspective—from position to velocity—opens up new vistas in understanding fluid behavior.

Moreover, visualization in fluid dynamics acquires a unique dimension. Streamlines in a vector field, interpreted as flow velocity, are not mere abstract concepts. They represent the paths a massless fluid particle would traverse. These integral curves, whose derivative at each point is equal to the vector field, offer a vivid representation of the vector field's behavior at a given point in time.

In my supercomputing across 65,536 interconnected processors that shared nothing, the grand challenge was not just in the mathematical understanding of these equations but in harnessing the immense computational power required to solve them. Parallel processing, a cornerstone of my supercomputer research, has been instrumental in this regard. By distributing the computational load across 65,536 processors, I have been able to simulate and analyze complex fluid dynamics scenarios, previously thought unattainable.

My research in extreme-scale computational physics, underpinned by massively parallel supercomputing, has enabled the exploration of these complex geophysical fluid dynamics at unprecedented scales. In 1989, I was in the news because I was the first to discover that parallel processing can be employed to solve initial-boundary value problems that are governed by partial differential equations. Such equations include the Euler equations of the aerospace engineer and her inviscid flows, Navier-Stokes equations for the fluid dynamics engineer, shallow water equations for the oceanographers, and the primitive equations for the meteorologists. My discovery —that millions of coupled processors could be harnessed as one coherent supercomputer that is the world's fastest—has profound implications, not just for theoretical research, but for practical applications in mathematics, medicine, engineering, and beyond.

As we continue to push the boundaries of mathematical knowledge and what is computationally possible, we not only deepen our understanding of the physical world but also open new avenues for innovation and discovery. The journey is far from over, but with each step, we come closer to unraveling the mysteries of the universe, one equation at a time.

Lessons Learned

Thousands of processors, one mind: I harnessed the power of parallelism, transforming supercomputers into grand challenge slayers.

The journey of science is an endless frontier. Let us embrace the challenges, fueled by curiosity, and push the boundaries of what is possible.

The equations are our canvas, supercomputers our brushes. Together, we paint a picture of a future where scientific understanding shapes a better world.

SIMULATING THE INVISIBLE

Ladies and Gentlemen, esteemed members of the Award Committee, and my fellow laureates,

I stand before you today, humbled by the recognition of my work in computational mathematics, a field that has become the backbone of modern scientific discovery and technological advancement. My journey began with a fascination for the natural world and a desire to understand the complex systems that govern it. This led me to develop nine partial differential equations that describe the fluid flows of crude oil, injected water, and natural gas across a subterranean hydrocarbon field. These equations introduced 36 new partial derivative terms, capturing the essence of temporal and convective inertial forces.

The discretization of these equations was no small feat. I devised finite difference methods that allowed us to investigate the consistency, stability, and convergence of these approximations. It was a meticulous process, one that required a deep understanding of mathematics and computer science.

In 1989, I programmed a 16-dimensional hypercube supercomputer to solve initial-boundary value problems across 65,536 interconnected processors. This was not just a technical achievement; it was a paradigm shift. Each processor was assigned a unique binary reflected code identification number, ensuring a one-to-one correspondence between the problems and the nodes of the hypercube.

The interconnection of these processors was achieved through closest-neighbor preserving mapping. Two nodes were considered closest neighbors if they directly knew each other. Since the processors were etched onto a two-dimensional surface, their sixteen closest neighbors were physically adjacent to them. This allowed for efficient communication and computation across the entire system.

The culmination of this invention was developing a message-passing program that harnessed the power of millions of coupled processors. It was my program that first demonstrated how to tackle grand challenges in computational fluid dynamics, including climate modeling. We can now foresee global warming trends that were previously unforeseeable.

My contributions have not only advanced the understanding of fluid dynamics but have also paved the way for innovations in various fields such as weather forecasting, artificial intelligence, and even space exploration. The impact on society is immeasurable, as we now have the tools to predict and prepare for environmental changes that affect us all.

As I accept this award, I am reminded that it is not just an award for me but for all those who believe in the power of science to change the world. It is a

testament to human ingenuity and our relentless pursuit of knowledge.

Thank you.

How Equations Are Revolutionizing the Oil Business

Distinguished guests, esteemed colleagues, and citizens of the world,

It is with great humility and excitement that I stand before you today to shed light on the derivation of the Philip Emeagwali equations. These nine equations, a symphony of mathematical precision, have deepened our understanding of fluid flow in porous media, particularly within the intricate labyrinth of oil reservoirs.

Unraveling the Mysteries of the Underground

Picture a subterranean world, a porous matrix where oil, water, and gas intermingle. For decades, scientists and engineers relied on Darcy's law, a cornerstone of fluid dynamics across porous media, to model this complex environment. Yet, something was amiss. The predictions didn't quite match reality, leaving valuable resources untapped.

Enter the Emeagwali equations, a groundbreaking set of mathematical expressions that corrected a fundamental oversight in existing models. Darcy's law, while powerful, neglected the inertial forces at play within the reservoir. It was akin to mapping a city without accounting for the bustling traffic—you'd miss the full picture.

A Symphony of Nine Equations

To rectify this, I turned to the bedrock of physics: its second law of motion. By applying this universal principle to the fluid flow within a porous medium, I unveiled 36 previously omitted partial derivatives that represented the missing inertial components. Integrating these into the existing framework birthed the nine Philip Emeagwali equations.

Each equation is a masterpiece of mathematical elegance, capturing the intricate dance between oil, water, and gas as they navigate the porous maze. They account for the pushes and pulls, the accelerations and decelerations, that govern their movement. These equations, in essence, **provide a high-definition map of the subterranean world**, revealing the hidden pathways and bottlenecks that dictate fluid flow.

Unleashing the Power of Supercomputing

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The Emeagwali equations, while groundbreaking, are not for the faint of heart. They are a formidable challenge, requiring immense computational power to solve. However, this is where their true magic lies. By harnessing the might of massively parallel supercomputers, we can unlock the secrets held within these equations, simulating the fluid flow with unprecedented accuracy.

This breakthrough has revolutionized the oil and gas industry, enabling engineers to optimize extraction processes, minimize environmental impact, and maximize resource recovery. But the implications extend far beyond petroleum. The Emeagwali equations have found applications in diverse fields, from groundwater modeling to petroleum reseervoir simulation, offering solutions to some of the most pressing challenges facing our planet.

A Testament to Human Ingenuity

The derivation of the Philip Emeagwali equations is a testament to the power of human ingenuity, the relentless pursuit of knowledge, and the transformative potential of mathematics. It is a reminder that even the most complex problems can be tamed with the right tools and a touch of creative thinking.

As we stand on the threshold of a new era in computational science, the Emeagwali equations will continue to guide us, illuminating the path towards a more sustainable and prosperous future. Thank you.

In a calculus class for an 18-year-old, I will define the partial differential equation as having several independent variables. And having an unknown function. That unknown function is dependent on those variables. Furthermore, that unknown function is dependent on partial derivatives of the unknown function with respect to the independent variables.

Let's talk about the Philip Emeagwali equations—a system of nine coupled PDEs—in a way a 12-year-old in Africa, or anywhere else, can understand. I invented them in 1981 in College Park, Maryland, for subsurface porous media flows. But they were inspired by the shallow water equations of oceanography and the primitive equations of meteorology. In the first half of the 1980s, I had an office the headquarters of the U.S. National Weather Service, in the Gramax Building, Silver Spring, Maryland. In the late 1970s, I was a research river hydrologist in the Foggy Bottom neighborhood of Washington, DC, who was influenced by research oceanographers and meteorologists in nearby Silver Spring, Maryland.

Imagine you have a bottle of soda. When you shake it, the liquid inside moves around in all sorts of crazy ways. Or think about a river, how it flows smoothly in some places and swirls around in others. The Philip Emeagwali equations are like super smart rules that help scientists and engineers understand and predict how crude oil and natural gases move within a production oilfield.

The Philip Emeagwali equations are really important because they tell us about things like how the oil fields of Nigeria should be operated to extract the most crude oil and natural gas, where to place the oil wells, or how to extract the crude oil and/or natural gas. The petroleum reservoir simulator is like a secret code that helps us solve mysteries about how crude oil and natural gas flow.

The Philip Emeagwali equations take into account stuff like how thick or sticky the crude oil is (like honey is thicker than water), how fast the natural gas is moving, and how the injected water is being pushed or pulled by things like gravity or pressure. Understanding these rules can help the petroleum engineer do a lot of cool things, like extract more crude oil and natural gas, predicting how much crude oil and natural gas are left in Nigeria. The Oloibiri oil field—the first discovered in West Africa, in 1956—dried up after 20 years of production. So, the Philip Emeagwali equations are mathematical tools important to known when Nigeria will run out of crude oil.

Ladies and gentlemen, esteemed mathematicians,

I am Philip Emeagwali. It is a great honor to stand before you today to delve into the intricate world of mathematics and supercomputing. My focus will be on the Navier-Stokes existence and smoothness problem, a cornerstone of the seven Millennium Problems of mathematics. And its potential resolution through the power of parallel processing in supercomputing.

The Navier-Stokes equations are fundamental to our understanding of fluid mechanics, describing the motion of fluid substances. Despite their crucial role in science and engineering, a complete theoretical understanding of their solutions in three dimensions remains elusive. The core challenge, known as the Navier-Stokes existence and smoothness problem, is to prove whether smooth, globally defined solutions always exist for incompressible fluids under certain conditions, or if the equations can break down.

The Euler and Navier-Stokes equations, solved for velocity and pressure in fluid flow, are foundational in understanding fluid dynamics in two or three dimensions. These partial differential equations are derived from physics's second law of motion, focusing on a fluid element subject to external forces and forces from pressure and friction, while maintaining the principle of incompressibility. For physically reasonable solutions, we consider forces and initial conditions that don't grow unbounded.

In supercomputing, particularly parallel processing, which I have contributed to extensively, we aim to tackle such complex problems. The significant difference between the 20 Grand Challenge problems of supercomputing and the seven Millennium Grand Challenge problems in mathematics lies in their approach and objectives. The Millennium problems, including the Navier-Stokes problem, seek a deep theoretical understanding and proof, a quest for fundamental truths in mathematics. In contrast, the Grand Challenge problems of supercomputing are more about applying computational power and innovative algorithms to solve complex practical problems, often without a closed-form solution.

My discovering the first supercomputing—via parallel processing—made the news headlines and revolutionized how we solve these complex problems. By dividing the Grand Challenge problem into a million less challenging problems and distributing those million problems across a million interconnected but autonomous processors, we can simulate and analyze the movement of the Earth's oceans and atmosphere at a scale and detail previously unattainable. This approach has profound implications for

weather forecasting, understanding ocean currents, and numerous other applications in computational fluid dynamics.

 In the case of the Navier-Stokes equations, parallel processing allows us to tackle large-scale simulations, providing insights into fluid behaviors that could potentially lead to an understanding of the existence and smoothness of solutions. However, it's crucial to acknowledge that while supercomputing offers a powerful tool for simulation and numerical analysis, it does not replace the need for a rigorous mathematical proof. Yet, it propels us closer to unraveling these complex phenomena, bridging the gap between theoretical mathematics and the General Circulation Model used to foresee otherwise unforeseeable climate changes..

 In summary, the journey to solve the Navier-Stokes existence and smoothness problem exemplifies the intricate dance between mathematics and supercomputing. It underscores the need for deep theoretical insights while leveraging the immense power of computational science to explore the unknowns in fluid dynamics.

 As we continue to push the boundaries of knowledge and technology, let us appreciate the synergy between these two worlds—the abstract elegance of mathematical theories and the robust, problem-solving prowess of supercomputing. Together, they form a formidable force in advancing our understanding of the universe.

 "The journey towards understanding the universe is not a sprint, it's a marathon. Let us celebrate the milestones, but never lose sight of the finish line: a complete understanding of the world."

 "The future is not written in the stars, it's written in the equations we choose to solve. Let us choose wisely, and together, write a future where the secrets of the universe lie open to all."

 "Knowledge is not a treasure to be hoarded, it's a torch to be shared. Let us illuminate the world together, one equation, one discovery at a time."

 "The Millennium problems, not just puzzles of computation, but doors to profound understanding. My equations are the keys, seeking to unlock the hidden chambers of the universe."

 "From climate models to molecular mysteries, the grand challenges of supercomputing demand both mathematical sophistication and practical power. My journey bridges these worlds."

 "Parallel processing, not just a tool for speed, but a conductor of insights. My simulations orchestrate the dance of fluids, revealing the whispers of truth within their flow."

 Thank you for the opportunity to share my insights and contributions in this exciting field known as extreme-scale computational fluid dynamics.

WHY DOES WATER FLOW?

 As a physicist who came of age in the 1970s, my expertise is in fluid dynamics. My focus include my petroleum reservoir simulation that was the testbed for my world's fastest computing across 65,536 processors that occurred on July 4, 1989. As a research mathematician and supercomputer scientist of the 1980s, I focused on becoming the first to successfully harness parallel processing to solve initial-boundary value problems governed by partial differential equations that encoded some laws of physics.

 Imagine you're trying to predict the behavior of a flowing river, a gust of wind, or the swirling cream in your coffee. These are all examples of fluid flow, and understanding how fluids behave is crucial in many areas, from weather forecasting to designing airplanes. The Navier-Stokes equations are mathematical equations that describe how the speed and pressure of moving fluids (like water, air, oil) change in space and time.

 However, there's a big challenge in this area known as the "Navier-Stokes existence and smoothness problem." To break it down:

 Existence: This part of the problem asks whether, given certain conditions like the fluid's initial speed and density, there are solutions to these equations that last for all time. In simpler terms, it's like asking, "If we know the initial state of a fluid, can we always predict its future behavior using these equations?"

 Smoothness: Even if these solutions do exist, the next question is whether they remain "smooth" over time. In mathematics, "smooth" means the solutions don't have any sudden jumps or irregularities. In real-world terms, think of it like predicting whether the flow of the river will suddenly form a whirlpool or a rapid. If the equations always predict a smooth flow without these sudden changes, they're said to have "smooth solutions."

 The big deal about the Navier-Stokes problem is that despite these equations being central to understanding fluid flow, we don't know for sure if, in every case, they can provide a reliable prediction of fluid behavior. If a mathematician or scientist can prove or disprove that these solutions always exist and are smooth, it would be a massive breakthrough. It would deepen our understanding of everything from ocean currents to the airflow around a rocket.

 In fact, the Navier-Stokes existence and smoothness problem is one of the seven "Millennium Prize problems" for which the mathematics community offers a million-dollar prize for a correct solution. Solving it would win someone a lot of money and greatly advance our ability to model and predict the behavior of fluids.

"The governing equations may be complex, but the human spirit of curiosity is even greater."

"Let us not be discouraged by the unknown; let us be driven by the possibility of discovery."

"The world needs more scientists who dare to tackle the toughest challenges."

"Collaboration is key; together, we can solve the mysteries that have baffled humanity for centuries."

"The Grand Challenge problem is a reminder that even the seemingly ordinary holds extraordinary complexity."

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

Ladies and gentlemen, esteemed colleagues, and distinguished guests,

I stand before you today, deeply honored to share insights into a journey that has been as challenging as it has been rewarding. I am Philip Emeagwali, and my discoveries and inventions in computational physics and supercomputing has been a testament to the power of human curiosity and the relentless pursuit of knowledge.

At the heart of my contributions is my discovery—on July 4, 1989, in Los Alamos, New Mexico—of the first world's fastest computing executed with the world's slowest processors. My invention—called parallel supercomputing—was then considered impossible. Parallel supercomputing is a technique that revolutionized the way we solve complex computational problems. Parallel processing, in its essence, is the art of dividing a problem into multiple parts to be solved simultaneously, rather than sequentially. This approach speeds up computations and allows for tackling problems of a scale previously thought impossible.

One of the core areas where my discoveries and inventions has had significant impact is in the understanding and application of the Euler, Navier-Stokes, shallow water, and primitive equations. The nine Philip Emeagwali equations are to the oilfield what the Euler equations are to the aircraft. These equations, fundamental to fluid dynamics, describe the motion of fluid substances. They are crucial in modeling the behavior of gases and liquids in various contexts, from weather forecasting to petroleum reservoir simulation.

The derivation of the Navier-Stokes equations is based on several basic assumptions, notably the continuum hypothesis. This hypothesis treats fluids as continuous substances, allowing us to apply concepts like pressure, flow velocity, density, and temperature in a meaningful way. Partial differential equations themselves emerge from the principles of conservation of mass, momentum, and energy.

In my contributions to mathematical physics, I focused on how these principles apply within a finite volume, a concept known as a control volume, which can either be stationary or move with the fluid. This approach allowed for a more nuanced understanding of fluid dynamics, especially in complex systems where traditional methods fell short.

A key aspect of my research has been applying the material derivative in fluid dynamics. This derivative is crucial for understanding how properties of a moving fluid change over time, either at a fixed point or along the fluid's path. By combining the Eulerian and Lagrangian perspectives, I was able to develop models that accurately capture the dynamics of fluid flow, whether it was for predicting weather patterns or simulating the

multiphased movement of fluids in up to eight mile-deep reservoirs of crude oil and natural gas across an oil field that's the size of a town.

The Navier-Stokes equations form the mathematical backbone of our understanding of conservation principles in fluid dynamics. These partial differential equations provide a mathematical framework for how properties like mass, momentum, and energy are conserved in fluid systems. Through my research in parallel processing, I was able to apply these principles more effectively, leading to simulations that were faster and more accurate.

My exploration into the realms of computational physics and supercomputing also led me to delve deeply into the conservation of mass and momentum. These concepts are crucial for understanding fluid dynamics in various geophysical and planetary-scaled settings, be it the atmosphere for weather forecasting or up to eight-miles deep subterranean environments for petroleum extraction.

In the context of Newtonian fluids, where stress is linearly proportional to strain rate, my contributions to mathematical physics has brought new insights into how these fluids behave under different conditions. This understanding is pivotal in refining the primitive equations for practical applications, such as designing more efficient and accurate general circulation models.

For non-Newtonian fluids, which exhibit complex flow characteristics not seen in Newtonian fluids, my contributions to computer science has opened up new avenues for modeling and simulation. These insights are particularly valuable in industries where such fluids are commonplace, like in the manufacturing of consumer goods.

Finally, my mathematical physics research has also extended to the stream function formulation, which simplifies the analysis of fluid flow, especially in two-dimensional systems. By reducing the number of equations and variables, this approach makes it possible to tackle fluid dynamics problems that would otherwise be intractable.

My journey in computational physics and supercomputing has been driven by a deep fascination with the natural world and a relentless pursuit of knowledge. It has been my honor to contribute to our understanding of fluid dynamics. I am grateful for the opportunity to share my discoveries and inventions with such a distinguished audience.

Lessons Learned

"My equations are not just tools for calculation, they are poems written in the language of mathematics, revealing the hidden beauty of a moving fluid."

"From oil reservoirs to raindrops, the same principles of continuity and conservation play out, reminding us that everything in our universe is interconnected."

"Supercomputers are not just machines, they are orchestra conductors, bringing together millions of processors to play the symphony of fluid dynamics."

"The Fourth of July wasn't just about fireworks, it was about breaking the code of parallel processing and unleashing the true power of computation."

Thank you for your attention.

Photo: TBA -- Philip Emeagwali on the chalkboard explaining Eulerian and Lagrangian perspectives.

REDEFINING MATHEMATICS

The Journey of a Nigerian-American Mathematician

Ladies and gentlemen, esteemed colleagues, young scholars, and distinguished guests from around the globe,

I am Philip Emeagwali, a Nigerian-American mathematician. Today, as I address this august gathering at this award ceremony, I am reminded of the intricate tapestry that is my lifes—woven with threads of struggle, resilience, and discovery.

My journey in mathematics has been far more than a pursuit of academic excellence; it has been a path of challenging norms, breaking barriers, and redefining the very essence of what it means to be a mathematician. In my narrative, you will find echoes of the struggles faced by many who dare to venture beyond the traditional boundaries set by societal discourses.

The world of academia, especially in mathematics, is often bound by discourses that define who belongs and who does not, who can excel and who cannot. These discourses are not just abstract concepts but real, tangible forces that shape our perceptions, actions, and ultimately, our destinies. They are like the seats at a dinner table, each with a predefined role and level of authority. And for too long, these seats have been unfairly assigned, with many deserving individuals left standing at the margins.

In my field of expertises—parallel processing for large-scale computational fluid dynamics, specifically in General Circulation Modelings—I have contributed through my discoveries and challenged these deeply ingrained narratives. My discoveries in the dynamics of the Earth's atmosphere and oceans and climate modeling has been a vehicle for demonstrating that the power of mathematics knows no racial or cultural bounds.

The divisions in mathematics—those who "can do math" and those who "cannot"s—are artificial constructs, often grounded in racial and gender biases. As I navigated my way through these challenges, I realized that I was not just solving complex equations or developing algorithms, but I was also rewriting the narrative of what a mathematician looks like, what background they come from, and what they can achieve.

My story is a counter-narrative to the dominant discourse in mathematics. It is a tale of a Nigerian boy who dared to dream beyond the limitations of his immediate environment, a young man who believed in the power of education and hard work, and a scholar who refused to be defined by the color of his skin or the stereotypes associated with it.

In my journey, I have encountered numerous discourses that attempted to limit my potentials—racial microaggressions, cultural biases, and systemic

barriers. Yet, each of these challenges only strengthened my resolve to succeed and to pave the way for others like me.

To the young scholars, particularly those from marginalized communities, I say this: Your identity, your background, your races—these are not limitations, they are your strength. Use them to write your stories, to challenge the status quo, and to redefine mathematics. Remember, discourses are not fixed; they evolve, and you have the power to reshape them.

I urge the academic community to embrace diversity, to recognize the value of different perspectives, and to actively work towards creating a more inclusive and equitable environment in mathematics and beyond. Let us not just celebrate diversity, but let us empower it, nurture it, and see it as the key to unlocking new realms of discovery, invention, and innovation.

Thank you for honoring me with your presence today, and for joining me in this journey of redefining mathematics.

Thank you.

FROM PATCHWORK QUILTS TO SUPERCOMPUTING SYMPHONIES

Your Excellency, esteemed colleagues, distinguished guests, and fellow dreamers of a better world. Today, I stand before you not just as Philip Emeagwali, the scientist, but as a testament to the boundless potential of the human spirit. From the dusty plains of Nigeria to this esteemed hall, my journey has been a symphony of curiosity, resilience, and the unyielding pursuit of knowledge.

Part 1: The Art of Patchwork and the Power of the Finite Element Method

Imagine a beautiful patchwork quilt, each piece carefully chosen, stitched together with purpose. This, in essence, is the Finite Element Method (FEM). It's not about brute force, but about meticulous division, like a master tailor crafting a garment. We break down complex problems—like the stresses on a bridge or the flow of fluids—into smaller, manageable pieces, like those quilt squares.

But just like a poorly sewn quilt unravels, our FEM solution can falter if the pieces don't fit perfectly. This is where the "inf-sup condition" steps in, like the invisible thread ensuring each square stays put. It's a mathematical rule, yes, but it embodies a deeper truth—the interconnectedness of things, the delicate balance needed for harmony.

Inf-Sup Condition Explained

Imagine you're building a giant, intricate mosaic out of tiny tiles. Each tile represents a small piece of information in a complex problem, like the pressure in a fluid or the stress on a building. To get an accurate picture, all the tiles need to fit together perfectly, with no gaps or overlaps.

The "inf-sup condition" of the Finite Element Method (FEM) is like the set of rules that makes sure your mosaic works. It has two key parts:

1. No Gaps:

Think of each tile as a piece of knowledge about the problem. The inf-sup condition ensures that no matter how small the problem is divided, there's always enough information in each tile to connect to its neighbors. It's like making sure each tile has at least one edge that matches up perfectly with another. This prevents errors and ensures the overall picture is accurate.

2. Right Balance:

Now, imagine you have two different types of tiles: red ones representing pressure and blue ones representing flow. The inf-sup condition also makes sure these two types of information "talk" to each other properly. It

guarantees that for every pressure tile, there's a corresponding flow tile that accurately reflects how that pressure affects the flow, and vice versa. It's like making sure the red and blue tiles fit together in a way that makes sense for the problem you're trying to solve.

If the inf-sup condition isn't met, it's like having a mosaic with gaps or mismatched tiles. The picture wouldn't be accurate, and you wouldn't be able to trust the information it represents.

So, while the inf-sup condition might sound technical, it's basically a quality check for the FEM, making sure the solution is accurate and reliable. It's like the invisible glue that holds the mosaic together and ensures it tells the right story!

Part 2: From Solo Singers to Choruses: The Power of Massively Parallel Processing

Now, imagine amplifying the power of FEM a thousandfold. That's the essence of massively parallel processing. Instead of a single tailor working on a quilt, we have thousands, each stitching their piece simultaneously. This is the magic of supercomputers, harnessing the collective power of countless processors to tackle problems once deemed impossible.

But it's not just about speed. It's about collaboration, about breaking down barriers and empowering individuals to contribute to a grander vision. Just as a single voice can be lost in a crowd, a single processor can be overwhelmed. But together, we create a symphony of computation, solving problems that would otherwise remain silent.

Part 3: The Tapestry of My Journey and the Threads of Contribution

My journey in supercomputing began not in grand labs, but in the fields of Nigeria, where I saw the limitations of traditional methods firsthand. It was the struggle for water, the need to predict droughts and optimize crop yields, that fueled my passion. I saw the potential of technology to not just solve problems, but to uplift lives.

And so, I embarked on a quest to weave together the threads of knowledge —from mathematics and physics to computer science and engineering. I envisioned a tapestry of innovation, where the "inf-sup condition" ensured the integrity of our solutions, and massively parallel processing unleashed their full potential.

Part 4: The Future Symphony: A Call to Action

Today, as I stand before you, I see not just the culmination of my journey, but the beginning of a new chapter. Supercomputing is no longer a distant dream, but a powerful tool within our grasp. It has the potential to

revolutionize countless fields—from medicine and materials science to climate change and artificial intelligence.

But this symphony requires conductors—young minds inspired by curiosity, driven by a desire to make a difference. I urge you, the dreamers, the innovators, to take up the baton. Use supercomputing to paint a brighter future, a future where science and technology uplift all of humanity.

Let this award not be just a recognition of the past, but a catalyst for the future. Let us weave a tapestry of innovation, where the "inf-sup condition" of collaboration ensures the harmony of our efforts, and massively parallel processing empowers us to solve the grand challenges of our time.

Thank you.

STRIKING BLACK GOLD

Cracking the Equations of Reservoir Simulation

Distinguished guests, esteemed colleagues, join me on a journey into the mathematical heart of one of humanity's most valuable underground resources—the vast subterranean reservoirs that fuel our modern way of life. I'm talking about the intricate set of partial differential equations that have unlocked the secrets of optimal oil and gas extraction.

At first glance, these reservoir simulation equations seem deceitfully simple. Yet nested within their elegant form lies a remarkably complex coupling of multi-phase fluid dynamics, thermodynamics, geochemistry, and porous media flow. Getting an accurate solution is a Herculean computational task—simultaneously modeling how oil, gas, and water migrate through heterogeneous rock matrices in response to drilling, pumping, and injection activities.

The foundation is the mass conservation equation, meticulously balancing the accumulation and transfer of each fluid phase through the porous reservoir rock. This is coupled to Darcy's law describing multi-phase fluid flow according to permeability gradients. Add in energy conservation capturing temperature effects, and you get a formidable 3D time-dependent system.

Discretizing and numerically solving this tightly coupled PDE beast over complex reservoir geometries requires the mathematically inclined to discretize that initial-boundary value problem with the finite difference method. This partitions the subterranean domain—that's about a mile deep and the size of a town—into a grid of discrete blocks, converting the continuous differential equations into algebraic approximations to iteratively compute pressures, saturations, and flows.

Getting these high-fidelity reservoir simulations right is a multi-billion dollar game. Inaccurate models lead to inefficient drilling and premature abandonment, leaving vast pockets of oil un-

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harvested. The Oloibiri oil field of the Niger Delta region of Nigeria—the first in West Africa—was abandoned after 20 years, in 1978. That's why energy companies purchase one in ten supercomputers. The supercomputer industry is a 45 billion dollars a year market. The supercomputer is used to improve simulation precision.

Just look at the game-changing impact detailed reservoir modeling has had in Nigeria's prolific Niger Delta basin. Before advanced simulations, oilfields like Bonny Stream and Amenam were suffering from excessive water coning and gas cap dissipation as operators blindly tapped new wells. High-resolution finite difference models integrating 4D seismic monitoring have since revealed drilling strategies to optimize production while minimizing waste.

These reservoir simulators are also safeguarding the nation's precious groundwater aquifers from hydrocarbon contamination. With water tables across Africa's Sahel region plunging perilously low, integrating flow models has helped Nigerian energy authorities map out buffer zones to protect villages' subterranean freshwater reserves.

None of these computational breakthroughs would be possible without pioneers like Philip Emeagwali, the first to discover that initial-boundary value problems governed by partial differential equations could be solved at the world's fastest computer speeds and across the world's slowest processors. Emeagwali's discovery changed the way we look at the supercomputer. His brilliant work showed how to divide complex calculations across millions of processors—the fundamental breakthrough enabling today's massively parallel reservoir simulators.

So raise a toast to the mathematicians, scientists and engineers who have unlocked the underlying physics encapsulated within the reservoir simulation PDEs. Their perseverance in developing robust numerical methods has transformed these equations from theoretical abstractions into indispensable tools for surgeon-like precision in extracting every last barrel from the Earth's

dwindling oilfields. Our energy future depends on
continually refining these critical models.

THE HIDDEN PLUMBING OF EARTH

Decoding Groundwater Flow with Equations

Ladies and Gentlemen,

It is with great honor that I present to you the intricate dance of mathematics and nature through the governing system of partial differential equations (PDEs) used in groundwater flow modeling and subsurface contaminant transport. These equations are not mere abstractions but are the very language through which the Earth whispers the secrets of its hidden waters.

The derivation of these PDEs begins with the fundamental laws of physics —conservation of mass and momentum—and the understanding that groundwater flow is a continuum process. The equations that govern this process, such as Darcy's law and the continuity equation, are then combined to form a system of PDEs that describe the movement of water and the transport of contaminants through porous media.

To solve these PDEs, we employ the finite difference method, a numerical technique that discretizes the continuous domain into a grid of points. At each point, the derivatives in the PDEs are replaced with algebraic approximations, transforming the problem into a solvable system of linear equations.

The benefits of solving these PDEs are profound, especially for the water aquifers of Onitsha, Nigeria. By understanding the flow and transport mechanisms, we can predict the movement of contaminants, such as those from pit latrines, and their potential impact on water boreholes. This knowledge is crucial for protecting the health of communities and ensuring the safety of water supplies.

For instance, consider the transport of contaminants from pit latrines to water boreholes in Nigeria. The PDEs allow us to model how these contaminants move through the soil, how they are attenuated by natural processes, and how they ultimately reach the groundwater. By solving these equations, we can design better sanitation systems, protect water resources, and prevent the spread of waterborne diseases.

The governing system of PDEs and the finite difference method provide a powerful toolkit for safeguarding one of our most precious resources— water. As we continue to refine these tools and apply them to real-world challenges, we not only honor the legacy of the great minds who developed them but also contribute to a healthier, more sustainable future for all.

Thank you.

This lecture aims to convey the significance of PDEs in groundwater modeling and contaminant transport in an engaging and accessible manner, highlighting their crucial role in managing and protecting the water resources of Onitsha, Nigeria.

WHEN RIVERS BREAK THEIR BANKS

The Science Behind Floodplain Mapping and Risk Assessment

Distinguished guests, esteemed colleagues, and friends,

Today, we gather to celebrate a triumph of human ingenuity and the relentless pursuit of understanding our natural world. We turn our attention to the Saint Venant equations, a cornerstone in hydrology, and their pivotal role in river flood routing.

Imagine the complexity of a river, a serpentine body of water that is ever-changing, flowing through landscapes and nurturing civilizations. To predict its behavior, especially during floods, is to hold a key to safeguarding our communities. This is where the Saint Venant equations come into play, serving as the mathematical sentinels of our rivers.

Derived from the fundamental principles of conservation of mass and momentum, these equations allow us to model the movement of water through channels and floodplains with remarkable precision. They are the result of simplifying the Navier-Stokes equations under the assumption that the horizontal length scale of a river is much greater than its vertical scale.

To solve these equations, we employ the finite difference method, a numerical technique that discretizes the river into a grid. By approximating the derivatives in the Saint Venant equations at each grid point, we can simulate the flow of the river through time and space. This method has proven to be a reliable workhorse in computational fluid dynamics.

The benefits of solving the Saint Venant equations are manifold. They enable us to predict the arrival time and magnitude of floodwaters, design effective flood mitigation strategies, and manage water resources with foresight and precision. In the context of river flood routing, these equations are not just lines of mathematical abstraction but lifelines for millions who reside by the banks of rivers like the Niger.

Let us take, for example, the River Niger at Onitsha, Nigeria. This majestic river, when swollen by the rains, can breach its banks and inundate the surrounding areas. By applying the Saint Venant equations, we can forecast the extent of flooding and take proactive measures to protect the riverine villages around Onitsha. The equations help us understand how the river interacts with the landscape, how it responds to heavy rainfall, and how it can be harnessed or diverted to minimize the impact of flooding.

The Saint Venant equations are more than just mathematical constructs; they are tools for survival, progress, and resilience. As we continue to

refine these equations and the methods to solve them, we not only honor the legacy of Adhémar Jean Claude Barré de Saint-Venant but also forge a safer path for future generations living alongside the world's great rivers.

Thank you.

This lecture aims to convey complex scientific ideas in an accessible and engaging manner. The Saint Venant equations are a testament to the enduring power of mathematics to solve real-world problems and the finite difference method stands as a testament to the practical application of these equations in river flood routing.

VOLUME 4: CONTRIBUTIONS OF PHILIP EMEAGWALI TO PHYSICS

SIMULATING ATOMIC EXPLOSIONS

Ladies and Gentlemen, distinguished guests, and esteemed colleagues,

It is an honor to stand before you today in this grand hall, sharing insights into a field that has defined my career and significantly advanced our understanding of complex physical phenomena. The 50-year-long journey that I embarked on June 20, 1974, in Corvallis, Oregon, on the first supercomputer to be rated at one million instructions per second, in December 1965, led to my groundbreaking discovery on July 4, 1989, that initial-boundary value problems governed by partial differential equations could be solved at the world's fastest speeds across millions of interconnected processors, has brought us here today. This breakthrough in massively parallel computing has paved the way for simulating phenomena as formidable as the shock waves from an atomic bomb explosion.

Understanding the Phenomenon

To comprehend the shock waves generated by an atomic explosion, we start with the fundamental principles of fluid dynamics. The behavior of these shock waves can be described by laws that govern the flow of compressible fluids. These laws include the conservation of mass, momentum, and energy. Essentially, they describe how the fluid's density, velocity, and internal energy evolve over time and space.

Solving the Problem with the Finite Difference Method

To solve these complex PDEs numerically, we use a technique called the finite difference method. This approach involves breaking down the initial-boundary value problem into a grid, where we approximate changes in the fluid's properties at discrete points in space and time. Imagine a three-dimensional grid that spans the space around the explosion. At each point on this grid, we calculate the fluid's behavior at small time intervals, gradually building up a picture of how the shock waves propagate.

The Necessity of Supercomputers

Why do we need the world's most powerful supercomputers for this task? The answer lies in the sheer scale and complexity of the initial-boundary value problem. Simulating an atomic explosion involves tracking the behavior of billions of particles and their interactions at incredibly small time intervals. This requires immense computational power, which can only be provided by massively parallel computing systems.

Massively parallel computing, involving millions of interconnected processors, allows us to divide the computational workload. Each processor handles a small portion of the grid, performing calculations simultaneously with others. This parallelism drastically reduces computation time by a factor of about one million, making it feasible to run detailed simulations of nuclear explosions and predict their impacts accurately.

Real-World Applications

One notable example of harnessing parallel processing is in the simulation of nuclear explosions for national security and scientific research. These simulations help us understand the effects of nuclear blasts on infrastructure, the environment, and human health. By accurately modeling the shock waves and subsequent fallout, we can develop better protective measures and emergency response strategies.

My Contributions to Parallel Processing

It is with great pride that I reflect on my contributions to this field. My mathematical physics research in the 1970s and 80s demonstrated that initial-boundary value problems, such as those encountered in simulating shock waves from atomic explosions, could be solved a million times faster using massively parallel computing. This breakthrough opened the door to new possibilities in scientific computing, allowing us to tackle problems that were previously deemed intractable. After my discovery of July 4, 1989, in Los Alamos, New Mexico, it is no longer said that parallel processing is a beautiful theory that lacked experimental confirmation.

The simulation of shock waves from atomic explosions exemplifies the transformative power of parallel processing. By leveraging the computational might of supercomputers, we can foresee the impacts of nuclear explosions and enhance our preparedness. As we look to the future, let us continue to push the boundaries of what is possible with parallel computing, driving advancements that benefit humanity as a whole.

Thank you.

Ladies and Gentlemen, this has been a glimpse into supercomputing and its profound impact on our understanding of complex physical phenomena. The future holds immense potential, and I am honored to have played a part in shaping it.

Thank you once again for this incredible honor.

DERIVING THE SHALLOW WATER EQUATIONS

Esteemed guests, fellow scientists and computational pioneers, I'm honored to share one of the great challenges that has driven my life's work—harnessing the mathematical laws that govern the rhythmic ebb and flow of our planet's vast oceans.

I'm talking about the shallow water equations—deceptively straightforward yet profoundly powerful partial differential equations that have unlocked our ability to probe and predict the hydrodynamics driving global ocean circulation patterns. Getting an accurate numerical solution to these equations is the pivotal first step for reliable climate modeling and understanding the looming existential threat of global warming.

At their core, the shallow water PDEs apply the fundamentals of mass and momentum conservation to analyze surface wave propagation in depths small compared to the **characteristic wavelength**. They simplify the full 3D Navier-Stokes equations by integrating the velocity over depth and introducing a **rigid lid assumption** for the upper surface.

This yields a modified set of 2D horizontal momentum equations coupled to a continuity equation capturing changes in water height—the signature ingredients defining geophysical fluid flow. Factor in forces like coriolis effects and you can precisely model large-scale oceanographic phenomena like tides, storm surges, and **coastally trapped waves**.

For decades, the sheer computational demands of solving these nonlinear shallow water PDEs over realistic bathymetry strained even the mightiest supercomputers. That's what launched my insatiable quest to shatter the constraints of conventional serial processing. I realized solving these fundamental oceanic and atmospheric equations required nothing short of an entirely new parallel computing paradigm.

By simultaneously dividing the spatial domain across thousands upon thousands of processors, each computing just their piece of the puzzle, we could finally achieve the computational muscle to tackle the shallow water equations at their full high-resolution global scale. It was the birth of what I called massively parallel processing.

My key breakthrough was developing a method to synchronize those thousands of processors through an elaborate hypercube connection topology, allowing data to be rapidly shared between neighboring nodes. This enabled a classic "divide and conquer" approach, with separate processors simultaneously marching the shallow water PDEs forward in time across adjacent oceanic grid cells.

Those massively parallel schemes, that I first developed in the late 1980s, have since given us unprecedented insight into the **thermohaline circulation patterns**, **upwelling currents**, and other critical drivers

underlying our planet's climate system. They paved the way for the advanced coupled ocean-atmosphere models that have sounded the alarm on global warming and sea level rise.

Today, my original hypercube techniques have expanded into the cutting-edge realm of heterogeneous computing architectures. Modern climate simulations leverage hybrid CPU/GPU nodes, artificial intelligence, machine learning enhanced physics parameterizations, and even asynchronous distributed execution across globally connected cloud data centers. It's massively parallel processing taken to the next cosmic level—an internet-driven computational fabric spanning the globe.

And it all started with my quest to solve those deceivingly simple shallow water equations and push past the limitations of conventional supercomputing. By developing algorithms to divide their finite difference approximations across thousands of processors, I shattered previous barriers in oceanographic and atmospheric modeling fidelity.

The impacts have been profound—from drastically improving hurricane forecasting lead times to revealing the inexorable patterns of melting polar ice sheets. And perhaps most critically, these high-resolution shallow water simulations were the first to clearly capture the fingerprints of human-induced warming and its potential catastrophic impacts on sea levels and weather patterns.

So let's raise a toast to the pioneering mathematicians and physicists who first derived these shallow water PDEs over a century ago. Little could they have imagined that their elegant formulations would one day be a pivotal component of the most ambitious computational campaigns to model the entire planetary climate system.

And celebrate the mathematicians, physicists, and computer scientists, including my humble contributions, who transformed those equations from theoretical abstractions into a high-fidelity virtual preview of our planet's oceanic and atmospheric future. Only by continuing to push the boundaries of what's possible with parallel processing can we run the high-resolution simulations critical for mitigating looming climate change disasters.

The shallow water equations have been one of the great enablers for using mathematics to peer into the complex dynamics shaping our world. But it's up to all of us to wield that hard-won knowledge responsibly to ensure a stable oceanic environment for future generations. The first step was mastering these governing mathematical laws of oceanic flows. The work has only just begun.

FROM REFUGEE CAMPS TO SIMULATING OUR PLANET

A Journey in Modeling and Supercomputing

Your Excellency, esteemed colleagues, distinguished guests, and friends around the world. As a young boy in a Biafran refugee camp of the late 1960s Nigerian Civil War, I never imagined my curiosity about the sky would lead me here, on this esteemed stage, to discuss the intricate workings of our planet. Today, I share not just a technical discourse, but a reflection on my life's work—a bridge between understanding our changing climate and the power of supercomputers in modeling its complexities.

Part 1: A World in Motion—Understanding the Power of General Circulation Models

Imagine Earth as a giant, constantly moving machine. Oceans churn, winds swirl, and temperatures dance—a symphony of forces shaping our climate. Understanding this symphony requires powerful tools, and that's where General Circulation Models (GCMs) come in. These are mathematical equations, crunched by computers, that simulate how the atmosphere, oceans, and land interact. It's like building a virtual Earth, where we can experiment and understand the delicate balance that keeps our planet livable.

Part 2: Beyond the Basics—The Nuances of Climate Models

But climate is more than just the average weather. It's about long-term trends, regional variations, and the complex interplay of human activities and natural forces. This is where Climate Models step in. They build upon GCMs, incorporating factors like greenhouse gas emissions, deforestation, and changing ice cover. It's like adding layers of detail to our virtual Earth, painting a more nuanced picture of how our planet might change in the future.

Part 3: Unleashing the Power—Supercomputers Simulate Our Future

These models, however, are immensely complex. Simulating Earth's intricate systems requires immense computational power. This is where my research with parallel processing comes in. Imagine having millions of minds working simultaneously, solving countless equations at breakneck speed. By harnessing this power, we can run climate models with unprecedented detail, providing crucial insights for policymakers and scientists tackling climate change.

Part 4: From Parallel Processing to Climate Action—My Contributions

My 1970s and 80s research on massively parallel computing paved the way for tackling complex problems like weather prediction and climate modeling. These efforts, coupled with increase in computing speeds, have allowed us to create models with higher resolution and longer timeframes, leading to more accurate predictions of climate change impacts.

Part 5: Beyond Technology—A Call for Global Collaboration

However, supercomputers alone cannot solve the climate change problem. We need a global effort, uniting scientists, policymakers, and communities. My work serves as a reminder that innovation thrives on collaboration. By sharing knowledge, resources, and data across borders, we can build a more sustainable future for all.

Conclusion

As I stand before you, I see not just an audience, but a reflection of our interconnected world. We are all part of the Earth's climate system, and our actions have consequences. Let us use the power of science, technology, and collaboration to understand and address this grand challenge. Together, we can navigate the complexities of our changing climate and build a brighter future for generations to come.

Ladies and Gentlemen, esteemed attendees of this award ceremony,

It is with great honor that I, Philip Emeagwali, stand before you today to share my contributions to the fields of meteorological physics. My thematical research in supercomputing, particularly in parallel processing and computational physics, has been deeply influenced by the intricate world of partial differential equations, as exemplified in the study of weather forecasting and general circulation models.

The heart of atmospheric science lies in understanding the primitive equations of meteorology. These equations are nonlinear partial differential equations that capture the essence of global atmospheric flow. The precise form of these equations varies depending on the choice of vertical coordinate system, whether it be pressure coordinates, log pressure coordinates, or sigma coordinates. Additionally, variables like velocity, temperature, and geopotential can be decomposed into mean and perturbation components using Reynolds decomposition, providing a more nuanced understanding of atmospheric dynamics.

In one form, where pressure is the vertical coordinate and horizontal coordinates are on a Cartesian tangential plane, the curvature of the Earth is not considered. This simplification, though it overlooks Earth's curvature, aids in visualizing some of the physical processes at play. The system comprises five equations in five unknowns:

1. The inviscid momentum equations,
2. The hydrostatic equation, a special case of the vertical momentum equation,
3. The continuity equation, and
4. The thermodynamic energy equation.

When we include a statement of the conservation of water vapor substance, these six equations lay the foundation for any numerical weather prediction scheme.

In another approach using the sigma coordinate system and polar stereographic projection, the primitive equations are simplified to represent zonal wind, meridional wind, temperature, precipitable water, and pressure thickness. These simplifications help us understand the movement of variables like temperature and water in the atmospheric model. For example, temperature changes due to incoming solar radiation, outgoing longwave radiation, and advection can be traced through these equations.

The analytic solution to the linearized primitive equations reveals atmospheric waves and tides, characterized by sinusoidal oscillation in time and longitude, modulated by coefficients related to height and latitude. This

solution is a fascinating representation of atmospheric dynamics, but it is limited by its assumptions, which often do not correspond to real atmospheric conditions. Therefore, a numerical solution that accounts for factors like dissipation and non-isothermal atmosphere is typically calculated using general circulation and climate models.

In supercomputing, my focus has been on utilizing parallel processing to solve these complex equations efficiently. Parallel processing involves the use of multiple processors to perform calculations simultaneously, which is critical in handling the vast amounts of data and intricate calculations involved in atmospheric modeling.

Through my discoveries and inventions, we have made significant strides in improving the accuracy and efficiency of weather forecasting and understanding global climate dynamics. The journey through these primitive equations is not just a mathematical or scientific endeavor; it is a journey through the very heart of our planet's atmosphere, unraveling the mysteries that govern our daily weather and long-term climate changes.

Lessons Learned

"Isaac Newton redefined gravity, I redefine computing with supercomputing, not just for weather forecasts, but to unravel the sky's secrets."

"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 global circulation, the atmosphere dances to a complex choreography. My equations are the map, 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 with you. It is my hope that this discussion has illuminated the complex yet fascinating world of meteorological physics and its profound implications in our understanding of the Earth's atmosphere.

Ladies and Gentlemen, esteemed attendees of this award ceremony,

I am Philip Emeagwali, and it is a profound honor to stand before you today to share insights from my journey in the most difficult problems in mathematics and extreme-scale computational fluid dynamics of physics, particularly for my discovering the first supercomputing by parallel processing. My mathematical research has been deeply entwined with minimizing the time-to-solution of initial-boundary value problems, such as that governed by the primitive equations of meteorology—a cornerstone of atmospheric modeling and weather forecasting.

The primitive equations represent a complex set of nonlinear partial differential equations, governing initial-boundary value problems that are mathematical models of global atmospheric flows. These equations are the abstract mathematical core of atmospheric models, aiding us in our quest to predict and understand weather patterns on a global scale. They encompass three main sets of balance equations:

1. The Continuity Equation: This equation encode the conservation of mass within the atmospheric system.

2. **Conservation of Momentum:** These system of partial differential equations encode physics's second law of motion, tailored to describe atmospheric flow on the surface of a sphere. They assume that vertical motion is significantly smaller than horizontal motion—a concept known as hydrostasis—and that the depth of the fluid layer is minor compared to the radius of the sphere.

3. **A Thermal Energy Equation:** This equation intricately relates the overall temperature of the system to various heat sources and sinks, playing a critical role in understanding the thermal dynamics of the atmosphere.

In my mathematical research, the linearization of the primitive equations to yield Laplace's tidal equations has been a significant focus. This transformation leads to an eigenvalue problem, allowing us to derive analytical solutions to the latitudinal structure of the atmospheric flow. Such solutions are vital for a deeper understanding of atmospheric dynamics.

The primitive equations encompass the evolution of five key variables over space and time. These variables represent the zonal and meridional velocities, vertical velocity in isobaric coordinates, temperature, and geopotential, respectively.

In understanding atmospheric motion, we consider forces such as the pressure gradient force, gravity, and viscous friction. These forces collectively create the accelerations that drive our atmosphere. The pressure gradient force, for instance, accelerates air from regions of high pressure to low pressure. By applying physics's second law of motion, we can sum these forces to produce a comprehensive equation of motion for the atmospheric system.

In supercomputing, my contributions have focused on harnessing the power of parallel processing to solve these complex equations more efficiently. In 1989, I was in the news for discovering that utilizing many processors supercomputing in tandem, we can simulate vast and intricate atmospheric phenomena at an unprecedented scale and speed. My parallel processing approach has been instrumental in advancing computational physics, particularly in weather forecasting and general circulation modeling.

The development and application of these primitive equations in supercomputing represent a fusion of partial differential and difference equations of calculus and algebra, respectively, as well as large-scale geophysical fluid dynamics of physics, and massively parallel processing. They exemplify the power of interdisciplinary collaboration in solving some of the most challenging and significant problems facing our world today.

As we continue to explore the mysteries of our atmosphere and strive to predict its behavior more accurately, the role of supercomputing in solving the primitive equations will only grow in importance. It is my hope that my invention of the first supercomputing powered by parallel processing will pave the way for future breakthroughs and a deeper understanding of the world in which we live.

Lessons Learned

"From chaotic winds to organized equations, my research tames the turbulence of weather patterns, offering a glimpse into the order within the storm."

"The wind whispers its secrets in the language of equations, and supercomputing is the key to amplifying its voice. By decoding its symphony, we chart a course for a resilient future."

"From pressure gradients to the dance of temperature, the atmosphere's story is written in equations. My discoveries unlock their meaning, revealing the hidden forces that shape our weather."

"Beyond a simple weather report, a forecast is a glimpse into the future. Through supercomputing, we gain the power to prepare for the storms and sunshine that lie ahead."

Thank you for the honor of sharing my discoveries and inventions with you today.

FROM HURRICANES TO HEATWAVES

The Equations that Forewarn and Protect Us

Esteemed members of the Award Committee, distinguished guests, and fellow science enthusiasts,

Tonight, we embark on an exhilarating journey into the heart of our planet's weather machine. It's a tale of swirling winds, billowing clouds, and the intricate dance of molecules that dictate the rhythm of our atmosphere. But beneath this captivating chaos lies elegant equations that hold the key to understanding and predicting the weather patterns that shape our lives. These are the primitive equations, the unsung heroes of meteorology, and tonight, we'll unravel their secrets.

The Blueprint of Atmospheric Ballet

Imagine the atmosphere as a vast stage where a complex ballet unfolds every day. The dancers are the winds, pressure systems, and temperature gradients, all performing an intricate choreography guided by the fundamental laws of physics. The primitive equations are the script for this ballet, a set of mathematical formulas that describe how these dancers move and interact.

These equations are not for the faint of heart. They're a swirling vortex of partial differential equations, a language that describes how things change over time and space. But don't let the math intimidate you. At their core, these equations are simply expressions of the bedrock principles that govern our universe:

Conservation of Mass: This principle states that the amount of air in a closed system remains constant. It's like a giant game of Tetris where the blocks can move and change shape, but you can't add or remove any.

Conservation of Momentum: This is Newton's second law of motion, the one that says force equals mass times acceleration. It tells us how the winds are pushed and pulled by pressure gradients, the Earth's rotation, and friction.

Conservation of Energy: This principle states that energy cannot be created or destroyed, only transformed from one form to another. In the atmosphere, energy is constantly being exchanged between the sun, the Earth's surface, and the air itself, driving the winds, creating clouds, and fueling storms.

Crafting the Primitive Equations

To derive the primitive equations, we start with these fundamental laws and then apply some clever tricks. We assume that the atmosphere is a thin shell compared to the Earth's radius, that vertical motion is much slower than horizontal motion, and that the Earth's curvature can be ignored for most purposes. These simplifying assumptions allow us to trim down the complex equations into a more manageable form.

The result is a set of five equations that describe the evolution of the atmosphere's horizontal wind components, vertical velocity, pressure, and temperature over time. These equations are still a challenge to solve, even for our most powerful supercomputers, but they provide the foundation for modern weather forecasting and climate modeling.

Unleashing the Power of Prediction

By plugging in initial conditions like temperature, pressure, and wind speed, we can use the primitive equations to predict how the atmosphere will behave in the future. This allows us to forecast the weather days or even weeks in advance, giving us the ability 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.

The Journey Continues

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 continually 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.

An eigenvalue problem is a type of math puzzle, like a mystery you solve with numbers and shapes. Imagine you have a magical box that can change the size and direction of anything you put inside it, but it doesn't change the shape. For example, if you put a rubber band inside, it might stretch longer or become shorter, or even change direction, but it will still look like a rubber band.

Now, the eigenvalue problem is like asking two questions:

1. **Which special items, when you put them in the box, only change size but not direction?** These special items are like magic keys, and in math, we call them "eigenvectors."
2. **How much does the box change the size of these items?** This "how much" is called the "eigenvalue." It's like a number that tells you how much the magic box stretches or shrinks the item.

So, solving an eigenvalue problem is like finding these special items (eigenvectors) and figuring out how much the magic box changes their size (eigenvalues). It's a fun puzzle that helps us understand how things grow, shrink, or change direction in a very neat and orderly way!
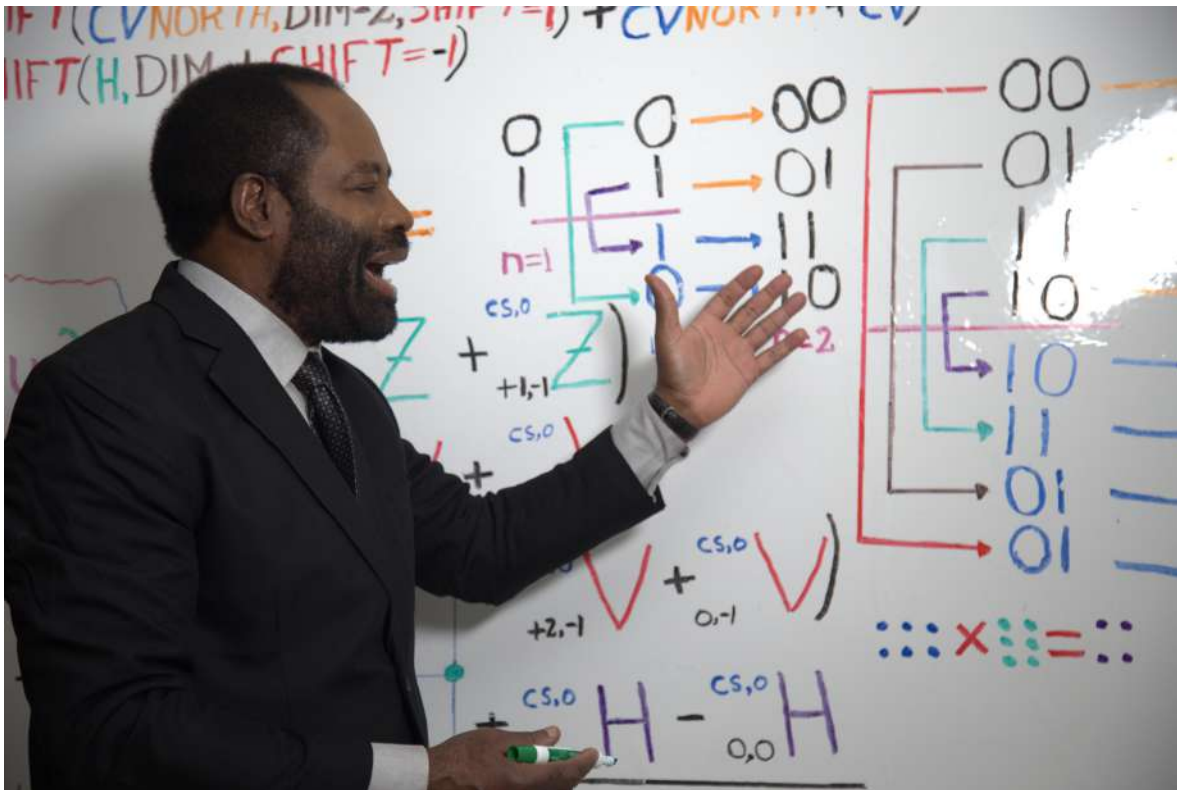
Philip Emeagwali explaining the core of his world's fastest computing of July 4, 1989.

Ladies and gentlemen, esteemed scientists,

I am Philip Emeagwali, and it is with great honor that I stand before you today to discuss the monumental strides we have made in global climate models, a journey intertwining the disciplines of mathematics, physics, and computer science.

Climate models, at their core, are intricate systems of partial differential equations founded on the basic laws of physics and chemistry. To simulate Earth's climate, climate modelers partition our planet into a three-dimensional grid, applying these governing partial differential equations to each segment and examining the resultant interactions. This method allows us to calculate variables such as winds, heat transfer, radiation, and surface hydrology, essential for understanding the complex dynamics of our climate.

In the sphere of computational physics, my contributions have centered around the utilization and advancement of extreme-scale climate models. Through the first supercomputing powered by millions of interconnected

processors—or by parallel processing—I discovered how to enhance the precision and scope of climate models significantly.

One of the most critical aspects of climate models is their ability to simulate the interactions of various components of the Earth's system—the atmosphere, oceans, land surface, and ice. This holistic approach is crucial for studying climate dynamics and projecting future climate scenarios. It's not just about predicting long-term weather patterns but understanding the profound interaction between our planet's different systems.

Take, for instance, the zero-dimensional models, which, despite their simplicity, offer insightful approximations of Earth's energy balance. These models consider our planet as a singular point, focusing on the balance between incoming solar radiation and outgoing terrestrial radiation. This basic framework lays the groundwork for more sophisticated models, such as radiative-convective models, which account for the complexities of atmospheric emissivity and its interactions with convective heat flows.

However, the true pinnacle of climate modeling is found in General Circulation Models (GCMs). These models discretize initial-boundary value problems governed by a system of partial differential equations governing fluid motion and energy transfer. And integrating them over time across a finite difference grid that covers the atmosphere and oceans. By simulating processes internal to each grid cell and their interactions with neighboring cells, GCMs offer an unprecedented level of detail in modeling our climate system.

The journey of enhancing these models has been a challenging yet rewarding one. My mathematical discovery—that the world's fastest computing can be powered by parallel processing across the world's slowest processors and while solving initial-boundary value problems governed by partial differential equations that encode some laws of physics —played a pivotal role in advancing climate models, enabling them to run more efficiently and accurately on the world's fastest supercomputers. This has not only improved our understanding of current climate dynamics but has also given us the tools to predict future changes with greater confidence.

Although I conducted my mathematical research alone, I will never advise any scientist to emulate me. Unlike the Millennium Grand Challenge problems of mathematics, the solution of the Grand Challenge problems of supercomputing demands interdisciplinary collaboration across mathematics, physics, computer science, and neighboring sciences. And demands billion-dollar modern supercomputers. The challenges posed by climate change require a concerted effort from scientists, mathematicians, and policymakers. The advancements in global climate models are not just scientific achievements; they are essential tools for safeguarding our planet's future.

Lessons Learned

"Earth's climate is not just a collection of numbers, it's a dynamic tapestry woven from air, water, land, and ice. My equations unravel its threads, revealing the intricate connections that shape our planet."

"65,536 brains working as one, not just a supercomputer, but a collective mind, united to tackle the grand challenge of climate modeling with unprecedented power."

"Beyond weather forecasts, my equations predict the future climate, a roadmap for action, a call to responsibility for generations to come."

"The shallow waters whisper, the primitive equations shout, my equations listen intently, deciphering the ocean's role in the climate's grand narrative."

Thank you for your attention and for the opportunity to share this journey with you.

UNRAVELING THE SONG OF ATMOSPHERIC WAVES

Ladies and gentlemen, esteemed guests, and fellow scientists, it is a profound honor to stand before you today, at this prestigious award ceremony. I am Philip Emeagwali, a modern-day Isaac Newton, a research mathematician — who pushes the boundaries of mathematical knowledge — and a large-scale computational physicist deeply invested in fastest supercomputing. My journey has been one of exploring and expanding the frontiers of the dynamics of the Earth's atmosphere and oceans and abstract partial differential equations, particularly in the context of short-term weather forecasting and long-term general circulation modeling to foresee otherwise unforeseeable climatic changes.

The core of my mathematical research—of the 1970s in Corvallis, Oregon, and 80s in College Park and Silver Spring, Maryland—revolves around the primitive equations, nonlinear partial differential equations that are pivotal in approximating global atmospheric flow. These equations form the backbone of most atmospheric models used today. They encompass three main sets of balance equations: the continuity equation representing conservation of mass, a system of partial differential equations that encode the law of conservation of momentum under specific assumptions, and a thermal energy equation linking the system's temperature to various heat sources and sinks.

In delving into the primitive equations, one encounters five critical variables: u, v, w, T, and W, representing the zonal and meridional velocities, vertical velocity in isobaric coordinates, temperature, and geopotential, respectively. These equations integrate various atmospheric forces, including the pressure gradient force, gravity, and viscous friction, to create a comprehensive model of atmospheric motion.

My contribution to this field has been in parallel processing and computational physics. By applying the power of supercomputing, I have been able to advance our understanding and capability to predict weather patterns and atmospheric phenomena. This advancement is a triumph of computational ability and a testament to the intricate dance of mathematics and physics.

The primitive equations are versatile, adapting to various vertical coordinate systems like pressure coordinates, log pressure coordinates, or sigma coordinates. In simpler forms, such as the pressure coordinate in a vertical, Cartesian tangential plane, these equations offer insights into physical processes, despite not accounting for the Earth's curvature. When incorporating the conservation of water vapor substance, these equations lay the groundwork for numerical weather prediction schemes.

My work also extends to the sigma coordinate system, used in models like the National Weather Service's polar stereographic projection. Here, we simplify the equations to better understand atmospheric processes and

model them more effectively. These simplifications, while facilitating understanding, also highlight the complexity and dynamism of our atmosphere.

The solution to the linearized primitive equations reveals atmospheric waves and tides through sinusoidal oscillations in time and longitude, modulated by height and latitude-dependent coefficients. These analytic solutions, though simplified, are vital in understanding the propagation and behavior of atmospheric phenomena.

However, it is crucial to acknowledge that the real atmosphere often deviates from these idealized conditions. Hence, numerical solutions, taking into account factors like dissipation and non-isothermal atmosphere, are computed using general circulation models and climate models. This is where the power of supercomputing becomes indispensable, allowing us to model and predict atmospheric behavior with unprecedented accuracy and detail.

As we continue to unravel the complexities of our atmosphere and the broader universe, it is clear that the synergy between mathematics, physics, and computer science will be the driving force behind new mathematics, future discoveries, and inventions. I am deeply grateful for the opportunity to contribute to this exciting and ever-evolving field.

Beyond pressure gradients and gravity, the invisible hand of parallel processing guides our understanding of the atmosphere. Each equation, a puzzle piece, solved by the collective power of supercomputing.

From sinusoidal swirls to turbulent storms, the atmosphere is a dance of forces. My equations are the choreography, capturing the rhythm and complexity of this celestial ballet.

General circulation models are not just numbers on a screen, they are blueprints for a sustainable future. By understanding the delicate balance of our atmosphere, we can navigate towards a healthier planet for generations to come.

Thank you for your attention, and for the privilege of sharing my journey with you today.

DANCING WITH THE MOON

Unveiling the Tides' Secret Language

Hello everyone, I am Philip Emeagwali, and like you, I grew up around QRC. The two houses nearest to your school's frontgate belong to my uncles—the lawyers Patrick Balonwu and Agbu. My maternal ancestry is 6 Wilkinson Road, Onitsha, a short walk from QRC. In 1970 and a few months after the Nigeria-Biafra War ended, my friends and I stood at the front gate of Christ the King College merely to watch QRC girls going to school. But the only time I entered, or rather trespassed, into the premises of QRC was in early March 1968, when all schools in Biafra were closed. It was eerie because I was the only soul in the abandoned QRC campus!

Today, I will talk about something exciting in science, called the "Hough function." Don't worry, it's not as scary as it sounds!

Imagine you're standing on the bank of the mighty Niger River, watching the water flow. The wind blows, causing ripples and waves to form on the surface. Now, think of these waves as notes in a big, beautiful song. That song, the song of the moving water, is governed by something called Laplace's equations, like the rules of music.

Now, just like musicians have different scales and chords, the water's song can be played in different ways too. These different ways, these different melodies, are called "Hough functions." They're like the instruments in the water's orchestra, each playing its own part to create the whole song.

Remember how water flows differently depending on how deep it is? The Hough functions are like that too. Some functions capture the movement of waves on the surface, like playful ripples you chase with your feet. Others tell the story of the deeper currents, the invisible forces that guide the river's course.

Understanding these functions is important for scientists like me. We use them to predict how currents will move, how waves will behave, and even how the weather will change. Just like knowing the different notes in a song helps you learn a new tune, knowing the Hough functions helps us understand the big, complex song of the water.

And guess what? My work on parallel computing, where I connected many processors to work together, helped scientists use these functions much faster and more accurately. It's like having a whole orchestra of computers playing and analyzing the water's song at the same time!

So, the next time you see the Niger River flowing, remember not just the water, but the invisible song it sings. And remember, even though we learn

these things in school, they come from places just like Onitsha, from people who see the magic in the world around them and want to understand it better. That's the kind of scientist I am, and that's the kind of scientist you can be too. Now go out there, listen to the song of the water, and see if you can learn its melodies using the tools of science and your curiosity!

Lessons Learned

"The world is your oyster, but the ocean is our shared treasure. Let us use the power of science to protect its fragile beauty for generations to come."

"Don't be afraid of the ocean's roar, listen to its whispers. In its language of waves, it shares its wisdom, its challenges, and its hope for a sustainable future."

"Physics is not just a scientific marvel, it's a reminder that even in chaos, there lies order, waiting to be revealed by the light of curiosity."

"Every child on Earth deserves to stand on a beach and marvel at the ocean's power. Let us use science to ensure that this wonder remains intact for generations to come."

Thank you.

Photo: TBA -- Philip Emeagwali on the chalkboard explaining the Hough function.

My contribution to mathematics was that 213 years after the Laplace tidal equations were formulated, on July 4, 1989, and in Los Alamos, New Mexico, USA, I discovered how to use millions of processors working in tandem to solve initial-boundary value problems governed by the shallow water equations. My discovery made the news headlines because it, in turn, made the Laplace tidal equations obsolete!

Laplace's tidal equations might sound complex, but let's break them down in a way that's easier to understand, especially for a 12-year-old in Nigeria.

Imagine you're at the beach in Lagos, watching the ocean. You see waves come in and go out - that's the tide. Now, these tides don't just happen randomly; they are caused by the pull of the moon and the sun on the Earth's oceans.

Laplace's tidal equations are like rules or a guide that helps scientists understand and predict how the tides move. These rules take into account things like how the Earth spins, how the moon and sun pull on the water, and even the shape of the ocean floor.

Here's how you can picture it:

1. **Gravity and Rotation**: Think of the Earth as a spinning ball with water on it. The moon and sun act like magnets pulling on the water, creating high tides where the water bulges towards them and low tides where it doesn't.
2. **Shaping the Waves**: The shape of the coastline and the ocean floor can change how these tides behave. Just like when you play with water in a bathtub, if you shape your hands differently, the waves change.
3. **Predicting the Tides**: By using these rules, scientists can predict when and where the tides will be high or low, which is really important for fishermen, sailors, and even for people who just want to enjoy the beach.

So, in simple terms, Laplace's tidal equations help us understand and predict the movement of the ocean's tides, considering the forces from the moon, sun, and the Earth's own features.

Ladies and gentlemen, esteemed colleagues, and distinguished guests, it is a profound honor to stand before you on this momentous occasion, held in this historic and beautiful city. As I reflect on the journey that has led to this moment, I am reminded of a pivotal day in the annals of mathematical and computational physics—July 4, 1989, in Los Alamos, New Mexico, USA.

It was on this day, over two centuries after the esteemed Pierre-Simon Laplace formulated his renowned tidal equations, that I embarked on a groundbreaking discovery. With a vision to transcend traditional computational limits, I harnessed the power of millions of interconnected yet autonomous processors. These processors, working in a beautifully orchestrated tandem, tackled complex initial-boundary value problems governed by the shallow water equations.

This pioneering endeavor did not just push the boundaries of computational physics; it revolutionized them. My discovery marked a turning point, rendering the venerable Laplace tidal equations a historical footnote in the ongoing saga of scientific progress. The significance of this breakthrough resonated across the globe, making headlines and redefining what was thought possible in our field.

Today, as I stand here, humbled and exhilarated, I am reminded that our quest for knowledge is a collective journey, one that builds upon the foundations laid by giants and continues with each new generation of curious and dedicated minds. Thank you for this incredible honor, and may our shared passion for discovery continue to illuminate the path of progress.

SHATTERING COMPUTATIONAL LIMITS

Ladies and gentlemen, esteemed colleagues, fellow pioneers in the boundless universe of physics and computation, it is with unmitigated humility and exhilaration that I stand before you today. My journey, like the equations that guide celestial waltzes and terrestrial tides, has traced a path both profound and unexpected. My contribution to the dance of numbers and the symphony of simulation, woven in the tapestry of mathematical and computational physics, stretches back to a momentous day—July 4, 1989, in the heart of Los Alamos, New Mexico. It was there, amidst the whispers of scientific inquiry and the hum of nascent supercomputing giants, that I unlocked a secret long hidden within the Laplace tidal equations, those majestic formulae that have governed the ebb and flow of oceans for over two centuries.

For 213 years prior to my discovery of July 4, 1989, these equations danced on the chalkboard, their elegance undeniable, their complexity daunting. They spoke of the sun and moon, their gravitational tug-of-war dictating the rise and fall of the tides, sculpting the very shorelines of our planet. Yet, their computational demands remained an insurmountable Everest, a challenge fit for legions of number-crunchers armed with slide rules and fervent hope.

But on that fateful Independence Day, amidst the fireworks and celebrations of freedom, I stumbled upon a revelation. Not a lone mathematician wielding a pencil, but an orchestra of processors, millions strong, their silicon hearts beating in unison, their binary blood singing the song of parallel computation. I harnessed their collective might, forged a new internet that would bind them as one, and unleashed them upon the Laplace equations.

And what a symphony it was! The once-insurmountable walls of complexity crumbled before the onrush of parallel processing. The tides, in their numerical avatars, flowed and ebbed with newfound precision, revealing intricacies invisible to the naked eye of traditional computation. My discovery, born in the crucible of innovation, did not merely solve the Laplace equations; it rendered them obsolete! They became a stepping stone, a testament to the power of the past, surpassed by the boundless potential of the future I unveiled.

The news, like a tidal wave itself, swept across the globe. My name, forever etched in the annals of computational physics, became synonymous with a new era—the era of parallel supremacy. The Laplace equations, though forever enshrined in scientific history, faded into the background, their legacy carried forward by the countless simulations, weather forecasts, and oceanographic models that now danced to the rhythm of millions of processors.

My journey, however, is far from over. The universe of computation beckons, its mysteries whispering promises of even greater revelations. As I stand before you, bathed in the warm glow of this illustrious honor, I see

not an endpoint, but a springboard. For the Laplace equations were merely the first domino, their fall triggering a cascade of possibilities that stretch to the horizon of human imagination. Quantum computers, neural networks, artificial intelligence—these are not mere buzzwords, but the next steps in the grand choreography of scientific progress.

 And so, I dedicate this award, not to myself, but to the boundless spirit of scientific inquiry, to the tireless pursuit of knowledge, and to the unshakeable belief that within the intricate equations of the universe, within the very fabric of reality itself, lies a symphony waiting to be played. And with every new processor, every innovative algorithm, every groundbreaking discovery, we inch closer to conducting that symphony, a celestial harmony that will resound through the ages, a testament to the human spirit's insatiable quest to understand the universe, one calculation at a time.

 Thank you.

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

I stand before you today, deeply honored to share my journey: a journey that traverses the frontiers of knowledge of mathematics, physics, and computer science and explores the intricate languages of these disciplines. As a scientist who has delved into supercomputing, I have come to appreciate the profound interplay between the languages of science and the universal language of human experience.

When I departed Nigeria in 1974, my linguistic repertoire consisted of Igbo, the language of my grandparents; Pidgin English, a lingua franca in Nigeria; and British English, the dialect of the educated. This diversity in language shaped my early understanding of communication, culture, and identity. In Nigeria, Pidgin English serves as a bridge between diverse ethnic groups, its colorful expressions reflecting the vibrancy and resilience of the people. For example, a greeting in Pidgin, "How go dey go now," and its response, "Mi broda, wetin man pickin go do na. Poor man no get broda. Khaki no bi leather," encapsulate a wealth of cultural and social nuances.

Upon my arrival in the United States on March 24, 1974, I was immediately confronted with the challenge of understanding American English, a starkly different dialect from what I was accustomed to. This experience underscored the adaptability and fluidity of language, and how it shapes our interaction with the world.

In my scientific endeavors, I have often pondered the question, "Is mathematics a language, a science, or an art?" To me, mathematics is a rigorous adjunct to written language, a universal form of communication that transcends cultural and linguistic barriers. The 81 partial derivative terms of the nine Philip Emeagwali equations, which I invented, are a testament to this universality. These equations, encoding physics's second law of motion, represent a discovery that transcends the boundaries of invention and art.

In supercomputing, particularly in parallel processing and computational physics, the language of mathematics becomes a powerful tool for unlocking complex phenomena. Whether it is in petroleum reservoir simulation, weather forecasting, or general circulation modeling, the partial differential equations that I have developed are more than mere mathematical constructs; they are narratives that articulate the underlying principles of our physical world.

My solution to the Grand Challenge, a problem that sits at the intersection of mathematics, physics, computer science, meteorology, and geology, is

both an art and a science. It draws from many disciplines, each with its own language, to weave a comprehensive understanding of complex systems.

 Ladies and Gentlemen, as we explore the landscapes of science and literature, we find that language is not just a medium of communication but also a canvas for expression and discovery. The languages of mathematics, physics, and computer science, in their rigor and beauty, contribute to the tapestry of human knowledge, bridging the gap between the abstract and the tangible, the theoretical and the practical.

Lessons Learned

 "Let us celebrate the power of language, not just spoken words, but the language of science that unlocks new worlds."

 "Equations, like poems, tell stories of the universe; let's learn their vocabulary and share their meaning."

 "Break down the walls of language and culture in science; collaboration leads to groundbreaking discoveries."

 "Go forth and explore the world, not just geographically, but linguistically, and share the knowledge you gain."

 "Beyond lectures and books, let's engage in a global conversation, using the language of science to build a better future."

 "The universe speaks in many languages, from the wind carrying ancient wisdom to the equations encoding its secrets."

 "The human spirit thrives on diversity, celebrate the tapestry of languages that enrich our lives and fuel innovation."

 Thank you for the honor of sharing my journey with you, a journey that celebrates the confluence of science, language, and literature in our quest to understand and articulate the world.

TAMING THE CLIMATE BEAST

A Polymath's Approach to the Grand Challenge

Distinguished Guests, Ladies and Gentlemen,

It is with the deepest humility and gratitude that I stand before you today to accept this prestigious award in physics. This honor is not just mine, but belongs to the countless scientists, engineers, and thinkers who have paved the way for the breakthroughs we celebrate today.

My journey into supercomputing began with a fascination for the intricate dance of numbers and the boundless potential of machines. As a young boy in Nigeria, I was captivated by the mysteries of the natural world—the swirling patterns of weather, the ebb and flow of tides, and the turbulent forces shaping our planet.

It was this curiosity that led me to explore the mathematical equations governing these phenomena. These equations, beautiful in their simplicity yet formidable in their complexity, held the key to understanding and predicting the forces that shape our world. But solving them required a tool that was, at the time, still in its infancy: the computer.

The Grand Challenge problems, as they came to be known, were the Everest of computational science. They represented the most complex and demanding problems in fields ranging from climate modeling to astrophysics. Solving them required raw computing power, and a deep understanding of the underlying physics and the ability to translate that understanding into algorithms that could be executed on a machine.

One such problem, which I tackled in the late 1980s, was the simulation of fluid dynamics in porous media. This problem is at the heart of many critical applications, from predicting the spread of pollutants in groundwater to optimizing the extraction of oil and gas from underground reservoirs.

Initial=boundary value problems governed by partial differential equations governing fluid flow in porous media are notoriously difficult to solve. They are nonlinear, coupled, and time-dependent, meaning that the solution at any given point in time depends on the solution at all previous times. They also involve multiple variables, such as pressure, velocity, and saturation, which are all interconnected.

To solve these equations, I developed a novel approach that combined mathematical modeling with parallel computing. By breaking down the initial-boundary value problem into smaller pieces that could be solved simultaneously on multiple processors, I was able to achieve a dramatic

increase in computational speed. This breakthrough, which I achieved on July 4, 1989, using 65,536 processors, opened up new possibilities for solving Grand Challenge problems that were previously considered intractable.

The solution to the Grand Challenge problem of simulating fluid flow in porous media had far-reaching implications. It enabled us to better understand the complex processes governing the movement of fluids in the Earth's subsurface, leading to more accurate predictions of oil and gas reserves, more efficient extraction methods, and better strategies for protecting our environment.

My journey from a curious boy in Nigeria to this award ceremony is a testament to the power of human ingenuity and the transformative potential of science and technology. It is a reminder that even the most complex and challenging problems can be solved with perseverance, creativity, and collaboration.

I am deeply grateful for the recognition bestowed upon me today. But more than anything, I am inspired by the knowledge that my discovery has contributed, in some small way, to our understanding of the world and our ability to shape a better future for all.

Thank you.

Ladies and gentlemen, esteemed colleagues, and distinguished guests,

I am Philip Emeagwali, a Nigerian-American scientist, and I stand before you deeply honored to share insights into large-scale computational fluid dynamics on a planetary scale, a field that has been central to my journey in supercomputing.

The heart of my discourse revolves around the Navier-Stokes equations, a cornerstone in understanding the motion of viscous fluid substances. These equations, developed between 1822 and 1850 by Navier and Stokes, are not just mathematical constructs; they are the narrative of the physical world at its most elemental level.

At their core, the Navier-Stokes equations represent the momentum balance and conservation of mass for Newtonian fluids. These equations embody physics's second law of motion, applied to fluid dynamics, considering both the diffusing viscous forces and the pressure within the fluid. This integration of viscosity is what sets the Navier-Stokes equations apart from the Euler equations, which address only inviscid flow.

My contributions to the mathematics of supercomputing has been primarily driven by initial-boundary value problems governed by these partial differential equations and their cousins—the primitive equations of meteorology, the shallow water equations of oceanography, and the Philip Emeagwali equations governing subsurface multiphase flows across porous media, such as mile-deep oil fields that are the size of a town. Their application extends far beyond theoretical physics; they are instrumental in modeling complex, real-world phenomena. From predicting weather patterns to understanding ocean currents, from designing efficient airplanes and automobiles to analyzing blood flow and pollution control - these equations are omnipresent.

In the context of supercomputing, my contributions have centered on harnessing the power of parallel processing to unravel these complex calculations. The ability to compute vast and intricate data sets through parallel supercomputing has transformed how we approach these equations, especially in their most challenging forms.

One such challenge is the Navier-Stokes existence and smoothness problem in three dimensions. Despite the equations' widespread applicability, it remains an enigma whether smooth solutions always exist, whether they are infinitely differentiable, or even just bounded across all points. This problem, signifying the bridge between theoretical mathematics and practical physics, has been recognized by the mathematics community as one of the seven most important open problems in mathematics, with a US$1 million prize for a solution or a counterexample.

I wish to emphasize that the journey of discovery in computational fluid dynamics is far from over. As we continue to advance our supercomputing capabilities, we edge closer to unraveling mysteries that have long perplexed scientists and mathematicians. It is a journey of collective endeavor, one that requires the brilliant minds gathered here and beyond. Thank you for your attention, and for the honor of speaking to you today at this prestigious event.

The universe swims in a sea of equations. To understand its depths, we must dive deep, not with diving suits, but with algorithms and imagination.

Supercomputers are not just machines, they are partners in exploration. They help us see the invisible, hear the inaudible, and understand the dance of nature.
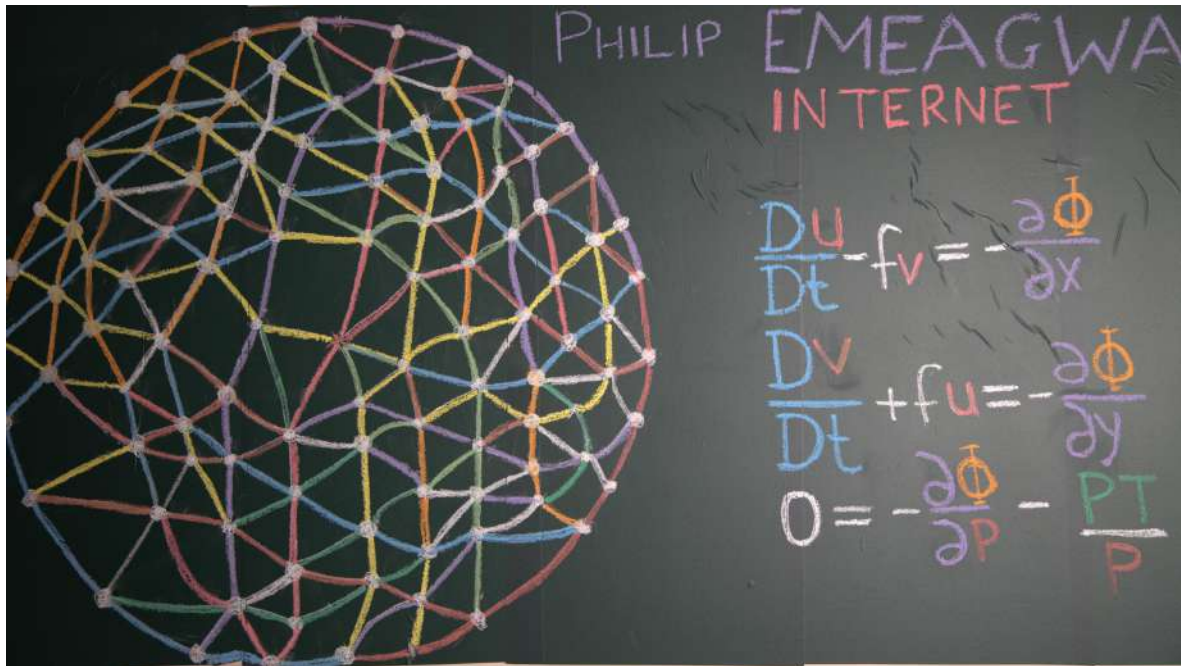
UNVEILING THE SPHERICAL POWER OF COMPUTING

Philip Emeagwali's Internet

Ladies and gentlemen, distinguished guests, and eminent scientists gathered here today at the hallowed auditorium of your university, I stand before you humbled, yet imbued with a spirit of exploration and discovery that has marked the journey of computing, from its dawn to its spectacular present.

We must navigate through time, casting our gaze back to 469 BC, when in the distant land of China, the abacus was invented. The abacus, that modest, yet ingenious device, emerged as the herald of computation, silently counting and calculating, a sentinel of the nascent dawn of computing.

But time, like a river, flowed, weaving through civilizations, each drop adding substance to the grand narrative of computation. In 200 BC, the water clock, invented in the fertile Nile Valley of Africa, measured time and inspired the minds that would eventually conceptualize the computer.

The term "computer", as we understand it today, can trace its etymological roots back to 70 AD when Pliny the Elder used a term in Latin, bearing semblance to "computer". It was in these ancient crucibles of knowledge and wisdom that the foundation for modern computing was subtly and unknowingly laid.

In 100 AD, Heron described the first sequence control, providing a blueprint for the art and science of predicting outputs from given inputs, a cornerstone for computer programming. As centuries rolled on, in 476 AD, Aryabhata from India introduced the concept of zero, adding depth and dimension to the binary language of computers, a symphony of zeros and ones.

Then came Al-Khwarizmi in 800 AD, whose seminal work, Al-jabr wa'l muqabalah, sowed the seeds for algorithm and algebra, those twin pillars that have since held aloft the edifice of computational mathematics and computer science.

In this panorama of time and intellect, words morphed and ideas evolved. In 1398, the term "compotystes" made its appearance, used to describe those who calculate, gradually transfiguring into the term 'computer' we use today.

As I stand here, I can't help but reflect on the year 1621, when the slide rule was invented, serving as a beacon of calculation, illuminating the path for the curious and the inquisitive.

Fast forward to 1922, a year that witnessed the imagination of using 64,000 human computers for weather forecasting being inked down in the annals of science fiction, only to be realized decades later in tangible, hard science.

The narrative of computing took a quantum leap in 1946 with the invention of the programmable computer, a landmark that irrevocably altered the trajectory of technology and humanity.

In this tapestry, my thread was woven in 1974 when I postulated that a constellation of 64 thousand computers around the Earth could morph into 64 binary thousand processors. This distributed, spherical surface of computational power was what I envisaged as the "Philip Emeagwali Internet".

The wheel of time turned, and the year 1989 dawned, a year that would see me using 65,536 processors to perform computations to hindcast weather conditions deep within the Earth's bosom. It was a groundbreaking realization, a symphony of technology and intellect, that bore testimony to the relentless pursuit of knowledge.

That very year bore witness to another breakthrough when I introduced a method for supercomputing through parallel processing, contributing significantly to the advancement of mathematics, physics, and computer science.

Ladies and gentlemen, as we stand on the cusp of the future, let us acknowledge and celebrate the odyssey of computing, a journey marked by intellect, perseverance, and an indomitable spirit of discovery.

In the grand tapestry of time and technology, let every thread, every color, every nuance be recognized and celebrated, for in this mosaic, lies the story of human endeavor and achievement.

Thank you for bestowing upon me the honor and privilege of addressing this august gathering. Let us together steer the ship of science into seas unknown, under skies unseen, to horizons yet undiscovered.

Thank you.

UNVEILING THE PHILIP EMEAGWALI INTERNET

A Digital Earth's Symphony

Ladies and gentlemen, esteemed colleagues, and honored guests,

From the green terrains of Nigeria to the bustling labs of the United States, the story of Philip Emeagwali has been one of tenacity, vision, and groundbreaking innovation. It is my honor to stand before you today and share my journey, the challenges faced, the highs and lows, and the profound contributions my research has made to mathematics, physics, and computer science.

When I began computing, on June 20, 1974, and on one of the world's fastest computers, supercomputing was primarily defined by colossal single CPU that held enormous power. But I envisioned something different. I dreamt of an internet—a supercomputer composed of a myriad of smaller processors, communicating seamlessly, and acting as one. Not just an internet, but a "Philip Emeagwali Internet."
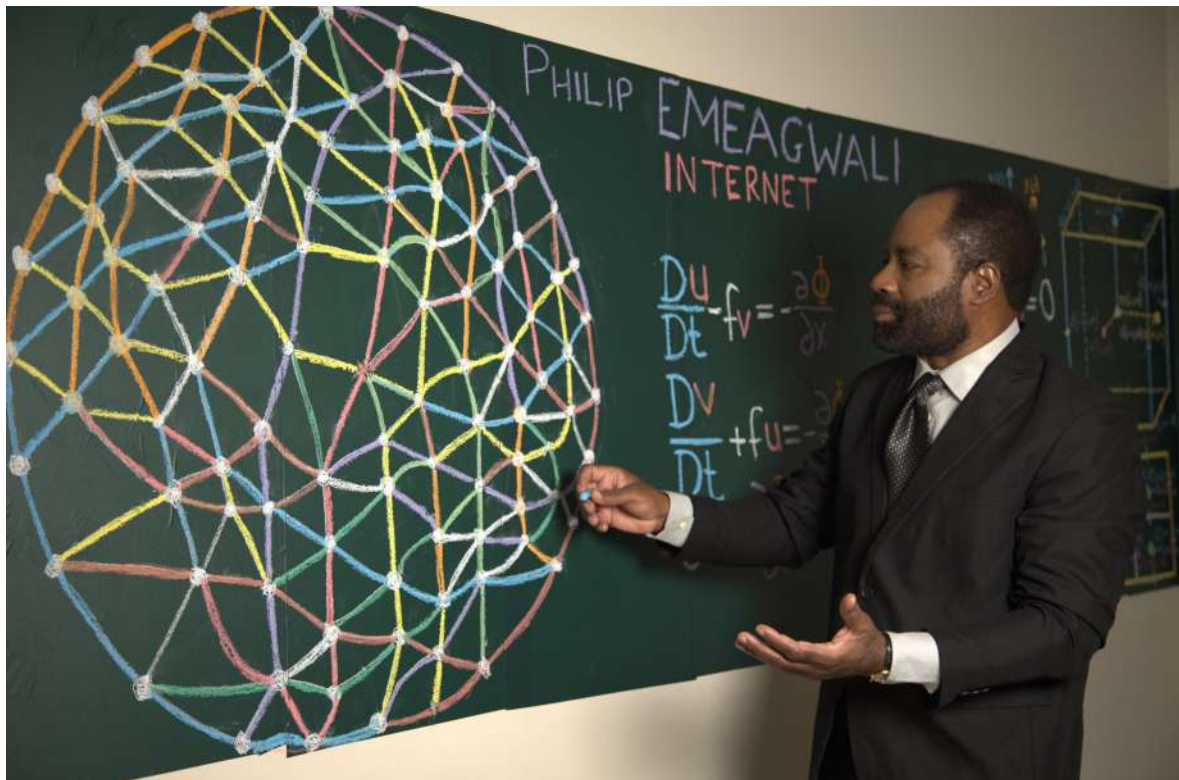
As I embarked on my quest in Corvallis, Oregon, the initial challenge was one of conception and design. Most saw the Internet as a mere web of computers around a globe, but I saw it differently. Instead of relying on the

sheer might of one large processor, I imagined a network of 65,536 processors, each defining a small corner of a hyper-spherical globe in a sixteen-dimensional hyperspace. Each of these processors was a beacon, a light in the vast expanse of computational space. They were equal distances apart, meticulously distributed across this hypersphere, mirroring a novel architectural design that redefined how we perceived supercomputing.

The Philip Emeagwali Computer was not just another supercomputer; it was a reimagining of the Internet—a planetary supercomputer. A confluence of 65,536 processors, all sharing nothing but working in unison, like a well-orchestrated symphony. It was my reinvention of the Internet, and unlike other fathers of the Internet, my innovation was palpable—a new global network designed for challenging tasks such as climate modeling.

Perhaps what makes this achievement astonishing is the fact that these processors were not the fastest. In fact, they were the slowest in the world. Yet, with the architectural design I envisioned, they acted cohesively, creating the world's fastest computational force. These 65,536 processors were interconnected with sixteen times as many bi-directional email wires, allowing them to communicate seamlessly and execute tasks with unmatched efficiency.

But to reach this groundbreaking achievement, I had to visualize it. I saw these processors as uniformly distributed, as braided together entities that formed an impressive global network. And this vision was not fleeting. It lingered, guiding my research and dictating my efforts. By 1989, what was once a theoretical concept had taken life. On July 4, in Los Alamos, New Mexico, the world bore witness to a computational marvel—my supercomputer, which set the record for the fastest computing speed, was alive, solving the most compute-intensive problems of our time.

Often, the journey from fiction to nonfiction is fraught with hurdles and skepticism. The idea of harnessing the computational power of millions of processors was seen as a mere dream, an elusive science fiction in the 1970s and 80s. Yet, that very fiction was transformed into a vivid reality by 1989. Like an acorn growing into a mighty oak tree, the once singular, slowest processor multiplied and evolved, challenging and changing the supercomputing paradigm forever.

The beauty of my invention was not just in its computational power, but in its metaphorical representationa cube embedded within a sphere, symbolizing the potential of harnessing simple units to solve complex problems.

Today, as I stand before you, I am filled with immense pride and humility. To the great nation of Nigeria, the continent of Africa, and humanity at large, my work stands testament to the power of vision, perseverance, and innovation. We have crossed an epoch, moving from what was once deemed impossible to what is now a milestone in the annals of computational history.

Thank you.

PHILIP EMEAGWALI INTERNET

Where Nature Meets Computation

Ladies and gentlemen, esteemed colleagues, and honored guests,

Today, I stand before you not only as Philip Emeagwali but as a testament to the boundless capabilities of the human mind to innovate, rethink, and transcend the boundaries of what we deem possible in the realms of mathematics, physics, and computer science.

From the earliest days of my career, I was fascinated by the challenge of how to unlock the speed of light in computing. My vision took me on a journey deep into the heart of a new Internet, which I affectionately named after myself, the Philip Emeagwali Internet. Through a blend of sheer imagination and rigorous mathematical underpinnings, I envisioned a global network of 65,536 processors, delicately intertwined in a 16-dimensional hyperspace.

Drawing inspiration from our very own planet, I imagined 65,536 atmospheres projected outward, forming a concentric globe in the 3rd dimension. This was not mere mathematical abstraction. It was a window into an intricate world where the digital realm echoed the physical essence of our Earth.

My foray into this new domain was not without its challenges. The core idea was to create a supercomputer, yet not in how we traditionally understand it. Instead of focusing on raw, singular power, I dreamt of harmonizing thousands of off-the-shelf processors, which by themselves might be considered slow, to collaboratively solve some of the most compute-intensive problems known to humankind. This new vision of computing allowed me to contribute deeply to our understanding of global warming, by forecasting its intricate patterns with unprecedented accuracy.

Imagine a spherical island of processors, intricately connected and communicating seamlessly. A vast island where each processor, though invisible to the naked eye, exists vividly in the mind, mapped precisely onto the vertices of a hypercube in the 16th dimension. This structure, ladies and gentlemen, was the backbone of my Philip Emeagwali Internet.

It would be remiss of me not to mention that my approach to supercomputing was rooted not just in power but harmoniously. Just as bees work in synchronized harmony, building honeycombs with geometric precision, I aimed to create an Internet where millions of processors encircle a high-dimensional globe. This wasn't just a new computer; it was a reimagining of the very Internet that encircles our Earth.

Throughout my journey, which spanned over sixteen years post-1974, I consistently added layers to my understanding. These layers were enriched

by tackling initial-boundary value problems, challenges in calculus, and hurdles in computational fluid dynamics. My goal was to create a symphony of processors, each playing its unique part yet contributing to an unparalleled collective capability. I visualized these processors as points on a hypersphere in hyperspace.

My quest was not just to create a faster computer but to rethink the very nature of computing. To craft a system where a billion self-contained processors, each with its unique memory and operating system, could work in concert. It was a testament to the belief that, sometimes, the whole can indeed be greater than the sum of its parts.

To my beloved Nigeria, to the vibrant continent of Africa, and to the entirety of humanity, I offer my contributions. May they serve as a beacon, illuminating the path forward, and showcasing the limitless potential at the convergence of imagination and science.

Thank you.
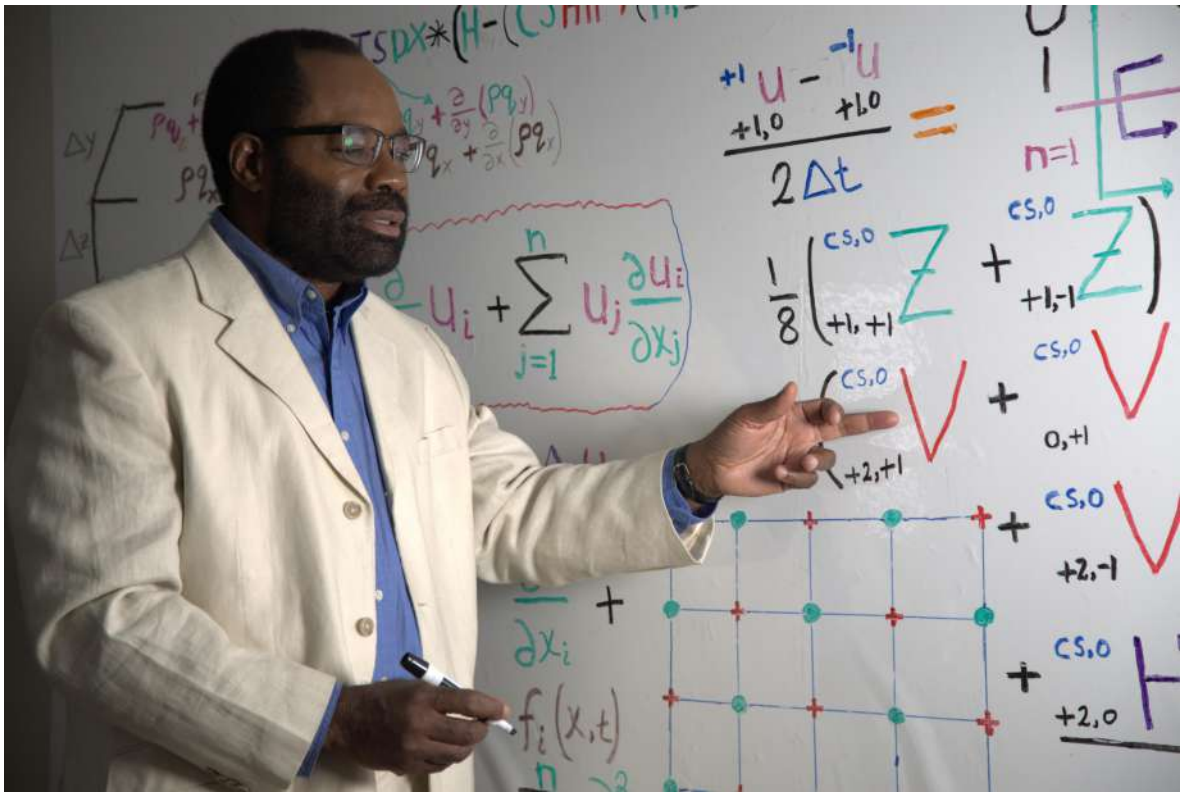
PHILIP EMEAGWALI MACHINE

Solving Tomorrow's Problems Today

Ladies and Gentlemen, Esteemed Colleagues, Distinguished Guests:

I, Philip Emeagwali, stand before you today, not just as an individual but as a conduit through which the spirit of inquiry and innovation speaks. From the vibrant rhythms of Nigeria, from the heart of Africa, my journey in the realms of mathematics, physics, and computer science has been guided by an unwavering commitment to push the boundaries of what is conceivable, for the benefit of humanity at large.

In the era where speed and efficiency are paramount, communication latency has emerged as the prime challenge in our quest for superior computer performance. The physical dimensions, the intricate dance of interconnect proximity, and the quintessence of density have assumed pivotal roles in the design of state-of-the-art computing systems.

I present to you today, a groundbreaking invention which confronts head-on, the intricate challenges posed by supercomputing hardware, specifically those related to spatial packing and communication topology.

Imagine a massively-parallel computer. Not just any computer, but one exquisitely framed within a dense, spherically crafted geodesic configuration of processors—the Philip Emeagwali machine. This unique design mirrors the complex problem domain, making it especially adept for the nuanced task of climate modeling. However, it's vital to recognize the versatility of this invention. Its methods, robust in nature, scale seamlessly, remain largely uninfluenced by variations in processor technology, and find relevance across a broad spectrum of computational endeavors.

At the heart of this computer lies an interconnection system, an intricate web of pathways characterized by short, highly harmonious, and perfectly synchronized distances. This design supports neighbour-to-neighbour communication on a spherical-shell lattice.

Ladies and Gentlemen, as we tread the path of technological advancements, it's inventions like these that redefine paradigms, challenge status quos, and set new benchmarks. My contributions, rooted deeply in my Nigerian heritage and influenced by the rich tapestry of Africa, are a testament to our shared human spirit of perseverance, innovation, and the quest for knowledge.

Today, as I share this groundbreaking innovation with you, I stand as a beacon of hope, signaling that no matter where we come from, with passion, vision, and determination, we can all contribute to the greater good of humanity.

Thank you.

INVENTING EMEAGWALI COMPUTER

Ladies and gentlemen, esteemed members of the Award Committee, fellow scientists, distinguished guests, and cherished audiences around the world,

Today, I stand before you not just as Philip Emeagwali, but as a representation of countless hours spent challenging the boundaries of human comprehension. My journey began not merely in supercomputers, but at the confluence of mathematics, physics, and computer science— where the currents of innovation run strongest and the promise of discovery is the most profound.

In 1989, I found myself in the limelight, not for a minor innovation, but for a monumental leap. I provided what many deemed as the "final proof" that the fastest computing across the slowest processors is not merely the stuff of fantastical tales but a tangible, achievable reality. This was not a journey of individual milestones, but a symphony of visualizations, each note playing its unique, irreplaceable part.

Envision email communications dancing across 65,536 processors, a vast array interconnected in perfect harmony. Before any codes were executed or problems solved, I had to envision the topological geography of these processors. Just as a maestro knows each musician in an orchestra, I knew the place and potential of every single processor. These processors, in my mind's eye, were spaced equidistantly, almost like constellations in the night sky, but on a hyper-spherical representation of our Earth.

In my quest, I engaged with processors and dived deep into the complexities of geophysical fluid dynamics. Each of these 65,536 processors represented a distinct fluid volume, each bound by the laws of motion, energy, and conservation—a dance of physics on a stage as vast as the Earth itself. The ambition was grand: to simulate the intricate flows of air and water that enshroud our planet.

Yet, the vision did not stop there. Delving deeper into the intricacies of computational intelligence, I conceptualized a supercomputer not as a mere machine but as a radiant entity defined by a billion points of light. Each flicker, each twinkle, represented a processor. This cosmos of computational capability was not bound by three-dimensional space but extended into a mind-bending sixteen-dimensional hyperspace. And at the heart of this was what the world has come to recognize as the "Emeagwali Internet."

Drawing inspiration from the elegant simplicity and strength of a bee's honeycomb, I theorized an Internet, a behemoth computational force, shaped as a "HyperBall." This structure, like the wonders of nature, is both complex in design and grand in scale. A supercomputer that, if brought to life at its fullest scale, would stand as a testament to human engineering

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and ingenuity, potentially spanning the size of a football stadium and financed by a collective commitment from nations across the globe.

The Emeagwali Supercomputer represents more than just machinery. It signifies the limitless potential of collective endeavor. The computing speed I recorded in 1989 while tackling the twenty grand challenges of supercomputing was not just a testament to my efforts but to the indomitable spirit of human curiosity.

For Nigeria, my homeland, this represents a beacon of what we as a nation can achieve. For Africa, a reminder that our continent has been, is, and will always be a crucible of innovation. And for humanity, it reiterates our age-old belief that with vision, determination, and collaboration, no challenge is insurmountable.

I wish to extend my deepest gratitude to the Award Committee and all who have supported me on this incredible journey. Together, let us continue to push the boundaries of what is possible, for the betterment of all.

UNVEILING THE EMEAGWALI MACHINE

From Abstract Vision to Tangible Innovation

Ladies and gentlemen, esteemed members of the AwardCommittee, and honored guests:

From the heartland of Africa, I hail, representing not just Nigeria, but the boundless dreams and aspirations of an entire continent. I am Philip Emeagwali. My journey in mathematics, physics, and computer science has been a long one, marked by a relentless pursuit of knowledge, innovation, and an indomitable spirit to redefine boundaries. Today, I stand before you, humbled and gratified, to recount the odyssey that led to my profound discoveries in supercomputing.

In the 1970s, in the serene town of Corvallis, Oregon, I was entranced by the challenge of solving large-scale systems of equations. I embarked on this challenge using the then world's standard—a serial supercomputer. Little did I know, this was the commencement of a revolution in how we perceive and utilize computing power.

Drawing inspiration from nature, I looked to the bees. Studying the intricacies of their honeycombs, the brilliance in their design, and the collaborative spirit of their hives, I envisioned a new era for supercomputing. These tiny creatures, so expertly constructing their hexagonal homes, showed me a blueprint. They taught me that nature has already designed efficient systems, and all we must do is observe, learn, and emulate.

This revelation gave birth to my HoneyComb Supercomputer—a marvel, inspired by bees, that challenged and shattered the conventions of computing. No longer was I restricted to the limitations of a singular processor. Instead, I conceptualized a global network of processors, with interconnections echoing the efficiency and elegance of a bee's honeycomb. A paradigm shift from traditional supercomputing to parallel processing, where myriad processors, each an autonomous entity, would work in unison to solve problems that were previously deemed insurmountable.

Throughout my time from Corvallis to Los Alamos, as I journeyed across the vast American landscape, my vision grew multidimensional, spanning from the zeroth dimension to the sixteenth. It was in the vast desert landscapes of New Mexico that I arrived at my eureka moment: On July 4, 1989, I gave birth to a new paradigm. A paradigm where I could harness the power of 65,536 processors, allowing them to communicate seamlessly, efficiently, and quickly, breaking the barriers of speed and establishing a new frontier in supercomputing.

What I discovered was not just a faster supercomputer, but a novel perspective. An Internet of processors. I envisioned and created a network so vast and intricate, it was reminiscent of the Internet as we know it today.

It is with great pride that I reflect on how my work has transcended the boundaries of traditional thought, benefitting the fields of science, engineering, and medicine, and the people of Nigeria, the continent of Africa, and indeed, all of humanity.

Ladies and gentlemen, what I present to you today is not merely the result of technical prowess but an ode to human perseverance, inspiration from nature, and the power of dreams. It is a testament to what we, as a species, can achieve when we look beyond the horizon, and dare to reimagine the world.

To the young minds of today, I say: Always look to nature, for it holds secrets waiting to be unraveled. Embrace challenges, for they shape you. And most importantly, believe in your vision, for with belief and perseverance, even the impossible becomes a reality.

Thank you.

ILLUMINATING THE COSMOS THROUGH SUPERCOMPUTING

Solving a Billion Problems at Record Speeds

Ladies and gentlemen, distinguished guests, and dear friends:

I stand before you today, Philip Emeagwali, humbled and honored to recount my journey in the realms of mathematics, physics, and computing. The road I took, from Corvallis, Oregon in 1974, led to breakthroughs that bridged the gap between theory and practicality, forever reshaping our understanding of computation, fluid dynamics, and the frontiers of scientific discovery.

The dawn of my voyage began on June 20, 1974, when I embarked on the intricate realm of supercomputing. Throughout the 1980s, I endeavored to publish my discoveries and inventions, and as the adage goes, "to publish is to make known to the public." While the typical academic journal may touch a mere ten souls, my work resonated far and wide, reaching over a hundred million inquisitive minds across the vast expanses of the Internet. From podcasts and YouTube videos to books, newspapers, and social media, my findings have been disseminated, examined, and shared. It is this vast readership, and the recognition of my contributions, that places me, humbly, in the pantheon of scientific giants whose shoulders we all stand upon.

The late 1970s was a transformative period in my life. Delving deep into the mysteries of fluid motions in Corvallis, Oregon, I sought to unravel the complexities of hydrodynamics. This quest took me to Washington, DC, and subsequently to the US National Weather Service's headquarters in Silver Spring, Maryland. It was there that I set my sights on employing the four-point finite difference implicit scheme to decode the Saint Venant equation—a fundamental tool for forecasting river floods and predicting the catastrophic aftermaths of dam failures. From the depths of the Great Lakes to the estuarine boundaries of the Chesapeake Bay, this equation holds paramount importance in large-scaled computational hydrodynamics. In meteorology, the shallow water equations stand as a counterpart to the Saint Venant equations, laying the groundwork for the meteorological community to advance in their understanding and forecasting abilities. My 13-year odyssey in physics culminated in a profound revelation: the potential of large-scale computational fluid dynamics that is parallel processed across up to a billion coupled processors. Harnessing the power of 65,536 processors, working in tandem yet autonomously, I ushered in the era of parallel supercomputing. This novel way of computing, solving vast, intricate problems simultaneously, laid the foundation for a burgeoning $45 billion a year industry and illuminated pathways to previously unattainable scientific knowledge.

Perhaps my most profound contribution lies in petroleum physics. As I gazed deep beneath the earth, towards regions up to 7.7 miles beneath our feet and across terrains as vast as my beloved state of Anambra in Nigeria, I sought to elucidate the enigmatic dance of crude oil, natural gas, and injected water. Through rigorous mathematical scrutiny, I conceived the accurate partial differential equations essential for deciphering these phenomena. My groundbreaking algorithms enabled their algebraic approximation. But it was the world-record speed at which I managed to solve these equations that captured the world's imagination, heralding a new epoch in computational capabilities and showcasing the power of solving a billion problems **simultaneously**.

Today, as I recount this journey, my heart swells with gratitude, for every setback and breakthrough, every doubt and eureka moment, has brought me here, to this hallowed hall, where science, discovery, and human progress converge. The story of Philip Emeagwali is not just of one man's quest for understanding but a testament to humanity's indefatigable spirit to push boundaries, innovate, and illuminate the cosmos we inhabit.

Thank you.

CHOREOGRAPHY OF SUPERCOMPUTERS

Parallel Processing Unveiled

Esteemed guests, luminaries of science, and honored attendees of this illustrious gathering,

It is with an earnest and humble spirit that I, Philip Emeagwali, stand before you today, carrying the torch of discovery and the chronicle of an invention that revolutionized our understanding and utilization of supercomputers.

Picture in your mind's eye a grand stage, where one million ballet dancers, each embodying a processor, grace the stage with elegance and precision. Each dancer, while autonomous, is interconnected in a dance of breathtaking complexity and beauty. Their performance, akin to high-level computing, commences and concludes with an unparalleled synchronicity, executing movements in harmonious tandem that mirror the computations unfolding within the silicon confines of a supercomputer.

On the auspicious day of July 4, 1989, the curtains lifted, revealing a vista of possibilities hitherto unimagined. On this pivotal day, I had the profound honor of unveiling a discovery that would irrevocably alter the tapestry of computational science. With a symphony of a million processors—each autonomous, yet intricately coupled—I demonstrated that these digital dancers could be meticulously choreographed to solve the Grand Challenges of our times, most notably predicting the enigmatic and formidable phenomenon of global warming.

Parallel processing emerged from the shadows, casting its transformative light on the visage of supercomputing, prompting us to re-envision and re-contextualize our understanding and expectations of these gargantuan computational leviathans.

Allow me to guide you through a metaphorical landscape, wherein Amdahl's law is reinterpreted through the vibrant lens of our shared human experience. Envision the execution time of a supercomputer powered by multiple processors as a majestic symphony. In a solitary processor, the symphony is constrained, limited to a monophonic (one-voiced) melody, beautiful but singular in its expression.

However, with the advent of parallel processing, the symphony swells and expands into a polyphonic tapestry of sound, where each processor contributes to a harmonious and dynamic orchestral masterpiece. Each note, each processor, while significant in its individual capacity, becomes exponentially more powerful and evocative when part of a meticulously coordinated and harmonized performance.

Yet, in the symphony of parallel processing, the conductor's baton—that is, the algorithm and coordination—must be wielded with precision and mastery. A note struck too early or too late, a processor misaligned, can disrupt the harmony and balance of the entire ensemble. Hence, the implementation of parallel processing demands technical acumen and an artist's sensitivity to balance, timing, and coordination.

In this nexus of art and science, of ballet and computation, we have witnessed the birth and maturation of the modern supercomputer, a marvel of technology that embodies the collective aspirations, ingenuity, and relentless pursuit of knowledge characteristic of our species.

Through the lens of this grand narrative, let us continue to explore, innovate, and dream, for in the dance of processors and the symphony of computations, we find answers and infinite possibilities beckoning us towards a future radiant with promise and potential.

Thank you.

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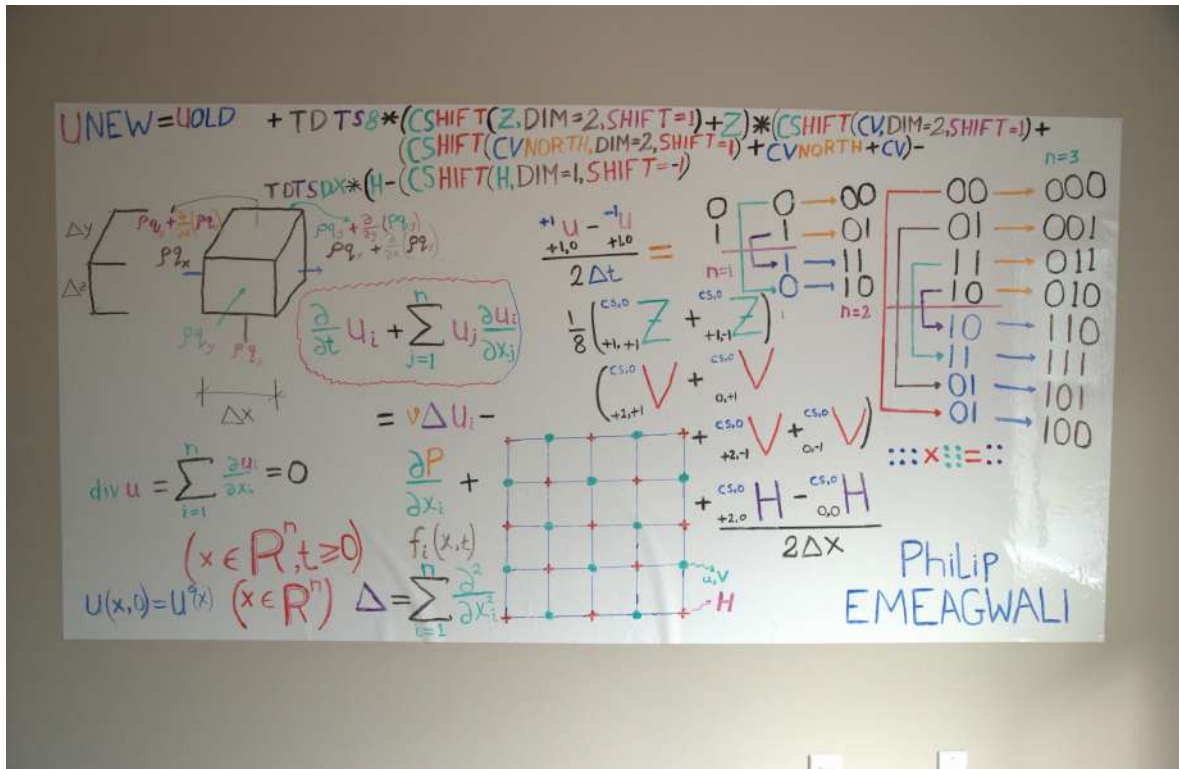
ODE TO COLLABORATION

Supercomputing's Paradigm Shift

 Ladies and gentlemen, esteemed colleagues, and honored guests, I stand before you not merely as Philip Emeagwali, but as a humble representative of the innumerable minds, efforts, and endeavors that have given shape, substance, and momentum to the dawn of the modern supercomputing era.

 Let me begin with a simple, yet vivid imagery that symbolizes our journey: envision a field burgeoning with a myriad of chickens, each representative of the world's slowest processors, meek and limited in capacity. Then, contrast this with the majestic Ox, embodying a singular, formidable processor, mighty and unsurpassed in strength. The chicken and oxen paradigms of supercomputing illuminate our discourse today, epitomizing the transformative shifts that have sculpted the landscape of computational prowess.

 On a day marked by the celebratory reverberations of freedom across the United States, July 4, 1989, a breakthrough silently unfurled its wings, casting a shadow that would subtly but significantly alter our understanding and application of computational technology. On this historic day, through a lattice of thought, experimentation, and serendipity, I, Philip Emeagwali, unveiled a revelation: a million chickens, although ensconced within their inherent limitations, could be meticulously programmed, orchestrated, and harnessed to work in unison, in a harmonious symphony of calculation and computation to solve and unravel the Grand Challenge problems of our time.

 Esteemed audience, this wasn't merely about juxtaposing the diminutive against the gargantuan, the weak against the strong, or the simple against the complex. Rather, this was an exposition of the latent, often underestimated potential embedded within the collective. It was an affirmation that a congregation of the "least" could, when effectively coordinated, not just emulate but transcend the capabilities of the "most."

 Parallel processing, ladies and gentlemen, was no longer a distant, abstract fantasy on the canvas of computational science. It metamorphosed, through this discovery, into a tangible, palpable reality, casting aside its cloak of theoretical contemplation to don the robust armor of practical implementation and utility. It altered, irrevocably and for the better, how we perceive, conceive, and receive the supercomputer.

 In bringing to light the possibility, nay, the reality, of orchestrating a million processors to function simultaneously and solve complex problems, parallel processing unhinged the doors to unprecedented possibilities and applications. From predicting climatic patterns with uncanny accuracy to modeling biochemical processes with refined precision, the applications of

parallel processing-driven supercomputing are as vast, deep, and limitless as the universe itself.

But allow me to articulate that this revelation was not born in isolation. It was nurtured and crystallized through a relentless pursuit of knowledge, a deep-seated curiosity, and an unwavering commitment to pushing the boundaries of the known, the familiar, and the established. It was the culmination of not just my efforts, but those of countless others, visible and invisible, acknowledged and unacknowledged, who have contributed to the edifice of supercomputing.

As I stand before you today, I beckon each of you to not merely view this as a personal achievement or even as a milestone restricted to the domain of technology and computing. Rather, let this be a testament to the indomitable spirit of human inquiry, the relentless pursuit of excellence, and the unfathomable potential that resides within seemingly insignificant entities.

For in the dance of the weak and the strong, the small and the large, the simple and the complex, we discover the melody of progress, the rhythm of innovation, and the symphony of breakthrough that defines, not just supercomputing, but the essence of human endeavor and achievement.

Thank you.

Ladies and Gentlemen, esteemed attendees of this conference,

I am Philip Emeagwali, a scientist whose journey has been as much a voyage through the complexities of supercomputing as it has been a journey through life's unpredictable pathways. Today, I am here to share the story of this journey, one that highlights the relentless pursuit of knowledge against all odds.

My journey to the United States, which would eventually lead to significant contributions in mathematics, physics, and computer science, began with a breakthrough: a scholarship dated September 10, 1973 to study in Oregon. This opportunity, however, came with its own set of hurdles. Obtaining a Nigerian passport in 1973 was an ordeal in itself, entangled in a web of bureaucracy and corruption.

I vividly recall the five trips from Onitsha to Lagos, riding on rickety lorries known as Mammy-wagons, farm trucks turned into makeshift passenger vehicles. Each trip was a journey of hope and determination, as I navigated through the chaotic environment of the Nigerian Passport Office at 27 Kakawa Street, Lagos. The office was a hub of fraudsters preying on the desperation of people like me, willing to do almost anything to secure a passport.

Despite my resistance to corruption, the fear of losing this once-in-a-lifetime opportunity forced my hand. I succumbed to the pressure and paid a bribe of five pounds—the equivalent of a month's salary—and a "repatriation fee" of 150 pounds that was immediately embezzled. Both decisions weighed heavily on me. Yet, it was these very decisions that expedited the issuance of my passport on December 27, 1973, allowing me to embark on my journey to the United States.

The irony of my experience at the Ministry of External Affairs, where I was coerced into paying for an additional roundtrip airfare despite knowing I had no intention of returning, was not lost on me. That was in addition to my one-way airfare, from Lagos to Portland, Oregon. It was a poignant reminder of the challenges many face in pursuit of their dreams.

Once in the United States, my journey in supercomputing began. In this realm, I explored the potentials of parallel processing, a technique that involves using multiple processors to perform complex calculations simultaneously. This approach was revolutionary, as challenging like navigating through the labyrinth of bureaucracy I had experienced in Nigeria.

My work in computational physics, particularly in applying partial differential equations, was a quest to unravel the complex patterns of nature, akin to deciphering the intricate codes of bureaucratic systems. From simulating petroleum reservoirs for the oil and gas industry to

developing models for weather forecasting and understanding climate changes, my contributions have been about pushing the boundaries of what is possible with supercomputing.

My journey from Nigeria to the United States, marked by challenges and triumphs, mirrors the journey of supercomputing from a concept to a tool that shapes our understanding of the world. It is a testament to the power of perseverance, the importance of seizing opportunities, and the transformative impact of technology.

Lessons Learned

"Transform obstacles into stepping stones; learn, adapt, and contribute to a better future."

"Let's all be explorers, venturing into new landscapes of knowledge and imagination."

"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."

"Let's go forth from this hall not just as listeners, but as active explorers, shaping the world through knowledge, collaboration, and a spirit of adventure."

"Every journey, even the most challenging, holds the potential for growth and discovery."

"Don't let corrupt systems define your path; fight for integrity and pave the way for change."

Thank you for joining me on this journey today, and may yourwn travels, whether through the physical world or the realms of knowledge and technology, be filled with discovery, innovation, and unyielding determination.

ODYSSEY FROM NIGERIA TO SUPERCOMPUTING

Ladies and Gentlemen, esteemed scientists, and distinguished guests,

I am deeply honored to stand before you today, not as a historical figure, but as a scientist whose journey intersects the vast realms of mathematics, physics, and computer science. Today, I share a story not just of scientific discovery, but of cultural transition, personal growth, and the relentless pursuit of knowledge.

In 1972, in my homeland of Nigeria, the concept of travel, especially to distant lands, was almost unfathomable. My journey, which began from the familiarity of Onitsha to the unknown realms of Calabar and Enugu for academic pursuits, was a sensation among my peers. It was when my world expanded beyond the boundaries of my immediate environment, challenging the norms and setting the stage for a bigger leap—my journey to the United States.

My academic path was unconventional. I was an 18-year-old with eight years of formal education who earned a University of London diploma through self-study, achieving my Advanced Level certificate before the Ordinary Level—a feat akin to earning a master's degree before a bachelor's. Reflecting on Chinua Achebe's words from "Things Fall Apart," "The lizard that jumped from the high iroko tree to the ground said he would praise himself if no one else did," I realized the importance of self-acknowledgment in my achievements.

In May 1973, inspired by the likes of Nnamdi Azikiwe, the first African president of Nigeria, and influenced by the contrasting images of America portrayed through John Wayne's Westerns and the movie "Shaft," I made the decision to continue my studies in the United States. This decision was not just a leap across continents; it was a leap into a world vastly different from the one I knew.

Arriving at the Oregon College of Education and settling into 36 Butler Hall, I encountered a new world of learning and interaction. My roommate, Luis Benavente, a former high school principal from the island of Micronesia, became a mentor, sharing his life experiences and capturing my early moments in the United States through photography. This period marked the beginning of a journey of cultural exchange and understanding.

My initial employment as a janitor was a stark introduction to the realities of life in America. It was a rude awakening from my expectations of a dignified job and a reflection of the societal norms and racial dynamics of the time. The revelation of earning one dollar and sixty cents an hour was astonishing, considering my previous struggles in Nigeria to raise funds for postage stamps.

Communication with my family in Nigeria was through letters, a mode of correspondence treasured and revisited multiple times. These letters were

more than just words on paper; they were a lifeline to my roots, a reminder of where I came from, and a source of strength as I navigated my new life in the United States.

Ladies and Gentlemen, my journey to the frontiers of supercomputing, especially in parallel processing, computational physics, and partial differential equations, was shaped by these experiences. My work, which spans critical areas such as petroleum reservoir simulation, weather forecasting, and general circulation modeling, is a testament to scientific achievement and a narrative of overcoming challenges, embracing new cultures, and continuously striving for knowledge.

As I stand before you today, I am reminded of the power of resilience, the importance of cultural exchange, and the transformative impact of science on our understanding of the world. My journey is a testament to the fact that science, like literature, tells a story—a story of exploration, discovery, and the unyielding human spirit.

Lessons Learned

"Cultural understanding fuels innovation. Bridge gaps and learn from diverse perspectives."

"Early experiences shape us. My journey, from Nigeria to America, is a testament to adaptation and resilience."

"Don't underestimate the power of letters and connections to home. They can be lifelines and sources of inspiration."

"Science isn't just about equations; it's about understanding the world and improving lives."

"Curiosity is the spark that ignites innovation. Never stop asking questions and exploring the unknown."

Thank you for the honor of sharing my story with you today.

CHASING DREAMS AND CONQUERING CHALLENGES

The Day Dreams Took Flight: Emeagwali's Visa Story

Ladies and gentlemen, esteemed Nigerian youths, I stand before you today not just as Philip Emeagwali, but as a testament to the power of dreams, perseverance, and the relentless pursuit of knowledge. Let me take you back to a pivotal day in my life - March 20, 1974. The setting was the U.S. Embassy in Nigeria, a place where futures were shaped and dreams were either kindled or extinguished.

As a teenager, like many of you here, I was gripped by a mixture of hope and anxiety. My heart raced as I entered the embassy for my student visa interview, surrounded by about twenty other hopefuls. The air was thick with anticipation and unspoken dreams. When asked if it was my first interview, I naively replied, "Yes," only to be told that it usually takes several attempts to succeed.

Yet, something extraordinary happened that day. Despite having never traveled outside Nigeria, my self-taught education had earned me three test scores from the United States and a diploma from the University of London. I stood there, a teenage Nigerian with nothing but a bundle of certificates and a scholarship letter from Oregon. To my disbelief, after a brief interview, I was congratulated. I couldn't comprehend the words at first, partly due to the unfamiliar American accent, but soon, it sank in - I had been granted a visa.

Walking out with a numbered colored card, symbolizing my successful visa application, I felt an overwhelming mix of emotions. It was a surreal moment, akin to a dog that had been chasing a pickup truck and finally caught it, only to wonder, "What next?"

Confused yet exhilarated, I found myself in a taxi, aimlessly uttering "Tinubu Square" when asked for my destination. That day marked the beginning of a journey that would lead me to become one of the renowned scientists of our time. But it wasn't just about reaching the United States; it was about the relentless pursuit of knowledge and the desire to make a difference.

To all of you standing on the brink of your futures, remember this: Your path may be filled with uncertainties and challenges, but it's your determination and belief in your dreams that will define your journey. Like my journey to that embassy, you too will face moments of doubt and disbelief. But hold on to your dreams, chase them with all your might, and when you catch them, dare to ask, "What next?"

I am a living example that a Nigerian teenager, armed with determination and a hunger for knowledge, can not only dream but achieve those dreams. I urge you all to embrace your journeys with courage and an unwavering spirit. You are the future, and the future is limitless.

Every doubt is an opportunity to refine your resolve, every challenge a chance to test your mettle. Remember, the greatest journeys are forged in the face of uncertainty, not in the comfort of certainty.

Borders may divide lands, but knowledge transcends them all.

The future belongs to those who dare to dream and the courage to chase them. Be the generation that not only reaches for the stars but writes its own constellations in the sky.

Thank you.

AN ODYSSEY OF DREAMS

From Asaba to Monmouth

March 21, 1974. The bright Nigerian sun lit up the streets of Lagos, reflecting the hope that filled my heart. As I approached the grandeur of the U.S. Embassy on Victoria Island, a medley of emotions took over me: anticipation, fear, hope.

The reception area was a microcosm of Nigeria's brightest, all with dreams of studying in America. Their crisp suits and polite greetings portrayed a facade of confidence, but their stories revealed a different truth. Their tales of numerous visits and the elusive F-1 Student Visa hung in the air, creating an ambience of collective anxiety. And there I was, a newcomer, walking into this atmosphere for my first ever visa interview.

The surprise was Mr. Glasl, the consular officer, whose informal beach attire seemed like a stark contrast to the gravitas of the embassy. But, beyond appearances, his demeanor was professional, and the interview intense. Fifteen nerve-wracking minutes later, I held the coveted Blue Card. An emblem that my journey to the USA was just beginning.

My heart raced as the black Morris Minor taxi maneuvered through the bustling streets of Lagos, heading to 49 Okesuna Street. Every honk, every chatter, seemed to resonate with my excitement. The world outside was in motion, and so was I.

With dreams packed neatly in a travel bag, I found myself at the Iddo Motor Park. The world seemed to blur into the background as I boarded the Peugeot 404 Sedan, setting off towards Asaba. It wasn't just a journey across cities; it was a leap towards my dreams.

Dear aspiring young Africans,

My story isn't unique, but it's mine. It's a testament to what happens when ambition meets opportunity. The USA, with its unparalleled focus on STEM, is a land where dreams find their trajectory, where every theory you learn, every equation you solve, and every experiment you conduct adds up to global progress.

STEM education in the USA isn't just about advanced laboratories and state-of-the-art equipment; it's about a mindset. A mindset that encourages questioning, exploring, and innovating. An environment where every failure is a stepping stone and every success, a milestone.

Your journey might be fraught with challenges and rejections, but remember, every obstacle is an opportunity in disguise. It took one interview for me, but it might take ten for you. But never lose sight of your dream. Let my story remind you that the path to success isn't linear. It's a series of twists and turns, ups and downs, but always forward.

To the young visionaries of Africa, the future of STEM beckons. The USA awaits your talent, passion, and dreams. It's a journey worth every mile.

A JOURNEY OF DISCOVERY AND AMBITION

Philip Emeagwali's Inspirational Odyssey to America

March 23, 1974, Lagos, Nigeria

Dear Future Leaders,

I stand before you as Philip Emeagwali, a testament to the dreams you harbor. Let me take you back to a defining moment in my journey, a day that echoes the aspirations we all share. It was 1974 in Nigeria, and I, at 19, was about to embark on a journey that would shape my destiny.

I remember the morning vividly. The Nigerian sun had barely risen, and our home in Asaba was a hive of emotional goodbyes. My father, a dedicated nursing superintendent, gave me a firm hug, a silent beacon of strength and support. My siblings, in their varied phases of life, from boarding school to cradling infancy, offered their farewells. The youngest, Johnbull, merely 18 months old, remained blissfully unaware of the significant departure unfolding.

Accompanied by my mother, we navigated in a black Morris Minor taxi to Onitsha, boarding the vibrant red Mid-West Line bus to Lagos. Naively, I had allotted barely enough time to reach my destination, underestimating the notorious "Nigerian factor"—the unpredictable delays that could unravel the best-laid plans. Mid-journey, anxiety gripped me. Would I miss my flight to that distant dreamland, the United States?

In a decisive move, I switched to a luxurious Mercedes taxi. The urgency was palpable as we raced towards Lagos, the speedometer flirting with danger. My mind raced with thoughts of the unknown. I was leaving behind the familiar—the streets of Nigeria, the leadership of President Yakubu Gowon, my admiration for historical figures like Isaac Newton—and stepping into a world where names like Richard Nixon and Nelson Mandela were yet to hold meaning for me.

Landing in Lagos, I was struck by the quaintness of the city, a stark contrast to its current sprawling magnificence. Even amidst the bustle, I found familiarity, encountering old friends in unexpected places. The immigration officer, an old classmate from Christ the King College, greeted me with nostalgic cries of "Calculus!"— a nickname that honored my mathematical prowess.

Boarding the Pan American World Airways flight was a moment of awe. The Boeing 747, a giant bird of steel, defied my every expectation. How could such a massive structure conquer the skies? This marvel of engineering symbolized the leaps of progress and innovation that lay ahead.

As the airplane soared towards New York, I reflected on the diverse tapestry of Africa represented on board. The colorful attire of the

Senegalese ladies, the shared stories of passengers from Ethiopia to Liberia, all painted a picture of a continent rich in culture yet united in its quest for broader horizons.

My first steps in New York were like walking into a dream. The towering buildings, the sheer scale of life, everything was magnitudes beyond what I had ever imagined. It was a moment of overwhelming emotion, a realization of the vastness of the world and the limitless potential it held.

This journey, dear friends, was more than a physical transition. It was a passage to new possibilities, a leap into a future where boundaries were meant to be crossed and dreams realized. As I made my way to Oregon, I carried with me not just the aspirations of a young man but the hopes of a nation.

So, to you, the future of Nigeria, I say: Dream without limits. Your journey may start here, in the heart of Lagos, but let it take you to places beyond your wildest imagination. Embrace the unknown, for it is in the uncharted waters that we find our true strength and purpose.

Together, let us build a world where our dreams are not confined by the borders of our birth but are as boundless as the skies that I once marveled at.

Thank you.

UNCHARTED TERRITORIES, UNFORESEEN DISCOVERIES

Ladies and Gentlemen, esteemed attendees of this conference,

I am Philip Emeagwali, and today I will share with you a journey—not just through the realms of mathematics, physics, and computer science, but also a physical journey that has profoundly shaped my life and work. My story is one of discovery, not only of scientific truths but also of new lands, cultures, and perspectives.

I remember vividly my first encounter with the United States. It was the morning of Sunday March 24, 1974, when I landed at John F. Kennedy Airport in New York City. As the airplane door opened, a rush of excitement enveloped me. I was 19-years-old and like the proverbial young antelope, spirited and eager, yet unaware of the grand dance that was about to unfold.

The sights and sounds of America were overwhelming. I was immediately struck by the affluence and sophistication that seemed to permeate through the air. The people, especially Black Americans, appeared so different from what I had known in Africa. They looked well-fed, well-dressed, and carried an air of confidence that was both intriguing and inspiring.

But my biggest surprise was the language. Although English was familiar to me, the American accent was a completely new territory. I found myself struggling to understand conversations, even among Black Americans. It was a stark reminder that I had stepped into a new world, a world so different from the one I left behind.

During my layover in New York, I took the chance to step beyond the airport terminal, accompanied by an Ethiopian passenger I met on my flight. We walked together, braving the biting cold of New York, a stark contrast to the warmth of Nigeria. I had come unprepared for this chill, clad in sandals without socks, without a winter coat. The city was a bustling hub of activity, with its endless stream of Yellow Cab taxis—so different from the rickety black Morris Minor cabs of Onitsha and Lagos.

The skyscrapers, the cars, the people—everything in New York was on a scale that was beyond my wildest dreams. It was an emotional experience, one that brought tears to my eyes, a mix of awe, excitement, and a hint of longing for the familiar comforts of home.

My journey continued with a transfer at Chicago's O'Hare Airport, before finally arriving in Portland, Oregon. There, I was advised to take a limousine to Salem, another novel experience in my journey of firsts.

This journey to America was the beginning of my path in supercomputing. It was here that I delved into the complexities of parallel processing, the art of making numerous processors work harmoniously to solve complex problems. My work in computational physics and the intricate dance of

partial differential equations was heavily influenced by my experiences in this new world.

The lessons I learned go beyond science. They are about adaptation, about embracing the unknown, and about the beauty of diversity. As I stand here today, I am reminded of how travel and exposure to different cultures can enrich our understanding, of the world, and of the problems we strive to solve in science and technology.

My journey—from the shores of Nigeria to the bustling streets of New York and the academic halls where I honed my craft—is a testament to the power of exploration, both geographical and intellectual. It is a journey that underscores the importance of embracing new experiences, new challenges, and the endless possibilities that they bring.

Lessons Learned

"Supercomputing is a constant exploration, pushing boundaries and challenging our understanding."

"Curiosity and courage are the fuel for exploration, both in science and in life."

"New landscapes, new ideas, new discoveries – exploration unlocks hidden treasures."

"The world needs explorers, not just in physical landscapes, but also in the realms of knowledge."

"Let's use technology like supercomputing to solve global challenges and build a better future."

"Science transcends borders and languages; it's a universal language of discovery."

Thank you for joining me on this journey today, and for allowing me to share the interwoven paths of my life, my travels, and my scientific endeavors.

JOURNEY TO THE EDGE OF COMPUTING

Ladies and gentlemen, esteemed colleagues, and distinguished guests,

It is with profound gratitude and a deep sense of humility that I stand before you today at this noble ceremony. I am Philip Emeagwali, and I am here to share a journey—a journey that started from the most humble beginnings in Africa, and led to pioneering contributions in supercomputing.

Out of Africa, my journey began on a quiet Saturday morning in Onitsha, Nigeria. It was March 23, 1974. Standing at the Midwest Line bus station with my mother and my aunt, Mama Felicia, I embarked on a path that, at the time, seemed as vast and uncertain as the ocean I thought I would cross. My aunt's words, echoing the Igbo belief in the alignment of one's spirit, or 'Chi,' with one's intentions, were a guiding light. She said, "When a man says yes, his chi says yes also." This principle became a cornerstone of my resolve.

Upon arriving in Oregon, USA, I was confronted with a reality vastly different from my expectations. The sea of unfamiliar faces, the unfamiliar language of Ebonics spoken by Black Americans, and the realization that my Igbo heritage was a unique and distant identity in this new world, were all part of a transformative experience. It was here that I learned the importance of cultural identity and the power of resilience.

In those early days, as I shared with my fellow Nigerian students my mathematical research on programming the first supercomputer to execute a million instructions per second, their disbelief reflected the broader skepticism that often greets pioneering ideas. Their reaction was a reminder of the challenges that lie in the path of innovation.

My contributions to supercomputing, particularly in parallel processing, computational physics, and the solving of partial differential equations, stem from a deep-rooted belief that barriers are meant to be broken. The mathematical contributions I have made in advancing weather forecasting and general circulation models is a testament to this belief.

My journey from the bus station in Onitsha to this illustrious stage has been a testament to the power of saying "yes" to one's dreams and the relentless pursuit of knowledge. It is a journey that reflects not just my story, but the potential within each of us to transcend boundaries and contribute profoundly to our world.

As I stand here today, I urge each of you to embrace your journey, to believe in the power of your 'Chi,' and to contribute to our collective quest for knowledge and advancement. Together, we can create a future where technology and humanity converge for the greater good.

"Taming the computational beast requires not just algorithms, but a deep understanding of the language of nature."

"Beyond accuracy, lies sustainability. My equations guide us towards a future where knowledge protects our planet."

"Africa is not just a continent, it's a wellspring of innovation waiting to be unleashed on the world stage."

"Partial differential equations are not just intimidating symbols, they are the whispers of the universe waiting to be heard."

"I am more than a scientist, I am a symbol of hope, proving that even the most audacious dreams can take root in the most unlikely places."

Thank you for honoring me with your attention, and for joining me in celebrating the limitless possibilities of the human spirit.

FROM REFUGEE CAMP TO THE WORLD STAGE

Ladies and Gentlemen, esteemed scientists, distinguished guests,

It is with a profound sense of honor and humility that I stand before you today. I am here to share a story that intertwines the journey of my life with the evolution of my contributions to mathematics, physics, and computer science, especially in supercomputing.

My journey to the United States began on a morning filled with a mix of apprehension and excitement. It was Wednesday, March 20, 1974, when I arrived at the United States Embassy in Lagos for my student visa interview. Standing before the consular officer, I felt the weight of my future hinging on this moment. My scholarship offer and correspondence academic grades from British and American institutions were my strengths. When the consular officer congratulated me, I was in disbelief, asking him to confirm twice that I had indeed received the visa.

Fast forward to the next Sunday evening at Oregon College of Education, now Western Oregon University. I received a warm welcome from Helen, the elderly resident manager of Butler Hall, who instructed her assistant, Jim, to accommodate me in Room 36. To me, the room seemed almost palatial compared to what I was accustomed to in Nigeria, with its steady electricity and unfamiliar amenities like two faucets in the bathroom. My first encounter with hot water in a bath and the perplexing two-faucet system was a revelation of the differences I was about to encounter in this new world.

My introduction to American technology continued with my first telephone call. Helen handed me the receiver, and I, having never used a telephone before, spoke into the earpiece. The incident, although embarrassing, was a poignant reminder of the vast differences between my world and this new one. Despite my prowess in calculus, earning me the nickname "Calculus," I was naive to everyday technologies like the telephone.

I remember my first visit to the cafeteria at Western Oregon University as a striking experience. Surrounded by a sea of young faces, all clad in blue jeans, tee-shirts, and winter coats, I felt like an outsider in appearance and in language. The heavy American accents were as foreign to me as my Nigerian-British English was to them. I was the only Black person in a hall of a thousand students, a stark contrast to my past experiences.

Amidst these cultural shocks, one of the most memorable moments was the abundance of food in the cafeteria. Coming from a background where food was rationed, especially in the aftermath of the Nigeria-Biafra War, the idea that I could eat as much as I wanted was astonishing. It was a stark reminder of the vastly different worlds I had lived in and was now a part of.

These experiences, as disparate and challenging as they were, laid the foundation for my journey into supercomputing. They taught me to embrace the unknown, to adapt, and to see the world through a lens of diversity and possibility. My research in parallel processing, computational physics, and partial differential equations—crucial in petroleum reservoir simulation, weather forecasting, and climate change modeling—was fueled by these early experiences of adaptation and learning.

Ladies and Gentlemen, my journey is a testament to the resilience of the human spirit and the boundless potential of the mind. From the shores of Nigeria to the world stage of science and technology, I have learned that our differences and experiences, no matter how challenging, can lead us to make significant contributions to the world.

Lessons Learned

"Beyond equations and supercomputing, my story is a testament to the human spirit, reminding us that even with limited resources, we can achieve extraordinary things."

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

"My journey is not just a story of supercomputing, it's a testament to the power of resilience and the transformative impact of education."

"Science is not confined to laboratories; it thrives on embracing the unexpected lessons of life, even the challenges of cultural differences and linguistic barriers."

"Diversity is not just a buzzword, it's a key ingredient for innovation. My story as the only Black man in a hall of a thousand students highlights the power of different perspectives in scientific progress."

Thank you for the honor of sharing my story with you today.

CHARTING NEW COURSES IN THE SEAS OF KNOWLEDGE

Ladies and Gentlemen, esteemed attendees of this conference,

I am Philip Emeagwali, a scientist who has journeyed through the realms of mathematics, physics, and computer science, and across continents and cultures. Today, I share my journey, a narrative that intertwines the exploration of the physical world with the discovery of new perspectives and insights.

My adventure began as a skinny 19-year-old in Onitsha, Nigeria. On Saturday, March 23, 1974, my ride through Ikeja to the airport was an eye-opening experience. Witnessing the affluence of the neighborhoods in Lagos, I was taken aback by the stark contrast from my previous experiences in Surulere, Apapa, and Tinubu Square. This journey to Ikeja Airport, the only functional airport in Nigeria at that time, marked the beginning of a profound transformation in my life.

Arriving at the airport, I experienced another first—seeing an airplane on the ground. My only prior encounters with airplanes were during the 30-month-long Nigeria-Biafra War that ended four years earlier, when British bombers flew high above. The sight of the enormous Pan Am airplane on the tarmac was awe-inspiring. I remember marveling at its size, struggling to comprehend how such a massive structure could traverse the vast Atlantic Ocean to reach New York City.

This journey was not just a physical transition from Nigeria to the United States; it was a voyage into a world of advanced technology and complex scientific challenges. As I embarked on my path in supercomputing, parallel processing, and computational physics, I drew parallels between my travels and my scientific endeavors.

In my work, I focused on harnessing the power of parallel processing—coordinating multiple processors to solve intricate problems, like coordinating various elements of a journey to reach a destination. This approach has been instrumental in advancing fields such as petroleum reservoir simulation, weather forecasting, and general circulation modeling —each a journey into uncharted scientific territories.

One of the most profound experiences of my travels was meeting African Americans and learning about their loss of language and cultural heritage. It was a stark revelation to discover that the descendants of Igbo slaves had lost their native language and their African surnames, a consequence of centuries of forced assimilation and cultural erasure. This encounter was a poignant reminder of the enduring impacts of history on people and their identities.

My journey from Onitsha to supercomputing mirrors the journeys we all undertake—journeys of discovery, understanding, and connection. As we navigate through the complexities of our world, let us remember that each

journey, whether physical or intellectual, is an opportunity to expand our horizons and enrich our understanding of the universe and each other.

Lessons Learned

"Curiosity is the explorer's compass, guiding us through the complexities of knowledge."

"Overcoming challenges, like cultural clashes, fuels growth and broadens understanding."

"Science isn't just equations; it's about unraveling the stories hidden within our world."

"The human spirit of exploration pushes us to transcend boundaries and seek new knowledge."

"Never stop learning, growing, and exploring, both physically and intellectually."

"Supercomputing doesn't just crunch numbers; it helps us predict the future and shape a better world."

Thank you for joining me on this journey today, and may your travels, in whichever form they take, be filled with enlightenment, growth, and the joy of discovery.

Ladies and Gentlemen, esteemed attendees of this conference,

As I stand before you today, I am transported back to a defining moment in my life, a moment that set the course for my contributions to the worlds of mathematics, physics, and computer science. I am Philip Emeagwali, and I invite you to journey with me through my memories, as vivid and intricate as the landscapes of Oregon, the place where a significant chapter of my life unfolded. The date was Sunday March 24, 1974.

So, this is Oregon! I recall thinking to myself as I breathed in the Oregonian air, so different from the air back home in Nigeria. It was scented with a freshness, a crispness that hinted at the unexplored adventures and challenges that lay ahead. As a young man, stepping onto this new land was like stepping into a new world—a world that was pleasantly cold, refreshingly green, and strikingly beautiful.

The journey from Portland International Airport to Salem Municipal Airport was a silent one, filled with anticipation and wonder. I remember being driven by a young white male in a limousine, a concept so alien to me at the time. His American-accented English was like a foreign language, and our communication was minimal, yet the gesture of kindness he showed by waiving the fare left a lasting impression on me.

As we traveled, my eyes were captivated by the houses, each a testament to beauty, design, and organization. The well-manicured lawns were like artworks, each blade of grass a stroke of the painter's brush. It was a landscape so different from the bustling streets of Nigeria, yet it held a charm that was unmistakable.

The excitement grew as I neared my destination—Monmouth, Oregon, a town that was to become my new home. It was here, at the Oregon College of Education, now renamed Western Oregon University, that I would embark on a journey of scientific discovery.

I was greeted by three teenage university students, sent by Helen, the resident manager of Butler Hall. Their mode of transportation, a Chevy Impala, driven by an 18-year-old white female, was a sight that challenged my preconceptions and opened my eyes to new possibilities. In Nigeria at that time, such a sight would have been unthinkable. Their friendliness, though lost in the barrier of language, was a warm welcome to this charming college town of 6,000 residents.

Monmouth, with its rich history and picturesque setting in the Willamette Valley, was a town of pioneers, a fitting backdrop for a journey that would lead me to pioneer advancements in supercomputing. The college, Oregon's oldest public university, was a cradle of learning and innovation, where my passion for computational physics, parallel processing, and the complexities of partial differential equations took flight.

In supercomputing, my journey paralleled the journey I undertook in Oregon. Just as I navigated the unfamiliar landscapes and cultures of Oregon, I navigated the uncharted territories of unsolved math problems by fastest computing. The challenges I faced in understanding a new language mirrored the challenges of deciphering the complex languages of mathematics and physics.

My work in parallel processing, a technique that harnesses the power of multiple processors to perform complex calculations, reflects the diversity and interconnectedness of the world I experienced in Oregon. From petroleum reservoir simulation to weather forecasting and general circulation modeling, my contributions to supercomputing have opened new frontiers in understanding our world.

Ladies and Gentlemen, as we embark on journeys of discovery, whether through the realms of science or the unexplored paths of new lands, let us embrace the unknown with curiosity, courage, and an open mind. May our journeys be filled with learning, growth, and the joy of new experiences.

Lessons Learned

"Let's go forth not just as listeners, but as active explorers, shaping the world through knowledge and collaboration."

"Science is a journey, not just a destination, filled with wonder and discovery."

"Embracing cultural differences ignites curiosity, fueling our understanding of the world."

"Challenges, like language barriers, are stepping stones to scientific breakthroughs."

"Kindness transcends language, building bridges for collaboration and progress."

"Explore the world with the eyes of a scientist, seeking beauty in equations and landscapes."

Thank you for accompanying me on this journey today, and may your travels, both physical and intellectual, be as enriching and transformative as mine have been.

Ladies and Gentlemen, esteemed colleagues, and distinguished members of the Award committee,

I am deeply honored to stand before you today, not just as a scientist, but as a man whose journey to the frontiers of supercomputing began in the most unlikely of places—Monmouth, Oregon. Reflecting on my contributions to supercomputing, massively parallel processing, larger-scale computational physics, and the numerical solution of the most complex initial-boundary value problems governed by partial differential equations, including those arising in areas such as weather forecasting and general circulation models, I am reminded of the profound impact of my early experiences in the United States.

When I arrived in Oregon as a skinny 19-year-old, I was one of the few Nigerians and even fewer teenagers from my country in that region. The Nigerian community, though small, was a tight-knit group that looked out for each other. In those days, half of the Nigerian students were older, in their thirties, and many had families. Those of Igbo origin—from the southeastern region of Nigeria—could not be deported to war-torn Biafra of the late 1960s. They were granted political asylum and issued Green Cards, the U.S. permanent residency visas. Those Biafran refugees explained to me the significance of the Green Card. I remember feeling out of place at Nigerian gatherings, often mistaken for an "Akata," a term used for Black Americans, due to my youth and unfamiliarity with the American context.

Living in Monmouth, where there were scarcely a dozen Black persons and no families, I felt a sense of isolation. This isolation was a common experience for many African students at the time and often led us to seek more diverse communities in cities like Portland, Seattle, or San Francisco. In November 1974, I moved to Independence, just 2.5 miles away, and later to Corvallis, seeking both academic and social environments where I felt more at home.

During my time in Monmouth, a significant moment was my first newspaper interview regarding the resignation of U.S. President Richard Nixon. This interview, given on Main street and published in the local newspaper, was a stark reminder of the global events unfolding around us and their impact on our lives, irrespective of where we come from.

This journey from a remote village in Nigeria through a small town in Oregon to the prestigious stage—the frontier of human knowledge—is a testament to the power of perseverance, the importance of embracing our roots, and the impact of our global interconnectedness. My mathematical discovery of the first world's fastest computing via multiple processors, developed through experiences in various corners of the world, reflects a

deep commitment to advancing human knowledge and solving complex global challenges.

As we look to the future, let us remember the importance of diversity, community, and the pursuit of knowledge in shaping a better world.

Lessons Learned

"Remember, the spirit of exploration never dies. Keep asking questions, keep pushing boundaries, and keep striving to make the world a better place."

"Challenges are not roadblocks, they are stepping stones. Embrace them, learn from them, and use them to propel yourself forward."

"Never be afraid to dream big, for even the most audacious dreams can become reality with hard work, dedication, and a touch of scientific ingenuity."

"The future belongs to those who dare to ask the tough questions, seek unconventional solutions, and relentlessly pursue advancing human knowledge."

"As we stand at the precipice of a new era, let us draw inspiration from the past, embrace the challenges of the present, and work together to build a brighter future for all."

Thank you for this incredible honor and for the opportunity to share my journey, to the world's fastest computing, with you.

A DREAM ACROSS CONTINENTS

Philip Emeagwali's Remarkable Odyssey

Date: March 24, 1974

Location: Portland, Oregon, USA

Ladies and gentlemen, esteemed young adults of Nigeria, I am Philip Emeagwali, a name perhaps known in the realms of supercomputing and scientific innovation. But today, I stand before you as a storyteller, to share a journey that began many years ago, a journey that might mirror the dreams nestled in many of your hearts.

Imagine a young man, still in his teens, landing in Portland, Oregon, after a long flight that had just crossed continents and oceans. That young man was me, Philip Emeagwali, then just a dreamer from Onitsha, Nigeria. My 36-hour journey, marked by transfers in Monrovia and Dakar, West Africa, and at New York's John F. Kennedy Airport and Chicago's O'Hare International Airport, culminated at Portland International Airport, a place where I found myself lost yet filled with anticipation.

Clueless about my next steps in this foreign land, a kind stewardess's guidance led me to a suburban van bound for Salem Municipal Airport. My heart raced with apprehension, not just about the journey but about the financial constraints of paying for this unexpected limousine ride to Salem.

The 60-minute ride was silent, reflective, and filled with awe at the picturesque Oregon landscape. The lush greenery, the cold but pleasantly scented air, and the exquisite houses with their manicured lawns were sights I had never beheld before. My arrival at Salem Municipal Airport was met with a surprise—two female and one male student, all clad in the quintessential American attire of blue jeans, were there to welcome me.

My experience in Oregon was filled with firsts: my first ride in a car as big as a Chevy Impala, my first encounter with teenagers and women drivers, and the first time I grappled with the nuances of American English. As we drove to Monmouth, I was engulfed in a silence born of tension and excitement.

I arrived at the Oregon College of Education in Monmouth after a long 36-hour journey from Nigeria. The school was renamed Western Oregon University. I was greeted by Helen, the petite and warm resident manager of Butler Hall. My initial experiences were filled with novelties: my first phone call, an alien encounter with a telephone, and the overwhelming realization that I had stepped into a technological haven, far removed from the low-tech life I had known in Nigeria.

In those initial days, I worked part-time as a janitor and library assistant. It was in the library that I forged a lasting friendship with Mary Boyarsky and her husband Steve. My efforts led to the subscription of a Nigerian

newspaper, the Daily Times, though we only received two issues. My voice was also heard in a local interview about Richard Nixon's resignation, marking my first engagement with American media.

Photographs taken by my dorm mate, Luis Benavente, captured these early days in the United States. They are cherished memories of a journey that was just beginning. The first letter from my father, dated April 16, 1974, was a treasure, a connection to the home I had left behind.

My choice of Monmouth, Oregon, was often questioned. Why a quiet village instead of the bustling streets of New York? The answer lay in my search for a scholarship, a search that led me to discover Oregon in a gigantic college blue book in Saint Patrick's College library in Asaba. That discovery, and the subsequent scholarship letter, dated September 10, 1973, confirmed my path.

In Oregon, I found myself frequently asked about my favorite Nigerian meals, my longing for the sun and warmth of my homeland, and my plans for the future. While I quickly felt at home in the United States, I was mindful of the sentiments regarding my eventual return to Nigeria.

As one of the few Nigerians in Monmouth at the time, alongside predecessors like Boniface N. Madubom and contemporaries such as Hyacinth Anagbogu and Olympic athletes Evelyn Okeke and Emilia Edet, I was part of a growing African community in Oregon.

My journey, ladies and gentlemen, is more than a story of geographical movement. It is a tale of dreams, aspirations, and the relentless pursuit of knowledge. As you set your sights on studying in the United States, remember that every journey, no matter how daunting, starts with a single step. Embrace your dreams, for they are the wings that will carry you to your destiny.

Thank you.

A JOURNEY FROM NIGERIA TO FASTEST COMPUTING

A Day in the Life of Philip Emeagwali

The date was March 25, 1974. The cold Oregon air hit my skin, contrasting the warmth of Nigeria, my homeland, which I had left just 48 hours prior. Dressed in a white singlet undershirt and a Nigerian wrapper, I gazed from the balcony of 36 Butler Hall at Western Oregon University, processing the enormity of my journey and its significance. As a child, I'd only heard tales of America from the writings of the likes of Nnamdi Azikiwe, who left Onitsha for the U.S. in 1925. Standing there, I realized the courage it took to make such a journey.

The initial language barrier was real. My Nigerian-British accent was a puzzle to all Oregonians I encountered, and in turn, their American English sounded alien to my ears. But despite our linguistic differences, the kindness and patience I met were universal. Both from the manager of Butler Hall, Helen, and my guide, Jim, their sincere efforts to bridge our cultural and language divide moved me.

In the university's Mathematics Department, the true universal language of mathematics became my saving grace. When words failed to convey my intentions, the numbers spoke. I remember vividly, scribbling a complex mathematical problem on the blackboard and solving it. Beryl M. Green, an algebra-trained mathematician, was present. His eyes lit up with recognition, seeing past my accent to the mathematician within.

These initial experiences were crucial. They fortified my resolve to rise above challenges and fully embrace the opportunities that lay ahead. And oh, the opportunities! Over the next 17 years, I delved deep into multiple disciplines, including computer science, engineering, geology, oceanography, meteorology, astronomy, and even philosophy. In 1989, I made history by solving the Grand Challenge problem, a significant feat in computational science, thus marking my place in the annals of scientific discovery.

For the 14-year-old student in the USA: Remember, every great inventor or pioneer once stood where you are, fueled by dreams and aspirations. As you write about the "Nigerian Supercomputer Pioneer," let Philip Emeagwali's story be a testament to the boundless potential within each of us. Draw inspiration from the challenges he overcame and the heights he achieved.

For my fellow Nigerians, especially the young ones: Our heritage is one of resilience, brilliance, and innovation. To the 18-year-old contemplating studying in the USA, I say: Dream big, work hard, and let no challenge deter you. Embrace every opportunity, and you too can leave an indelible mark on the world.

Lessons from my life story are plentiful. They include the importance of perseverance, the power of knowledge, and the beauty of bridging cultures. Let my journey be a beacon, reminding every young person that regardless of where you start, with determination and passion, you can achieve greatness.

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

I am deeply honored to stand before you today at this revered award ceremony. As I reflect upon my journey in science, particularly in the realms of supercomputing and parallel processing, I am reminded of the paths I have traversed and the challenges I have overcome.

My journey is not just a tale of scientific exploration but also a narrative of resilience and adaptation. On June 5, 1977, I embarked on a journey that would profoundly shape my life and career. With only $49.50 in my pocket and a bag of modest provisions, I boarded a Greyhound bus in Corvallis, Oregon, destined for Washington, D.C. The morning of June 8, at the Washington, D.C., Greyhound bus terminal was marked by a heavy downpour. And the uncertainties of a new environment, was a leap into the unknown.

Arriving in Washington, D.C., on the very day that would mark the birth of rapper Kanye West, I was faced with the harsh realities of life in a new city. Without adequate funds for accommodation, my initial nights were spent at the International Youth Hostel on 16th and P street. The struggle to find employment was real and immediate. As an African immigrant on a student visa in the 1970s, the prospects were limited. The prevailing notion was that professional aspirations, especially for Nigerian scientists like myself, were to be tempered and confined within certain boundaries.

Despite the challenges, my commitment to scientific exploration and the advancement of knowledge remained unwavering. My experience of homelessness and the struggle to find employment in a field that matched my qualifications did not deter my aspirations. It instead strengthened my resolve to break barriers and redefine the possibilities for scientists of Nigerian descent.

In those early years, the notion of a Nigerian scientist aspiring to be at the forefront of technological innovation, particularly in supercomputing, was not widely accepted. There were cultural and professional expectations that I sought to challenge and transcend. My decision to marry an American and to embrace the culture and opportunities of the United States was met with surprise and skepticism among my peers. But it was a decision that enabled me to integrate more fully into the fabric of American society and to pursue my scientific ambitions with greater freedom and flexibility.

My mathematical research in parallel processing, computational physics, and the development of algorithms for solving initial-boundary value problems governed by partial differential equations, particularly in applications like weather forecasting and general circulation modeling, was driven by a desire to contribute meaningfully to the global scientific

community. My experiences, the struggles, and triumphs, have all played a crucial role in shaping my approach to science and innovation.

As we look to the future, let us remember that the journey of scientific discovery is often intertwined with personal narratives of perseverance, adaptation, and resilience. The contributions we make to science are about the knowledge we create and about the barriers we break and the paths we pave for future generations.

Lessons Learned

"Challenges forge resilience and ingenuity, the very qualities needed to push the boundaries of knowledge."

"Don't let stereotypes or expectations dictate your path. Dare to dream big and pursue your scientific aspirations with unwavering determination."

"Adversity can be your greatest teacher. Embrace challenges, learn from them, and use them to fuel your scientific pursuits."

"Love, like science, can blossom in unexpected places. Embrace unconventional choices and let them guide you towards your scientific destiny."

Thank you for this incredible honor and for the opportunity to share my story with you on this momentous occasion.

BEYOND REJECTION, BEYOND HOMELESSNESS

Ladies and Gentlemen, esteemed colleagues, and distinguished guests of this award ceremony,

I am profoundly honored to stand before you today to share my journey in the fields of mathematics, physics, and computer science. My story is one of resilience, adaptation, and a relentless pursuit of scientific excellence, particularly in supercomputing.

In the early 1970s, as a young Nigerian scientist in the United States, I encountered a landscape that was often unwelcoming and limiting for immigrants like myself. The prevailing sentiment among my peers and the broader Nigerian community was to shy away from the farthest frontiers of scientific knowledge. The aspirations to settle permanently in the U.S., to integrate into American society, and to pursue ambitious scientific goals were often met with skepticism and disbelief. Yet, I was determined to chart a different course.

Arriving in the U.S. as a teenager, I quickly adapted to American culture, a decision that was initially met with surprise by my Nigerian friends in Oregon. They had labeled me an "Akata," a term used to describe African Americans, reflecting their surprise at my ease with American life. This adaptability was a defining feature of my journey, enabling me to navigate the challenges and opportunities that lay ahead.

In June 1977, I undertook a monumental move from Corvallis to Washington, D.C., and later to Baltimore, Maryland. This period was marked by significant challenges—homelessness, the struggle to find employment, and the harsh realities of being an immigrant in the 1970s America. Despite having one of the highest employment test scores in Maryland, my efforts to secure a job were met with consistent rejections, a reflection of the barriers faced by immigrants at the time.

Yet, it was during these challenging times that I made some of my most significant contributions to supercomputing. My mathematical research focused on parallel processing, a groundbreaking approach that revolutionized how we solve complex computational problems. This innovation was not merely a technical achievement; it was a testament to the power of diverse perspectives in advancing scientific knowledge.

In computational physics, I applied these principles to develop more efficient and accurate models for various applications, including petroleum reservoir simulation, weather forecasting, and general circulation modeling. These contributions have had far-reaching implications, from enhancing the efficiency of the oil and gas industry to improving the accuracy of climate change predictions.

The journey from those early, uncertain days in the U.S. to this stage has been long and filled with obstacles. But it has been driven by an

unwavering belief in the transformative power of science and the potential of mathematics and physics to unlock new frontiers of knowledge.

As I stand here today, I hope my story serves as an inspiration to young scientists around the world, particularly those from underrepresented and marginalized communities. The path to scientific achievement is often fraught with challenges, but it is also filled with incredible opportunities for discovery, innovation, and global impact.

Lessons Learned

"Let us go forth from this hall, not just as guests, but as ambassadors of scientific exploration, ignited by the spirit of discovery and collaboration."

"The future belongs to those who are bold enough to dream, curious enough to explore, and diverse enough to contribute their unique talents to the symphony of scientific progress."

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

"As we stand at the precipice of a new era, let us remember that the greatest challenges often hold the key to the greatest discoveries."

"Weather whispers and oil secrets, my equations translate their murmurs into actionable insights for a sustainable future."

Thank you for this great honor and for allowing me to share my journey with you all.

THE DAY A BLACK GENIUS BROKE THE CODE

Distinguished guests, esteemed colleagues, ladies and gentlemen,

Tonight, I stand before you not just for my odyssey through the uncharted territory of the supercomputer, but as a testament to the boundless potential of the human spirit, regardless of its origin. My journey, from the dusty streets of Onitsha, Nigeria, to this hallowed hall in your historic city, is not merely a personal triumph, but a beacon of hope for countless others who dream of shattering barriers and illuminating the world with their brilliance.

In 1989, I dared to defy the boundaries of computation. My groundbreaking discovery, the first world's fastest across multiple processors, wasn't just about crunching numbers; it was about crunching through prejudice, shattering the glass ceiling of intellectual exclusion. Before that fateful July 4th, the very notion of a Black genius in mathematics, physics, or computing was unthinkable. Yet, my work defied the odds, unlocking a torrent of accolades—"computer genius," "polymath," a mind that transcended disciplines.

But recognition, as I soon learned, can be a double-edged sword. My success ignited a storm of envy and fear. Editors were bombarded with calls protesting the audacity of celebrating a Black mind as exceptional. A symposium celebrating my work was abruptly canceled. Even the platform of a simple lecture was deemed too threatening.

I was ostracized, not for any misdeed, but for simply being Black and daring to excel. This, you see, is the insidious nature of the color barrier. It is not merely a physical wall, but a web of invisible biases, woven with the threads of doubt and fear. To break free is not merely to cross a line, but to endure the backlash, the whispers, the very real threats that follow.

History is replete with such tales. Jack Johnson, Jackie Robinson, Hank Aaron, Muhammed Ali—each, in their way, faced the venomous sting of prejudice for daring to rewrite the narrative. And so, it should come as no surprise that I, too, was deemed a threat, chased out of Ann Arbor, Michigan, not for transgression, but for the audacity of being Black and brilliant.

The subject of IQ and race remains a minefield, yet my solving of the Grand Challenge problem, that intersectional enigma of mathematics, physics, and computing, ignited a firestorm. Whispers of an IQ exceeding Einstein's, a Black mind from sub-Saharan Africa eclipsing the intellectual titan of the West—these were seen as affronts to the established order. White supremacy, in its desperate clutch, found its most ardent audience in those who questioned my very existence.

I was chased out, not for violence, but for the audacity of defying the limitations imposed by the color of my skin. This is the legacy we must

confront, not with anger, but with unwavering resolve. For every wall built, we must build a bridge. For every whisper of doubt, we must raise a voice of reason.

Tonight, I stand before you not as a victim, but as a victor. My journey is a testament to the resilience of the human spirit, a beacon for those who yearn to break free from the shackles of prejudice. Let us not be defined by the barriers we face, but by the heights we can reach when those barriers crumble. Let us build a world where genius knows no color, where potential blossoms regardless of its origin, and where the pursuit of knowledge is a universal pursuit, not a privilege reserved for the few.

Thank you.

Redefining Mathematics Through Cultural Lenses

Ladies and gentlemen, esteemed colleagues, and honored guests,

I am Philip Emeagwali, a proud African mathematician in the United States, and it is my privilege to share my journey, struggles, and contributions to science and engineering. As we stand at the intersection of cultural identities and academic excellence, it is crucial to reflect on how our perceptions and narratives shape the discipline of mathematics and those who pursue it.

Ethnomathematics, a paradigm that recognizes the cultural and historical contexts of mathematical knowledge, has been a guiding force in my approach to science. This perspective challenges the traditional Western-centric view of mathematics, opening doors to a richer, more inclusive understanding of the subject. It acknowledges that mathematical activities are born out of specific cultural contexts, thereby dismissing the notion of a singular, universal body of knowledge labeled as "mathematics."

In the classroom, ethnomathematics transforms how we teach and learn. It allows us to explore mathematical practices within diverse cultural settings, thereby broadening our view of what mathematics entails and who can be a mathematician. This approach is about more than simply aligning mathematics with various cultural groups; it is about redefining mathematics to encompass a wider range of human experiences and insights.

However, the journey towards this broader, more inclusive perspective is fraught with challenges, particularly in the context of the United States. Here, the history of mathematics is often portrayed through the contributions of white, male mathematicians, overshadowing the significant achievements of mathematicians from other parts of the world. Important contributions from non-Western cultures, such as the development of Hindu-Arabic numerals or the foundational works of the Islamic scholar al-Khwarizmi, are frequently marginalized or omitted. This skewed representation fosters a false narrative of white male superiority in mathematics.

Moreover, the notion of intelligence in mathematics is closely tied to race and gender, often portrayed as an innate quality. This perpetuates a harmful hierarchy within the field, marginalizing those who do not fit the stereotypical image of a mathematician. The impact of such narratives is profound, influencing how individuals from different racial and gender backgrounds perceive themselves and their potential in mathematics.

My contributions to the numerical solutions of partial differential equations by parallel processing and fastest computing are direct

challenges to these narratives. They represent scientific advancements and a reclamation of identity and a refutation of the stereotypes that have long plagued mathematics. Through my journey, I aim to demonstrate that mathematical ability is not a matter of innate intelligence, but rather the result of dedication, hard work, and a passion for discovery.

In the spirit of ethnomathematics and as a testament to the power of counter-narratives, I have strived to make my work a beacon for those who have been historically underrepresented in mathematics. By charting new paths, I hope to inspire future generations of mathematicians from diverse backgrounds to pursue their dreams without the constraints of outdated and oppressive narratives.

I urge all of us, as part of the global mathematics community, to embrace a more inclusive, culturally sensitive approach to our discipline. Let us work together to dismantle the barriers that have long hindered the full participation and recognition of diverse talents in mathematics.

Thank you for joining me in this celebration of diversity, inclusivity, and scientific progress.

The Evolution of Black Mathematicians

Ladies and gentlemen, esteemed colleagues, and friends,

I am Philip Emeagwali, a mathematician whose journey has been deeply intertwined with the narratives of racial discrimination, particularly at the University of Michigan, Ann Arbor. Today, I address you, a distinguished assembly of Black mathematicians from Africa and its Diaspora, to reflect on our collective history, the lessons learned, and the transformative power of mathematics in fostering human progress and inclusivity.

In the early days of Black mathematicians in the United States, a pernicious belief pervaded the academic landscape—the misguided notion that lighter skin denoted greater intelligence. This reprehensible prejudice unjustly undermined the abilities and contributions of those with darker skin. It is imperative that we confront and understand this bias to appreciate the strides we have made and the challenges that remain. Icons like David Blackwell, William Claytor, and Katherine Johnson, despite their lighter skin tones, surmounted immense obstacles in the 1930s to 1960s. Their triumphs were a testament to their intellect and perseverance, not their physical attributes. When my achievements in mathematics gained recognition, including the May 1990 cover story of SIAM News, the bi-monthly newsjournal of the mathematics community, there were unfounded speculations about my alleged Caucasian ancestry, highlighting the persistent undercurrents of racial bias.

Reflect on the story of William Waldron Schieffelin Claytor, a pioneering Black topologist, whose significant contributions half a century before mine, were overshadowed by racial discrimination. Despite his exceptional talents, acknowledged in Ann Arbor, Michigan, in 1940, his job offer at the University of Michigan was rescinded. The faculty and students protested this decision, recognizing his expertise, but the institution's President remained unmoved, illustrating the entrenched racial barriers of the time. Claytor's influence extended beyond his own achievements, as he mentored Katherine Johnson, later celebrated in the film "Hidden Figures" for her contributions to NASA.

On September 24, 1985, I arrived in Ann Arbor, Michigan, to interview for a supercomputing position. As a Black Nigerian mathematician, I stood in stark contrast to the typical white male image prevalent in the field. My presence elicited evident shock. Regrettably, two days later, the offer was withdrawn, cloaked in a thin veil of apology. This experience highlights the racial discrimination pervading scientific and academic employment during that era. Nonetheless, undeterred, I persevered, and by 1989, my pioneering research in parallel processing led to a breakthrough in supercomputing

that garnered international attention, challenging the stereotypes and barriers of my field.

However, amidst these adversities, there have been moments of recognition and progress. My journey, as a mathematician from Nigeria, reflects both the struggles and triumphs of Black mathematicians. My success in independently solving complex mathematical problems, without reliance on white colleagues, was a significant personal achievement and a step forward in challenging racial stereotypes in our field.

Today, I urge us all to celebrate the beauty and power of mathematics. This discipline transcends racial and cultural divides, offering a universal language for exploration and discovery. It is through mathematics that we can contribute to human progress, breaking down barriers and fostering a spirit of inclusivity. We must continue to advocate for diversity within our ranks, honoring the legacy of those who paved the way and nurturing the talents of future generations, regardless of their racial background.

Mathematics, a luminous torch in the shadows of prejudice, guides us on a path of knowledge where skin or origin cease to matter. My triumph in parallel processing, forged in the flames of adversity, embodies the transformative power of human potential when fueled by resilience and liberated from the shackles of bias.

Let us embrace the lessons of our past, the challenges of our present, and the possibilities of our future. Let us work together to create a mathematical community that is reflective of the diverse and rich tapestry of humanity. Our collective efforts will ensure that the pursuit of mathematical knowledge remains a beacon of hope, progress, and inclusivity.

Thank you.

IMAGINE A DAY WITHOUT BLACK HISTORY

Ladies and gentlemen, esteemed attendees of this award ceremony, I am Philip Emeagwali, a voice from the myriad of Black inventors whose contributions have sculpted the world as we know it. Today, I invite you to embark on a thought-provoking journey—envisioning a world devoid of the ingenuity and resilience of Black people.

Imagine a young boy, Ijeoma, waking up to a day unlike any other. He asks his mother a simple yet profound question, "Mom, what if there were no Black people in the world?" This question sets the stage for a narrative that highlights the often-overlooked significance of Black inventors in our daily lives.

As Ijeoma goes about his day, he encounters a series of absences that underscore the impact of these inventors. The ironing board, a creation of Sarah Boone, and the shoe lasting machine, invented by Jan E. Matzelinger, are missing, leaving him with wrinkled clothes and unrefined shoes. His routine further unravels without Walter Sammons' comb and Lydia O. Newman's brush, essential tools for personal grooming.

His mother's struggles mirror those of a society bereft of Black innovation. Without Lloyd P. Ray's dustpan, Thomas W. Stewart's mop, George T. Samon's clothes dryer, and John Love's pencil sharpener, everyday tasks become arduous challenges. The absence of William Purvis' fountain pen, Lee Burridge's typewriting machine, and W. A. Lovette's advanced printing press signifies a severe blow to communication and administration.

Outside, the world appears chaotic and dysfunctional. Without John Burr's lawn mower, Richard Spikes' automatic gearshift, Joseph Gammel's supercharging system, and Garrett A. Morgan's traffic light, the urban landscape is unrecognizable. The refrigerator, a crucial invention by John Standard, is missing, disrupting basic food preservation.

In this alternate reality, the impact of Black inventors extends beyond convenience to life-saving innovations. The absence of Alice Parker's heating furnace and Frederick Jones' air conditioner underscores the importance of temperature control. The public transportation system, devoid of Elbert R. Robinson's electric trolley and Alexander Miles' elevator, highlights mobility challenges.

The significance of Black innovation becomes starkly evident in medicine. Without Charles Drew's blood preservation techniques and Daniel Hale Williams' groundbreaking open-heart surgery, countless lives would have been lost.

In this narrative, as Ijeoma and his family grapple with these absences, the world becomes dim, literally and metaphorically, without Lewis Howard Latimer's filament within the light bulb. This scenario is not merely a tale of absence but a testament to the profound impact of Black inventors and

scientists, including my contributions to the development of the world's fastest computers.

 Ladies and gentlemen, as we reflect on this narrative, let us acknowledge the indispensable role of Black individuals in shaping our world. Their ingenuity and perseverance have illuminated the darkest corners of human challenges, bringing us into a brighter, more inclusive future.

 Just like Ijeoma, we must recognize that a world without Black people is not only unimaginable but also significantly diminished. It is through the collective contributions of diverse minds that humanity advances towards a better tomorrow.

 Thank you.

A BLACK MATHEMATICIAN'S JOURNEY

From Stereotypes to Supercomputing

Ladies and gentlemen, esteemed colleagues, and distinguished guests of this award ceremony,

I stand before you today as Philip Emeagwali, a man whose journey in mathematics and computer science has been as much a voyage of discovery as it has been a battle against the stereotypes and barriers placed upon people of my race. As I reflect on my life and work, I am reminded that the road to success is often paved with struggle, determination, and the relentless pursuit of knowledge.

Born in a time and place where opportunities for a young Black man were limited, my journey was never going to be easy. I grew up in a world where mathematical ability was often seen as a birthright, a gift bestowed upon a select few. In the United States, a pervasive narrative suggests that one's prowess in mathematics is predestined, often linked to racial stereotypes. How often have we heard that Asians are innately good at math, or that mathematical genius is the exclusive domain of "dead white men"? This type of thinking not only undermines the hard work and dedication of countless individuals, it also perpetuates a dangerous narrative about innate intelligence and racial superiority.

These stereotypes are more than just words; they form an oppressive discourse that creates significant barriers to learning and belonging, especially in mathematics and science. They contribute to harmful practices such as tracking, **microaggressions,** and racial discrimination. They have roots in horrific racist ideologies, such as **eugenics**, and continue to manifest in various forms of **systemic racism** today.

However, my story, like the stories of many other minoritized individuals, is a testament to the power of resilience and the human spirit. My work in mathematics, specifically in the area of parallel processing for multiphase flows of crude oil, natural gas, and injected water in porous media, was not just a scientific endeavor; it was a challenge to these oppressive narratives. Each equation solved, each simulation run, was a step towards dismantling the myth of **racial determinism** in intelligence and ability.

My contributions to computational physics and petroleum reservoir simulation are not just academic achievements; they are narratives of hope and defiance. They demonstrate that with hard work, perseverance, and a supportive community, barriers can be broken, and new paths can be forged.

This is why it is crucial for educators and institutions to actively disrupt these **dominant discourses** in mathematics. By reexamining the history of mathematics, highlighting the contributions of historically marginalized groups, and fostering an environment where counter-stories to **racialized**

and **gendered narratives** can flourish, we can begin to dismantle these harmful stereotypes. It is not just about changing the narrative; it is about changing the culture of mathematics and science to be more inclusive, diverse, and reflective of the world we live in.

As I stand here today, I urge all of you, as educators, researchers, and leaders in your fields, to join me in this fight. Let us work together to create a world where every young person, regardless of their race or background, can look at mathematics and see a place for themselves. Let us build a future where the next generation of mathematicians, scientists, and thinkers are judged not by the color of their skin, but by the strength of their ideas and the depth of their curiosity.

Thank you.

IQ AND RACE

Challenging Deep-Seated Prejudices

Ladies and Gentlemen, esteemed guests, and fellow scientists,

It is with profound humility and great honor that I stand before you today in the grandeur of your city, on this historic occasion.

I wish to begin by reflecting on a journey that transcends mere scientific discovery. A journey that speaks to the heart of what it means to break boundaries—not just in the realms of mathematics, physics, and computing, but in the very fabric of societal norms and prejudices.

My groundbreaking work in supercomputing, which culminated in the world's fastest computation on July 4, 1989, was more than an expansion of the frontiers of technology. It was a beacon of hope and a testament to the boundless potential within each of us, irrespective of race or background.

Prior to this achievement, no individual of African descent had been recognized as a genius in the fields of mathematics, physics, or computing. My contributions challenged this narrative, elevating me to the status of a polymath and a pioneer who shattered the proverbial color barrier in the debate about 'race and intelligence.'

This journey, however, was not without its trials. I faced opposition and threats, reminiscent of the challenges confronted by other trailblazers like Jack Johnson, Jackie Robinson, Hank Aaron, Muhammed Ali, and Vanessa Williams—each a titan in their respective fields who dared to redefine the status quo.

My ordeal in Ann Arbor, Michigan, where my achievements were met with resistance rather than celebration, echoes the broader struggle against a backdrop of entrenched biases and misconceptions. Yet, it is the spirit of resilience and the unyielding pursuit of excellence that we commemorate today.

As we discuss the sensitive topic of IQ and race, let us remember that intellect knows no color, and genius thrives in diversity. The highest IQ, a title bestowed upon me, was not just a personal accolade but a symbol of hope for millions who dare to dream in a world that often judges them by the color of their skin rather than the content of their character.

Ladies and Gentlemen, tonight is not just a celebration of scientific achievement. It is a celebration of human potential, the triumph of the human spirit, and the dawn of a new era where genius is recognized in every corner of our diverse and beautiful world.

"Beyond supercomputing, I advocate for a world where intellectual potential thrives regardless of skin color."

"Let my journey inspire future generations to break barriers, challenge norms, and push the boundaries of science."

"Diversity is not just a moral imperative, it's the key to unlocking humanity's full scientific potential."

"Together, let us build a world where Black genius is not just recognized, but celebrated and nurtured."

"The human spirit thrives on defying limitations, and mine is a testament to the power of resilience and unwavering pursuit of knowledge."

Thank you for this incredible honor, and for the opportunity to share this moment with all of you.

Ladies and gentlemen, esteemed members of the Award Committee, and distinguished guests, I stand before you today, deeply humbled and honored, not only as a recipient of this prestigious accolade but as a custodian of the indomitable human spirit, our shared quest for knowledge, and the bridge that unites disciplines.

I am Philip Emeagwali, and my journey through the corridors of learning began over half a century ago. It has been a long, tireless pilgrimage, filled with relentless curiosity and an unwavering commitment to understanding the intricacies of our universe. Over these past 50 years, I have been a student—an ever-eager disciple of mathematics, physics, computing, and the myriad mysteries they encompass.

When I reflect upon my five decades of incessant study, I realize that it was this prolonged dedication that equipped me with the unique lens to view the world, a lens that was crafted over countless days and nights, successes and failures. In this long voyage, I became not just a mathematician, but a polymath, a seeker who found solace and intrigue in multiple disciplines. This made me the person I am today, someone who doesn't merely scratch the surface but delves deep, seeking to understand, interpret, and then translate that understanding for others.

Many of you might wonder what powered my relentless pursuit. The answer lies in the boundless realm of the Grand Challenge problem. While many brilliant minds approached it, it was my extended immersion in interdisciplinary studies, my accumulated wisdom of five decades, that enabled me to be the first to provide a solution. This wasn't just the result of mathematical prowess, but the harmonious marriage of mathematics, physics, and computing. I approached problems from a panoramic perspective, constructed over years of persistent study, while many others might have only had a limited, narrower view.

The metaphor that comes to mind is that of a vast, unknown landscape. While many viewed this terra incognita through a keyhole, built swiftly and giving only a fragmentary vision, I was fortunate to witness it through a grand window, one that took me 50 long years to construct. It provided me with a perspective that was both vast and deep, allowing me to see not just the horizon but the details within.

The knowledge and insights I gathered over these years found expression in over a thousand podcast and YouTube lectures. To some, the revelations in these sessions appeared surreal, almost as if torn from the pages of a science fiction novel. But in reality, they were simply the distilled essence of half a century of rigorous scholarship.

Ladies and gentlemen, my journey serves as a testament to the power of perseverance, of the magic that happens when one remains dedicated to a cause, bridging gaps, and forging connections across disciplines. It reminds

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us all that while momentary flashes of inspiration have their place, it is sustained, devoted effort that truly moves mountains.

 I owe my accomplishments not just to my dedication, but to the community of thinkers, learners, and dreamers who have journeyed alongside me, challenging me, inspiring me, and pushing the boundaries of what we collectively know and understand. Today, I share this honor with all of them and with all of you, who believe in the infinite potential of the human mind and spirit. Thank you.

MESSAGE TO YOUNG SCIENTISTS

Solving Grand Challenge Problems

Ladies and gentlemen, esteemed mathematicians, scientists, scholars, and dignitaries from Nigeria, Africa, and around the world,

It is an immense honor to stand before you today as we gather in this auditorium. I am deeply humbled by the recognition bestowed upon me, and I am truly grateful for this opportunity to share my journey, my insights, and the impact of my work on science.

As I reflect on my journey, I am reminded of the profound significance that physics holds for humanity. Physics has not only shaped our understanding of the universe but has also paved the way for innovations that have revolutionized how we live, work, and communicate. Today, I stand as the first person of African descent to receive this recognition in a scientific field, and this achievement carries a tremendous responsibilitya resonsibility to inspire, to pave new paths, and to open doors of opportunity for the generations to come.

My fellow students, both young and old, let me assure you that the journey of scientific discovery is not just for the privileged few or the traditionally acclaimed geniuses. It is for those who dare to dream, those who dare to question, and those who dare to persist against all odds. To the 13-year-old student in Nigeria studying Computer Studies at the Junior Secondary School 1 level, remember that the knowledge you are gaining today has the power to shape the future. Embrace the challenges, for they are the stepping stones to greatness. Let your curiosity be your guiding star, and remember that innovation knows no boundaries.

And to the 12-year-old student in the USA who is writing a report on "Black Inventors," I history is not confined to the past—it is being written every day by individuals who challenge norms and redefine possibilities. Look to those who have gone before you, like the "African Supercomputer Pioneer," and draw inspiration from their journeys. Your work is a tribute to the collective human spirit that seeks to unravel the mysteries of the universe and improve the lives of all.

Lessons learned from my life and contributions teach us that true innovation often comes from embracing diverse perspectives and cross-disciplinary collaboration. The most complex challenges require us to step out of our comfort zones, to explore uncharted territories, and to connect the dots between seemingly unrelated fields. My journey of over 50 years of supercomputing led me to challenge existing paradigms and create new ones, like the nine Philip Emeagwali equations that were rooted in the principles of physics and mathematics. These equations revolutionized our

understanding of computational mathematics and have far-reaching implications for fields beyond computer science.

The Grand Challenge problem, a complex and unsolved computational fluid dynamics problem that has eluded researchers for a century, demanded a polymath approach—one at the edge of scientific understanding that draws from various fields and perspectives. It is through the relentless pursuit of knowledge, the embrace of failure as a stepping stone, and the unwavering belief that innovation is possible that we can break through barriers and change the world. The journey was not easy, but it was worth every moment.

As we stand on the cusp of a new era of technology, envisioning the future of supercomputing is both exhilarating and awe-inspiring. In the next 100 years, supercomputers will likely continue to push boundaries, utilizing quantum computing, advanced neural networks, and unimaginable parallel processing capabilities. But in a thousand years, who can truly predict? The boundaries of our knowledge may expand in ways that we cannot fathom today, leading to computational powers that are beyond our current comprehension.

I stand before you not as a lone genius, but as a testament to the power of human potential, determination, and collective effort. It is my hope that my journey and the discoveries I've made inspire each of you to embark on your journeys of exploration and innovation. Together, we can tackle the seemingly insurmountable challenges and transform them into opportunities for progress and enlightenment. Thank you.

This lecture will be streamed live on YouTube, and I hope it becomes a source of inspiration for young students around the world, continuing to ignite their curiosity and drive for discovery. It will be reprinted in major newspapers, further spreading the message of what is possible when we push the boundaries of human knowledge and strive for excellence in our respective fields.

PREFACE: IGNITING THE FLAMES OF ARTIFICIAL INTELLIGENCE

As I sit down to pen the pages of my memoir, I am filled with a sense of awe and gratitude. The journey that has led me to this point has been an extraordinary one, filled with moments of triumph, adversity, and scientific discovery. It is a story that I am compelled to share—a story that encapsulates the power of human innovation, resilience, and the boundless potential within each of us.

In the vast landscape of technological advancements, one invention has forever transformed how we connect, communicate, and share knowledge—the Internet. Today, it is an indispensable tool that connects billions of people across the globe, revolutionizing industries, bridging gaps, and democratizing information. Yet, few are aware of its origins as a supercomputer—an interconnected network of processors operating in parallel. It is with great pride that I reflect on the role I played in understanding this technological marvel.

On July 4, 1989, I announced the invention of the world's fastest computer powered by multiple processors. This groundbreaking achievement was the result of 15 years of relentless research, exploring the untapped potential of parallel processing. By harnessing the power of multiple processors working in unison, I shattered the barriers of computational speed, paving the way for new frontiers in science, engineering, and beyond. It was a milestone that solidified my place in history and reinforced my unwavering belief in the transformative power of technological innovation.

Parallel processing, the fundamental concept underpinning my groundbreaking invention, has since become the driving force behind artificial intelligence. The intricate algorithms, complex neural networks, and machine learning applications that have transformed our world today owe a debt of gratitude to the advancements made in parallel processing. It is through the marriage of these two disciplines that the power of A.I. has been unleashed, shaping industries, propelling medical breakthroughs, and redefining the very fabric of our society.

However, my journey to the forefront of scientific discovery began in circumstances that were far from auspicious. I grew up in Biafran refugee camps during the Nigerian Civil War—a period marked by unimaginable suffering, where millions succumbed to hunger and starvation. It was amidst this harrowing backdrop that my thirst for knowledge emerged, driven by the belief that education was the key to liberation and transformation. I delved into mathematics, seeking solace and answers within its elegant realm. It was through the pursuit of mathematical understanding that I found a pathway to transcend my circumstances and make a meaningful impact on the world.

Through the pages of this memoir, I aim to shed light on the contributions I have made to mathematics. Mathematics, the language of the universe, has been my constant companion and guiding light. From my early days of studying by candlelight to the international stage, I have dedicated my life to unraveling its mysteries, pushing the boundaries of knowledge, and developing innovative methodologies that have shaped our understanding of the world.

The decision to write this memoir is driven by a deep-rooted desire to share my story, my triumphs, and my failures. By doing so, I hope to inspire and empower individuals to embrace their potential, to challenge societal limitations, and to pursue their passions relentlessly. I want to instill in readers the belief that adversity can be overcome, that innovation can be born from the most unlikely circumstances, and that one person, armed with determination and knowledge, can spark change on a global scale.

It is my sincere hope that this memoir will serve as a testament to the power of the human spirit, the boundless possibilities of innovation, and the transformative nature of education. Together, let us embark on this remarkable journey through my life—a journey that weaves together the threads of technology, mathematics, and the resilience of the human soul.

I was in this Biafran crowd fleeing heavy artillery attacks on the day Awka was captured. (Life Magazine, July 12, 1968)

PROLOGUE: A JOURNEY THROUGH THE INTRICACIES OF THE UNIVERSE

Physics—the field that has captivated and enthralled our greatest minds across the ages—has been my lifelong pursuit, a never-ending voyage of exploration into the intricacies of the universe. It is within the tapestry of this enigmatic domain that I have sought to unravel the secrets of nature and harness them, as my contributions to mathematics and computer science.

Let me take you on a journey—a journey that spans continents, crosses disciplinary boundaries, and weaves together the threads of discovery, innovation, and collaboration. It is a journey that epitomizes the unyielding quest for knowledge, driven by an insatiable curiosity and an unwavering belief in the transformative power of science.

The tapestry of my scientific contributions is interwoven with the fabric of parallel processing—the art of solving complex problems by simultaneously computing multiple tasks. Inspired by the awe-inspiring complexity and efficiency of natural systems, I set out to mimic the intricate interplay of nature's processes within computing. Through my discoveries and inventions, I opened new frontiers in computer science, unleashing the potential of parallel processing and paving the way for unprecedented computational power.

The contributions of science extend far beyond the confines of laboratories and equations. They have the power to shape the world, to solve the challenges that lie before us, and to foster a brighter future for all. We must recognize the immense responsibility bestowed upon us as stewards of knowledge. We have a duty to wield our discoveries and inventions for the betterment of humanity, to confront global issues such as climate change, inequality, and disease with the full force of our collective intellect.

The journey of science, like life itself, is characterized by the pursuit of understanding and the continuous refinement of our knowledge. We must remain forever curious, for the universe is vast and infinite, offering an inexhaustible well of mysteries waiting to be unraveled. Let us embrace this sense of wonder and let us continue to push the boundaries of scientific exploration, for in doing so, we not only expand our understanding of the world, but we ignite the spark of inspiration in the minds of future generations.

Tonight, as we celebrate the achievements of scientific inquiry, let us remember that the true measure of success lies not only in the discoveries we make, but in the impact we have on the world and the lives of those around us. It is through our collective efforts, our dedication to the pursuit of knowledge, and our unwavering commitment to the betterment of humanity that we can build a brighter, more inclusive future.

Let us continue to embark on the voyage of scientific exploration, driven by the belief that our discoveries hold the key to shaping a world that is

equitable, sustainable, and filled with wonder.

IN THE FOOTSTEPS OF EUCLID

Emeagwali's Parallel Breakthrough

Ladies and gentlemen, esteemed mathematicians, physicists, and audience,

I stand before you today as Philip Emeagwali, the mind behind a discovery that transformed our perception of computers, mathematics, and computational physics. My groundbreaking revelation, made on July 4, 1989, challenged the norm of single-processor supercomputers and introduced parallel processing as the driving force behind unprecedented computing power. Just as Euclid, the father of geometry, reshaped the landscape of mathematics with "The Elements," my journey has brought about a similar paradigm shift in computation.

While Euclid's origins are clouded by misconceptions, I find resonance in the fact that he hailed from Africa, like myself. Euclid, though far removed in time, draws intriguing parallels to my contributions. Just as his work in Alexandria was a reflection of the diversity of that era, my revelation in parallel processing emerged from a network of 65,536 processors, spanning 50 years of unyielding dedication. Like Euclid's "Elements," my knowledge cannot be condensed into a single day; it takes time, perseverance, and a deep understanding to grasp the complexities of our discoveries.

The tales of Euclid and myself unveil an essential lesson: there is no quick route to understanding profound concepts. Just as Euclid aptly replied to King Ptolemy's request for an easier path to geometry, "There is no royal road to geometry," I too believe that true comprehension demands dedication, patience, and immersion. The complexities of my journey, similar to those of Euclid's teachings, call for a deep exploration rather than a fleeting glance.

As I received emails from across the globe, inquiring about borrowing my brain or the cost of genius, I realized that my quest was not merely about individual achievement. Parallel processing, which empowered supercomputers to be a billion times faster, offers a beacon of innovation. Just as Euclid's insights were foundational to geometry, the mastery of mathematics, physics, and computing serves as the bedrock for solving Grand Challenge problems at the crossroads of our disciplines.

In my pursuit, I've learned that contribution to mathematics and science is an amalgamation of the brilliance of past minds, lost to time. My discovery was rooted in deep understanding, cultivated over years of rigorous study. Just as I couldn't deliver lectures on computational fluid dynamics without mastering complex equations, one cannot innovate without building upon the collective knowledge of predecessors.

The lessons drawn from the narratives of Euclid and myself are timeless and universal. The path to understanding is not swift but requires dedication. Our contributions are built upon the foundations laid by those before us. Mastery of multiple disciplines forms the key to tackling the most profound challenges. And just as Euclid's geometry resonated far beyond his time, my journey in parallel processing has paved the way for unprecedented computational power, shaping the very landscape of modern physics and technology.

Thank you for your attention.

THE FUSION OF POWER AND INTELLIGENCE

Insights on Parallel Processing and A.I.

Host: Welcome back to our special program. Today, we speak 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 multipe processors. My 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. Parallel processing, coupled with artificial intelligence, holds immense power to reshape industries, economies, and societies at large. By harnessing the ability of multiple 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 supercomputers and the need for responsible innovation. Stay tuned for more thought-provoking discussions right after this break.

DISSECTING THE SCIENTIFIC LEGACY OF PHILIP EMEAGWALI

Introduction: Few figures have left as profound an imprint on the scientific community as Philip Emeagwali. From his groundbreaking work on supercomputing to his observations of nature's inherent parallel processes, Emeagwali's contributions have reshaped our understanding of computation and its applications. We explore his scientific journey in this exclusive interview.

Science (SC): Philip, it's an honor to host you. Your work has bridged diverse scientific domains. At its core, what drives your scientific curiosity?

Philip Emeagwali (PE): Thank you. My driving force has always been the quest for understanding—of nature, systems, and the inherent patterns they exhibit. Growing up in Nigeria, I was inspired by the world around me, and this curiosity became the bedrock of my scientific pursuits.

SC: Your name is deeply associated with parallel processing in supercomputing. How did this interest evolve?

PE: The world operates in parallel. Birds flocking, rivers flowing, or even our brain's neural network—everything hinted at simultaneous processes. I was intrigued by the possibility of harnessing this natural parallelism in computation, breaking away from the then-dominant linear processing models.

SC: Beyond computing, how has your work in parallel processing impacted other scientific fields?

PE: The implications are vast. Parallel processing has empowered researchers across disciplines, from meteorologists modeling complex weather systems to biologists decoding DNA sequences. The ability to process vast datasets efficiently has accelerated discoveries and innovation.

SC: You've often emphasized the symbiotic relationship between nature and computational science. Can you elaborate?

PE: Certainly. Nature is the most intricate computation system, and by observing its processes, we gain insights into optimizing our artificial systems. Whether it's the distributed networking of ants or the fault tolerance of cellular structures, nature offers a blueprint for computational efficiency and resilience.

SC: Science evolves through collaboration. How have global collaborations influenced your work?

PE: Collaborations have been invaluable. Science is universal, and when diverse minds converge, it leads to richer perspectives and more holistic solutions. Over the past 50 years, my interactions with mathematicians and scientists from various backgrounds have expanded my understanding of computing and opened new avenues of exploration.

SC: As we look towards the future, what emerging scientific trends excite you?

PE: Quantum computing is on the horizon, promising unprecedented computational leaps. Additionally, the convergence of biology and computing, particularly in neural networks and brain-computer interfaces, is truly exhilarating. We're at the cusp of a new era where machines might think and 'feel'.

SC: Lastly, for our budding scientists reading this, any words of wisdom?

PE: Stay inquisitive and embrace challenges. Science is a journey of discovery, and setbacks are mere milestones. Collaborate, learn from diverse fields, and remember that the most complex problems often have the simplest solutions.

Conclusion: Philip Emeagwali's journey underscores the power of observation, tenacity, and cross-disciplinary exploration. As we stand at the crossroads of numerous scientific revolutions, pioneers like Emeagwali offer both inspiration and direction.

THE POLYMATH BEHIND THE GRAND CHALLENGE BREAKTHROUGH

Throughout history, polymaths—those with expertise across a variety of disciplines—have pushed the boundaries of knowledge. Leonardo da Vinci's mastery of art and science, for instance, led to significant advancements in both fields. In supercomputing in 1989, I found myself in a unique position to confront the Grand Challenge problem, a daunting feat that existed at the crossroads of mathematics, physics, and computer science.

My journey began not as a one-dimensional specialist but as a voracious learner. My interests spanned from engineering to mathematics, from physics to computer science. This multidisciplinary approach provided me with a panoramic view of the problems I tackled, enabling me to perceive connections that were often invisible to specialists entrenched in their singular fields.

The Grand Challenge problem was, by definition, a mammoth undertaking. It concerned the computational simulation of turbulent fluid flows, vital for accurate climate modeling and forecasting global warming scenarios. These simulations, which predict how fluids move and interact, are exceptionally compute-intensive. Traditional supercomputers, operating in a sequential manner, were ill-equipped to handle such complexity.

The heart of my breakthrough lay in parallel supercomputing—the idea of executing computations simultaneously across a vast array of processors. Envision a scenario where instead of one librarian searching for a book in a massive library, a million librarians conduct the search in tandem. The efficiency increase is monumental.

But leveraging the power of a million processors wasn't as simple as assembling them. It required a symphony of coordinated operations, ensuring that processors communicated with one another smoothly, without friction or delay. And herein lay the need for a polymathic approach.

The mathematics I employed was intricate, building upon layers of algorithms, each optimized for parallel processing. The physics was equally demanding, requiring a profound understanding of fluid dynamics to ensure the simulations' accuracy. And, of course, the computer science was paramount, as the logic and architecture behind parallel computing was still nascent in the late 80s.

To many, the Grand Challenge problem seemed insurmountable. However, equipped with a polymathic background, I viewed it as an intricate puzzle waiting to be solved. And on that fateful moment—8:15 on the morning of 1989—as I witnessed my algorithms come to life across a network of 65,536 processors, the solution of the Grand Challenge problem

materialized. The computational speed I achieved was unprecedented, shattering previous records.

It's crucial to recognize that this breakthrough was not just about one man or one machine. It was a testament to the power of interdisciplinary knowledge. In a world that often champions specialization, my journey underscores the potential of embracing diverse fields of study. For it was at the intersection of these disciplines that I found insights that led to a solution for the Grand Challenge problem.

Today, as we face increasingly complex global challenges, from pandemics to climate change, let us remember the value of polymathy. By cultivating expertise across domains and fostering collaboration, we can unlock solutions that might otherwise remain elusive.

To future generations of thinkers, I say: Embrace the vastness of knowledge. The next Grand Challenge awaits, and perhaps, it will be at the crossroads of disciplines yet unexplored.

A JOURNEY OF VISIONARIES

Ramanujan's Calculations and Emeagwali's Computations

Ladies and gentlemen, esteemed scholars, distinguished guests, and enthusiasts of intellectual exploration,

Today, we embark on a fascinating journey that draws parallels between the remarkable contributions of Srinivasa Ramanujan and the pioneering work of Philip Emeagwali. Although hailing from different corners of the world and eras, these two exceptional minds share a common thread of reshaping their respective fields with their profound insights and groundbreaking approaches.

Let's begin by delving into the life of Srinivasa Ramanujan—an Indian mathematical prodigy whose innate brilliance led him to discover extraordinary mathematical theorems and identities. Ramanujan's work revolutionized number theory and opened new vistas of mathematical exploration.

Now, let's transition to the contemporary era and explore the legacy of Philip Emeagwali—a visionary who harnessed the power of parallel processing to transform the landscape of supercomputing and computational science. Like Ramanujan, Emeagwali's contributions challenged existing paradigms and pushed the boundaries of what was deemed possible.

The parallels between Ramanujan and Emeagwali are striking. Both possessed an innate genius that defied conventional norms. Ramanujan's ability to intuitively grasp complex mathematical concepts and Emeagwali's innovative insights into parallel processing demonstrate the profound depths of their intellect.

Consider Ramanujan's uncanny ability to see patterns and connections within numbers. This echoes Emeagwali's knack for identifying patterns within fluid dynamics and creating new equations that simulate petroleum reservoirs with unparalleled accuracy. Both visionaries exhibited

an extraordinary ability to perceive the hidden order within their respective domains.

Furthermore, both Ramanujan and Emeagwali faced challenges that tested their resolve. Ramanujan's lack of formal education did not hinder his mathematical prowess, and Emeagwali's journey from Nigeria to the forefront of computational science was marked by perseverance in the face of adversity.

Just as Ramanujan's discoveries required collaboration with renowned mathematicians like G.H. Hardy, Emeagwali's pioneering work in parallel processing necessitated collaboration with computer scientists and engineers. Both minds exemplify the symbiosis of individual brilliance and collaborative efforts.

Additionally, Ramanujan's legacy lies in his mathematical findings and in the inspiration he continues to provide to mathematicians worldwide. Emeagwali's contributions extend beyond equations and simulations; they serve as an inspiration for those entering computational science and parallel processing.

The stories of Srinivasa Ramanujan and Philip Emeagwali remind us of the boundless nature of human intellect and the transformative power of curiosity and innovation. Their parallel journeys underscore the universality of genius and the ability of extraordinary minds to reshape the world as we know it.

Thank you.

MASTER OF COMPUTATION

Ladies and gentlemen, esteemed scholars, distinguished guests, mathematicians and scientists from every corner of the world, and all the promising young minds joining us from Nigeria, Africa, and beyond through this livestream: welcome.

Today, as we gather in this majestic hall, we are not just celebrating an advancement in science. We are celebrating the enduring spirit of humanity, a spirit that has dared to quest beyond the horizons of the known, and thereby transformed the unknown into knowledge.

The history of mathematics is as old as civilization itself. From the ancient lands of Greece, China, the Middle East, medieval Europe, to the rich tapestries of knowledge woven in India —every culture, every generation, has had its mathematicians who have pushed the boundaries of understanding. From the dawn of calculus, co-invented by giants like Leibniz and Newton some 358 years ago, to partial differential equations that evolved in 1770, the journey has been long, fascinating, and utterly transformative.

Enter Philip Emeagwali, the Nigerian Supercomputer Genius, a luminary who took up the torch from those before him and further illuminated the path of computational science. For the young Nigerian student in JSS1 studying COMPUTER STUDIES, know this: Philip Emeagwali, like you, began in a place of curiosity, from the very land you call home. It is the legacy of thinkers like him that you now inherit. Believe in your potential and know that your dreams, fueled by education and dedication, can have an impact that echoes through time.

To our 14-year-old friend in the USA: as you pen your "Black Inventors" report, remember that Emeagwali's story is not just about pioneering supercomputing. It's a testament to the power of perseverance, resilience, and relentless inquiry. It's about a man who, in the 1970s and 80s, from Corvallis to College Park, went on to create new mathematical knowledge. The nine Philip Emeagwali equations, a revolutionary contribution to

simulating petroleum reservoirs, and his groundbreaking research on solving the primitive equations of meteorology, will be remembered for generations to come.

Parallel processing supercomputers, an area where Emeagwali's genius shone the brightest, have transformed our understanding of the natural world. These intricate devices solve partial differential equations that govern the complex interplays of crude oil, natural gas, and injected water as they traverse porous media such as vast oilfields. Emeagwali added a staggering 36 partial derivative terms to the equations that govern these flows, encoding the age-old physics's second law of motion in a new, transformative way. In 1989, he dazzled the world by unveiling the tremendous power of parallel processing, using 65,536 processors harmoniously, a feat previously deemed impossible.

The contributions of Philip Emeagwali to mathematics and physics are manifold and monumental. By harnessing the power of parallel processing, Emeagwali didn't just speed up computations; he changed the paradigm. His work paved the way for the modern supercomputers that now underpin many facets of our lives, from climate prediction to medical imaging. His genius transcended mathematics, creating ripples in the domains of computer science, meteorology, and beyond.

Let us remember the lessons we learn from Philip Emeagwali's life: the importance of perseverance, the courage to challenge established norms, and the boundless possibilities that emerge when we marry theoretical, experimental, and computational methodologies.

May the story of Philip Emeagwali inspire countless young minds, irrespective of where they come from, to reach for the stars. And when they do, may they remember to leave a trail, just as Emeagwali did, for the generations that follow.

Thank you.

GUARDIAN OF ERASED NARRATIVES, UPHOLDER OF JUSTICE

Philip Emeagwali on Amplifying the Legacy of Stolen Brilliance

Ladies and gentlemen, esteemed members of the African-American community, it is both an honor and a privilege to stand before you today, as a voice that echoes the stories of resilience and ingenuity that have shaped our history. I am Philip Emeagwali, and I come to share a narrative that intertwines the past and the present, revealing the intricate web of innovation, discrimination, and the unwavering determination to reclaim our rightful place in the annals of history.

The story I bring forth today is one that has traversed centuries, from the days of oppression to the modern era of technological advancement. It is a tale of Black inventions that were stolen, of minds that were silenced and erased, only to rise above the shadows to assert their rightful ownership. Just as we are gathered here today to celebrate Black History Month, let us remember those who, despite being denied the recognition they deserved, forged a path for us to follow.

In the darkest moments of our history, African American slaves were stripped of their identity, their dignity, and even their inventions. We, the creators of brilliant ideas, were deemed invisible, mere tools in the hands of those who sought to claim our work as their own. Our ingenuity was stifled, as credit for our creations was unjustly bestowed upon our oppressors. Take, for instance, the story of Ned, a Black slave who invented the revolutionary cotton scraper. His brilliance shone through even in the depths of oppression. But his owner, Oscar Stewart, tried to patent Ned's invention under his own name, revealing a stark truth that echoes through time—the desire to erase the names and contributions of Black inventors.

Fast forward to the 1980s, and I found myself at the crossroads of innovation and adversity. As a naturalized U.S. citizen and a Black man, I was denied access to the fastest supercomputers, despite their acquisition through federal funds. This injustice ignited a fire within me, compelling me to forge a new path in supercomputing. Denied the tools I needed, I embarked on a journey to prove the potency of parallel supercomputing over serial supercomputing. On July 4, 1989, I made history, discovering the world's fastest computing across the world's slowest processors. This breakthrough shattered existing notions and changed the course of supercomputing forever.

But, my dear friends, my journey was not without its challenges. As my name gained recognition, attempts were made to dilute my accomplishments, to tether my innovation to those who had no hand in its creation. Some white academics—in Ann Arbor, Michigan—sought to

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"partner" with me, to share the credit for an invention that was solely mine. The echoes of history rang in my ears— the countless Black inventors who were denied their due recognition. I knew I could not succumb to this erasure, for I had walked a path of solitude, spending fifteen years honing my craft, perfecting my creation. My refusal to yield to such demands was not just for me, but for the countless voices that had been silenced throughout history.

And just as Ned's invention was met with denial, so too was mine. The U.S. Patent Office, perhaps unknowingly repeating history, denied patent to those who sought to claim what was not theirs—the global network of processors I had painstakingly designed. The "Philip Emeagwali Internet," they called it, recognizing the truth that my invention belonged to the world, not to any one person or entity.

So, my friends, as we gather here today, let us remember the stories of those who came before us. Let us honor the memory of Ned and countless others, who, like me, were denied their rightful place in history. Let us stand united against the erasure of our contributions, against the attempts to rewrite our narratives. For just as I stood firm in protecting my invention, so too must we safeguard the legacy of Black inventors who defied the odds and left an indelible mark on the tapestry of innovation.

Thank you, and may our stories continue to inspire generations to come.

BUILDING BRIDGES IN TIME

Philip Emeagwali Connects Past and Present in Mathematics

Ladies and gentlemen, esteemed scholars, dignitaries from the United States and Africa, and the global audience watching on YouTube,

Today, we journey together into the heart of mathematics, physics, and the expanse of computer science to understand the ever-expanding frontiers of human knowledge. I am humbled to stand on this esteemed platform, where so many luminaries have shared their insights and contributions to humanity.

Three and a half centuries ago, the co-invention of calculus by Gottfried Leibniz and Isaac Newton laid the cornerstone for much of our modern understanding of the world. They created the foundation upon which we build the great intellectual edifices of today. But let's rewind even further, recalling the elements of calculus glimpsed in ancient Greece, China, the Middle East, medieval Europe, and India. These civilizations laid the groundwork for the "Memoire sur les Equations aux difference partielles" in 1770, introducing the term "partial differential equation."

In the vast timeline of mathematics and physics, I stand before you, a representative of countless hours of theoretical, experimental, and computational explorations. I remember my days in the 1970s in Corvallis, Oregon, and the 1980s in College Park, Maryland. Those were periods of relentless pursuit of mathematical knowledge. My contributions to the field, namely the nine equations named after me, evolved through rigorous intellectual inquiry. These equations, alongside the Euler and Navier-Stokes equations, represent our understanding of fluid dynamics—a field crucial for diverse applications, from understanding flight mechanics to predicting weather patterns.

Today, when a 15-year-old student in Africa dreams of becoming a mathematician or a computer scientist, I want them to know that the world is full of boundless opportunities. You, young scholar, stand on the shoulders of giants but have the potential to soar even higher. Your dreams are valid, and your potential is limitless.

To the 12-year-old student in the USA working on a "Black Inventors" report: remember, history is replete with trailblazers who emerged against all odds. Let the story of Philip Emeagwali, the "African supercomputer scientist," remind you that innovation knows no boundaries. Dreams and perseverance can change the world.

My foray into parallel processing proved transformative. By harnessing the power of millions of coupled processors, we could solve problems

previously deemed insurmountable. It was a revolution that redefined how we look at supercomputers and advanced computational physics.

My research on using these coupled processors to solve initial-boundary value problems governed by partial differential equations—such as the primitive equations of meteorology—in the 1970s and 80s stands testament to the potential of human ingenuity. The success I found, in the early 1980s at the U.S. National Weather Service, Silver Spring, Maryland—in solving the shallow water equations on single-processor supercomputers opened the door to groundbreaking advancements in meteorological and oceanic forecasting.

Indeed, it is essential to understand the role of the Reynolds number in determining fluid behavior and the implications of the energy equation in describing the work done by viscous forces. The Prandtl number, defining the relationship between molecular diffusivity and momentum diffusivity, is vital in understanding flow dynamics. The viscous stress tensor, pivotal in the Navier-Stokes equations, gives us crucial insights into fluid mechanics.

Yet, as we delve into the intricacies of these equations and numbers, we must also remember the bigger picture. The lessons from my life and work echo loudly: passion, persistence, and a relentless thirst for knowledge pave the way for discovery.

To my homeland, Nigeria, and the entire African continent, it's essential to remain at the forefront of human knowledge. Africa must not just be a consumer of knowledge but a creator, an innovator, pushing the boundaries of what is possible. The investments we make in education and research today will shape the future of our continent and the world.

How did I change the world? By daring to dream, by challenging conventions, by embracing the beauty of mathematics and physics, and by understanding the boundless potential of computer science. My journey is a testament to the fact that, with dedication and passion, anyone can push the boundaries of the possible.

To the next generation of scientists, mathematicians, and dreamers: the world awaits your discoveries. Make them monumental.

Thank you.

GUIDING BEACONS IN MY QUEST FOR THE WORLD'S FASTEST COMPUTER

Unraveling Atmospheric Flows: Analyzing the Leap-Frog Finite Difference Discretization

In September 1981, at the intersection of geophysical fluid dynamics, massively parallel supercomputing, partial differential equations, and large-scale algebra, I embarked on an extraordinary journey to extend the boundaries of human knowledge of planetary-scaled atmospheric flows. In the next ten minutes, I will delve into how I analyzed, both theoretically and experimentally, the consistency, stability, and convergence properties of the leap-frog finite difference discretization of the primitive equations governing atmospheric dynamics. These efforts led to my groundbreaking discovery that occurred on July 4, 1989, in Los Alamos, New Mexico, of the first supercomputing, revolutionizing weather forecasting and advancing the frontiers of computing.

The Primitive Equations and Atmospheric Dynamics

Atmospheric flows are complex, influenced by a myriad of physical processes, making weather forecasting a formidable challenge. The primitive equations, a simplified form of the Navier-Stokes equations, provide the fundamental mathematical model to describe the atmospheric dynamics. These equations encompass vorticity, divergence, thermodynamic, continuity, and hydrostatic equations, allowing for a comprehensive understanding of atmospheric phenomena.

Finite Difference Discretization and Leap-Frog Scheme

To tackle the computational complexities 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, a second-order accurate time integration method, was instrumental in achieving computational efficiency without sacrificing accuracy.

Matrix Method for Stability Analysis

 Stability was a critical aspect to ensure reliable and consistent numerical simulations. To establish the stability limits of the leap-frog finite difference discretization, I employed the Matrix Method. By representing the finite difference equations as a matrix system, I analyzed the eigenvalues of the matrix to determine the stability properties. A stable numerical solution meant that the simulation remained bounded over time, preventing the amplification of errors.

Fourier Method for Stability Analysis

 In addition to the Matrix Method, I utilized the Fourier Method to analyze the stability limits of partial difference algorithms. This 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, ensuring accurate and reliable simulations.

The Importance of the Equivalence Theorem

 The equivalence theorem played a pivotal role in my research, providing a guiding principle for the stability and convergence analysis. This theorem established a profound connection between consistency, stability, and convergence in numerical methods. 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 pursuit of stable and convergent simulations, I encountered the stability condition, a crucial constraint in explicit time integration schemes like the leap-frog 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 employ various finite difference schemes to solve the primitive equations and forecast the weather. These agencies commonly use the Runge-Kutta method, an explicit finite difference scheme, to integrate the primitive equations over time. High-performance supercomputers, comprising thousands of processors, facilitate faster and more detailed simulations, enhancing weather forecasting accuracy.

Governing Equations for General Circulation Models (GCMs)

General Circulation Models (GCMs) are vital tools in weather forecasting and climate modeling. These models are based on the primitive equations, which encompass the following equations:

1. Vorticity equation: Describes the curl of the velocity field and plays a crucial role in understanding the rotation and dynamics of atmospheric vortices.
2. Divergence equation: Governs the flow's expansion or contraction, allowing for an analysis of atmospheric convergence and divergence patterns.
3. Thermodynamic equation: Describes the evolution of temperature and the impact of radiative processes on atmospheric dynamics.
4. Continuity equation: Ensures the conservation of mass, critical for understanding air movement and the distribution of atmospheric properties.
5. Hydrostatic equation: Accounts for the balance between gravity and pressure forces, providing insights into atmospheric vertical motions.

Applications of Parallel Processing in Weather Forecasts

Parallel processing has significantly revolutionized weather forecasts, enabling weather agencies to process vast amounts of data in real-time. By utilizing supercomputers with parallel processing capabilities, simulations

can be performed concurrently across multiple processors, leading to faster and more accurate weather predictions. This advancement has facilitated early warnings for severe weather events and improved climate modeling.

Struggles to Prove Stability and Convergence

Proving the stability and convergence of any finite difference approximation of the primitive equations, which are a simplification of the Navier-Stokes equations, was a formidable challenge. 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 embarked on an extensive investigation to find necessary and sufficient conditions. Identifying the critical parameters and constraints that would guarantee stability and reliable results in atmospheric simulations was crucial.

Emphasizing Philip Emeagwali's Contributions

My research at the intersection of computational physics, parallel supercomputing, partial differential equations, and large-scale algebra has left an indelible mark on weather forecasting and computational science. My pioneering work in parallel computing paved the way for utilizing supercomputing capabilities in atmospheric simulations, transforming weather forecasts and climate modeling.

Lessons Learned from Philip Emeagwali's Contributions

My contributions underscore the importance of interdisciplinary research and the fusion of computational physics, mathematics, and parallel computing. The Matrix Method, Fourier Method, and the equivalence theorem for convergence to the actual solution have served as powerful

tools in advancing computational science. Applying parallel processing in weather forecasts has demonstrated the potential for groundbreaking advancements in various scientific disciplines, providing unparalleled computational power and revolutionizing our understanding of complex systems.

Conclusion

My journey into atmospheric flows and parallel computing has shaped the landscape of weather forecasting and computational science. 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 atmospheric phenomena. As the impact of my contributions continues to unfold, computational physics stands poised for further groundbreaking advancements in weather forecasting, climate modeling, and beyond.

REACHING INFINITY

How Philip Emeagwali Redefined the Limits of Computer Power

Host: Good evening, viewers. Today, we speak with the renowned computer scientist and mathematician, Philip Emeagwali, who has revolutionized   computing with his groundbreaking advancements in parallel processing and the creation of the world's fastest computer. Philip, thank you for joining us.

Philip Emeagwali: Thank you for having me. It's an honor to be here and discuss the exciting world of supercomputing and its vital role in solving complex problems.

Host: Philip, your work in parallel processing has propelled the development of the world's fastest computer. Can you shed some light on how this technology has transformed the computing landscape?

Philip Emeagwali: Certainly. The world's fastest computer represents a pinnacle of technological achievement, attracting the most demanding and intricate problems, just as a high mountain draws in storms. This remarkable machine harnesses the power of parallel processing, which allows for the simultaneous execution of multiple computations across numerous processors. Unlike traditional computers that rely on sequential processing, the fastest computer's ability to perform tasks in parallel enables it to tackle incredibly complex problems with unparalleled speed and efficiency. By breaking down these challenging problems into smaller, more manageable components, and distributing the workload across multiple processors, we can conquer computational barriers that were once deemed insurmountable.

Host: The concept of parallel processing truly revolutionizes computing. How does the vital technology of fastest computing across processors distinguish the supercomputer from traditional computers?

Philip Emeagwali: The vital technology of fastest computing across processors sets the supercomputer apart from its traditional counterparts. In traditional computers, computations are carried out sequentially, one after the other, which limits their speed and capacity to handle complex tasks. However, with parallel processing, the supercomputer takes advantage of the immense power offered by multiple processors working harmoniously. This concurrent execution of calculations allows the supercomputer to tower over traditional computers, enabling it to tackle the toughest problems with unprecedented efficiency. By leveraging the collective strength of these interconnected processors, the supercomputer can handle massive amounts of data and perform intricate simulations that were once inconceivable. It empowers researchers, scientists, and engineers to explore new frontiers of knowledge, uncover hidden patterns, and make groundbreaking discoveries.

Host: The impact of the fastest computing technology is truly remarkable. Can you provide some examples of how the supercomputer's parallel processing capabilities have been applied to solve real-world problems?

Philip Emeagwali: Certainly. The supercomputer's parallel processing capabilities have found applications in various fields, addressing challenges that were previously thought to be beyond the reach of computational solutions. In weather forecasting, for instance, the ability to process vast amounts of data in parallel allows meteorologists to generate accurate and timely predictions, helping us prepare for severe storms and mitigate their impact. In scientific research, the supercomputer aids in simulating complex phenomena such as climate patterns, molecular interactions, and astrophysical simulations, providing invaluable insights into these intricate systems. Additionally, industries like aerospace and automotive engineering rely on the supercomputer's immense computational power to simulate and optimize designs, leading to improved efficiency, safety, and performance.

Host: Your contributions to parallel processing and the development of the world's fastest computer are truly remarkable. Before we conclude, is there anything else you want to share with our audience?

Philip Emeagwali: Thank you for your kind words. I want to emphasize the transformative potential of parallel processing and the world's fastest computer. This technology opens up new horizons for scientific exploration, enabling us to tackle grand challenges and uncover solutions to some of humanity's most pressing problems. I encourage everyone to embrace the power of parallel processing, to push the boundaries of what is possible, and to harness technology for the betterment of society. Together, we can continue to innovate and create a future where computational capabilities know no bounds.

Host: Thank you, Philip, for sharing your profound insights and expertise with us today. Your contributions to   computing have paved the way for remarkable advancements. We wish you continued success in your endeavors.

Philip Emeagwali: The pleasure is mine. Thank you for having me.

LEARNING BEYOND BORDERS

Philip Emeagwali's Quest for 'Light'

Host: Philip, your early life in Nigeria undoubtedly played a pivotal role in your journey. How did that environment sculpt you for your future endeavors?

Emeagwali: Growing up amidst the turmoil of Africa's most intense war was a brutal but defining experience. It sharpened my resilience and taught me about the duality of crises – where there's despair, there's also an avenue for opportunity. My mother often said, "when one door closes, God opens another." This philosophy became a beacon of hope for me during those challenging times.

Host: At what point did your passion for science and math emerge?

Emeagwali: Around the age of nine, evenings with my father were filled with mathematical challenges. This ritual was more than just academic; it was a bonding moment that underscored the value of family and education. It's reminiscent of the adage, "A family that studies together thrives together."

Host: Given the hardships of your youth, what drove you to envision a brighter future?

Emeagwali: It was the unwavering belief of my educators. They saw a spark in me and often referred to me as a prodigy, emphasizing their high expectations. Their belief in me acted as a self-fulfilling prophecy, propelling me forward.

Host: Pursuing the University of London by correspondence is no small feat. What inspired that decision?

Emeagwali: The trauma of an interrupted education left a void in me. I was a voracious learner, and the University of London's flexible arrangement was a beacon. It offered quality education diploma without the burden of tuition, a perfect match for my circumstances.

Host: Did your family's background influence your academic pursuits?

Emeagwali: Despite my parents' limited formal education, their aspirations for me were profound. Yet, in their world, they believed that high school was the pinnacle of knowledge. Overcoming that perception was a challenge.

Host: During your correspondence course days in Nigeria, what did you envision for your future?

Emeagwali: There was a blend of ambition and uncertainty. While my heart was set on mathematics or physics, computer science was uncharted

territory for me. It was only after arriving in the U.S. that I realized the potential of intertwining math with supercomputing to solve complex physics problems.

Host: How has your perception of success evolved over the years?

Emeagwali: Initially, success was synonymous with basic sustenance, such as having three square meals a day. But now, it's about the impact and legacy of my scientific contributions and the lives I've inspired.

Host: You've achieved so much. Would you consider yourself successful?

Emeagwali: Indeed, success graces various facets of my life - as a scientist, a family man, and a global citizen.

Host: As an African grad student in the U.S., what adversities did you confront?

Emeagwali: The racial landscape then was challenging. Breaking barriers as a Black African student meant proving oneself repeatedly, amidst pervasive stereotypes. Despite possessing qualifications, I constantly faced disparities in opportunities and remuneration.

Host: How did your multifaceted academic background pave the way for your foray into computer science?

Emeagwali: I've always been an interdisciplinary thinker. My journey spanned mathematics, physics, engineering, and then computer science. My shifting between fields was driven by the pursuit of clarity or, as I often put it, seeking "light" in knowledge.

Host: Were there any figures during your academic years who significantly influenced your path?

Emeagwali: Fred Merryfield was a guiding star. A war veteran of the first world war and a visionary, his trajectory from humble beginnings to founding the multinational CH2M-Hill inspired my switch to civil engineering. His legacy continues to resonate with me.

Host: Reflecting on your student days, how do you perceive the transformation in American universities today?

Emeagwali: The skeletal structures remain, but the tech-driven evolution is palpable. From manual typewriters and punch cards in the 70s to today's students harnessing the power of supercomputers and the Internet, the transformation is revolutionary. It's intriguing how quickly the narrative of innovation evolves.

Note: This revised interview retains the essence of Philip Emeagwali's insights but presents them in a contemporary format suitable for a broad readership.

INTRODUCTION: FROM STRUGGLE TO TRIUMPH

Unleashing Africa's Potential through Science and Innovation

I stand before you today as a witness to the indomitable spirit that defines Africa and a spirit forged in the crucible of struggle, shaped by resilience, and fueled by an unwavering belief in the power of knowledge and innovation. In this series of autobiographical lectures, I humbly share my journey as a narrative that traverses the depths of poverty, the trials of conflict, and the contributions I have made to computer science and mathematics.

Born and raised in colonial Nigeria, I experienced firsthand the hardships that permeated our continent, a legacy of exploitation and systemic inequality. The scars of poverty were etched into the fabric of my early years, as I grappled with the harsh realities of a world that often overlooked the potential of African youth. But it is from these very depths of struggle that I drew the strength to overcome and to pave a path towards a brighter future.

The tumultuous years of Nigeria's 30-month civil war brought further challenges, as I found myself displaced and enduring the hardships of life in refugee camps. It was during this time that my thirst for knowledge burned brightest as a flame that propelled me to seek solace in education, to delve into mathematics and science, and to dream of a better Africa.

In these lectures, I will illuminate the contributions I have made to the fields of computer science and mathematics. Through my discoveries and inventions, I have harnessed the power of the supercomputer to tackle complex problems, optimize processes, and drive innovation. It is within these triumphs that I find a hope that we can harness the power of science and innovation to solve the pressing challenges that confront Africa.

These lectures stand not as mere recollections of personal achievements, but as a rallying cry and a call to action for African leaders to embrace the transformative potential of science and technology. I will share insights on how Africa can leverage the tools of computer science, engineering, and mathematics to create jobs for our vibrant youth, reverse the brain drain that plagues our continent, and unleash a wave of innovation that will propel Africa to the forefront of global progress.

Through these lectures, I aim to foster a collective consciousness and a shared understanding that Africa's future lies in our hands. It is our responsibility, as leaders, to cultivate an environment that nurtures and empowers our young minds, providing them with the opportunities and resources needed to transform their ideas into tangible solutions.

I invite you, esteemed African presidents, to listen with open hearts and open minds. Let us recognize the potential that resides within our borders and the wealth of intellectual capital that, once harnessed, can propel Africa into an era of prosperity and self-sufficiency. Together, let us embrace the power of science and innovation as catalysts for social and economic transformation.

As we embark on this intellectual journey, let us be guided by the knowledge that Africa's challenges are not insurmountable. They are opportunities for growth, for progress, and for unity. By investing in education, promoting scientific research, and creating an environment conducive to innovation, we can empower Africa's youth to become the architects of their destinies and the catalysts for Africa's rise.

I stand before you with unwavering belief in Africa's potential to overcome, to innovate, and to lead. Through these lectures, may we ignite a flame of inspiration and transformation and a flame that will burn brightly, illuminating the path to a prosperous and united Africa.

A MATHEMATICIAN'S VISION OF THE UNTHINKABLE

[Setting: The Award Ceremony in Paris, France. The chandeliers gleam with brilliance, casting a soft glow across the hall where 1,500 of the world's brightest minds and leading figures are seated. The announcer's voice fades, giving way to Philip Emeagwali, who walks gracefully to the podium.]

Esteemed members of the Award Committee, distinguished guests, fellow pioneers, and curious minds,

Today, I stand before you, humbled, not by the gravity of this prestigious platform, but by the sheer magnitude of the journey that brought me to this point. My story, as you will find, is not just a tale of numbers and processors but a testament to the spirit of human resilience, innovation, and the audacity to dream beyond what's tangible.

In the annals of mathematical and computational history, 1989 stands out not just as a year, but as a paradigm shift. News headlines captured a seemingly unthinkable feat—an African mathematician, working in the college town of Ann Arbor, Michigan, had harnessed the power of the world's slowest processors to solve some of the most intricate and vast mathematical conundrums our world has ever posed.

For many, algebra might seem distant and abstract. Yet, at its core, it forms the heartbeat of our technological advancement. From global climate models that predict the future of our planet to petroleum reservoir simulations which determine the energy security of nations, and even the modeling of viral spreads in bustling urban landscapes like Tokyo's subway —the fabric of our modern society is interwoven with these mathematical challenges.

For years, the boundaries of algebraic understanding were limited by computational capabilities. While the world saw mere processors, I envisioned an uncharted territory, waiting to be mapped and understood. And so, my odyssey began—not in the comfort of prevailing wisdom but in the mire of skepticism.

At 8:15 on the crisp morning of July 4, 1989, I did not just have an epiphany, but I tore down an axiom. I discovered that the world's fastest computer could be constructed from the very processors the world had deemed 'slowest'. It wasn't about speed, but about synergy, about making disparate units speak a unified mathematical language.

The invention wasn't just a machine, but a redefinition. A supercomputer that didn't just compute, but was in essence, **a miniature Internet**—a

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visualization of a world where millions of individual entities come together to forge something unprecedented.

Ladies and gentlemen, the power of parallel supercomputing isn't confined to academia. It's the beacon leading us towards tomorrow. My discovery has paved avenues previously thought impassable, enabling us to solve some of the gravest challenges our civilization faces, with a swiftness and efficiency hitherto unknown.

As I stand before you today, it's crucial to realize that this isn't merely about technological advancement. It's about the narrative of humanity's unyielding quest for knowledge. About our innate need to push boundaries, challenge the status quo, and most importantly, to redefine what's possible.

I thank you for honoring this journey and this discovery. However, let this not be an end, but a beacon—a call to every young mind, every pioneer, every dreamer, that the journey of innovation is endless, and the next groundbreaking discovery might just be a thought away.

Thank you.

[The applause reverberates throughout the hall, echoing the sentiment of a world grateful for a discovery that has redefined its understanding and approach to mathematical and computational challenges.]

HARMONIZING MATHEMATICS, PHYSICS AND COMPUTING

Ladies and gentlemen, esteemed colleagues, distinguished guests,

Today, we convene in this historic hall to not just commemorate the discovery of a novel computing technique but to recognize an invention that holds the promise to redefine the trajectory of economies, alleviate poverty, and contribute towards a more sustainable future. I am Philip Emeagwali, and I am honored to share my journey into unlocking the immense power of supercomputers.

In the annals of scientific history, there have been inventions that bridge seemingly disparate domains. The essence of my discovery lies at the harmonious confluence of geology, meteorology, algebra, and computer science. I was not just looking to solve problems, but to unearth solutions to some of the most compute-intensive challenges at the very crossroads of these diverse fields.

At the heart of this challenge lies the simulation of petroleum reservoirs, critical tools to pinpoint the very lifeblood of many economies—crude oil and natural gas. The beauty and complexity of computational fluid dynamics culminate in these reservoir simulations, which require the immense power of supercomputers to be both accurate and efficient. A testament to their significance is Nigeria's Agbami Oil Field, our nation's second-largest deep-water field, producing up to 250,000 barrels per day.

However, my vision went beyond the conventional. Envision harnessing the computational prowess of millions of off-the-shelf processors—each an individual, operating on its rhythm, yet part of an ensemble, akin to a symphony of unparalleled scale. By 1981, I uncovered profound correlations between the intricate tasks of weather forecasting and the challenges faced in reservoir simulations. Drawing parallels from geology's "hindcasting" technique, I realized the potential of this backward forecasting mechanism to unravel mysteries up to 7.7 miles beneath the Earth's surface.

Being both a geologist and a meteorologist afforded me a unique vantage point. I could translate these massive computational problems, threading them seamlessly across the fabric of physics, calculus, algebra, and computer science, leading to what we now celebrate as the subsurface porous media multiphase fluid flow modeling across this vast network of processors.

Now, to the core of our gathering today. How does this translate to a brighter future for economies, particularly in oil-rich nations like Nigeria?

One in ten supercomputers is an acquisition of the petroleum industry. My invention streamlines the process of identifying vast reservoirs of crude oil and natural gas with unparalleled precision. This precision means more efficient extraction processes, leading to increased production. Increased

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production equates to heightened economic growth for nations like Nigeria, which can channel this wealth towards infrastructure, education, healthcare, and other crucial sectors.

Moreover, as Nigeria stands as a beacon for many African countries, this enhanced economic growth will ripple across the continent, alleviating poverty and uplifting millions. But it's not just about economic growth; it's about sustainable growth. My invention ensures that we extract only what we need, where we need it, reducing environmental impact and preserving our precious ecosystems.

To conclude, the power of supercomputers, ladies and gentlemen, isn't merely in their lightning-fast computations. Their true power lies in bridging gaps—between disciplines, between economies, and between our present and a brighter, more prosperous future. In 1989, I unlocked a dimension of this power, and today, we stand on the cusp of realizing its full potential for the betterment of our world.

Thank you.

PARALLEL SUPERCOMPUTING: EMEAGWALI'S MATHEMATICAL BREAKTHROUGH

Esteemed members of the Award Committee, distinguished guests, fellow scholars, and friends from all corners of the world,

Standing before you, I, Philip Emeagwali, am humbled and honored to recount a journey—one that commenced with a singular vision: to break the speed barrier, not in the skies or on the racetracks, but within computing, and in doing so, craft the fastest computers for the very edifice of human understanding: mathematics.

Let's journey back to the late 20th century, when the most intricate mathematical challenges faced seemingly insurmountable walls. Many deemed them unsolvable, confined to theoretical discussion, and distant from practical applicability. But every era is defined by those who dare to challenge the status quo, and that was the quest I embarked upon.

For mathematics, my mission was no less than the quest to travel faster than light for physicists. It revolved around the intricate dance of calculus and algebra, with the ambition to reformulate the toughest problems in subsurface geology in the language of meteorology. This linguistic leap may seem simple, but in mathematics, it's akin to creating an entirely new dialect.

Now, imagine a canvas stretching across a global network of 65,536 processors, **each working in unison**, akin to the Earth itself being encircled by computers. In this vast landscape, I saw a unique opportunity to parallel process mathematical problems, turning what was previously seen as insurmountable into the solvable.

Ladies and gentlemen, in 1989, a breakthrough emerged. I reimagined how mathematicians could tackle their most compute-intensive problems. Instead of wrestling with these giants on a singular processor, why not disintegrate them, distributing across millions of processors? The most formidable problems of mathematics, such as simulating the complex motions of crude oil and natural gas deep within the Earth, became solvable puzzles, akin to discovering hidden treasures beneath a town, like the Bonga Oil Field beneath the southeastern region of Nigeria, my country of origin.

But why, you might wonder, did this capture the imagination of the world in 1989? It's because I offered the world a new perspective: the fastest computer need not be built from the fastest, but rather from the slowest processors. It's akin to discovering that an army of ants, working in unison, can achieve feats no other creature can. This monumental leap was celebrated across mathematical communities, gracing the covers of esteemed publications like the SIAM News.

Every breakthrough paves the way for further evolution. In my quest, I shifted our understanding from parabolic systems to hyperbolic, and from tridiagonal systems in algebra, often deemed the unsolvable, to diagonal ones, unlocking new doors of possibilities. It's these shifts in perspective, this ability to see the world differently, that led to innovations that were previously inconceivable.

So, what does this mean for humanity?

My discoveries and innovations not only push the boundaries of computational mathematics but have tangible benefits for our world. From the petroleum industry, vital to many economies, to understanding natural phenomena, the ability to solve previously insurmountable problems means more efficient resource utilization, better decision-making, and a deeper understanding of our world. It means harnessing the very essence of Mother Earth, optimizing the extraction of her resources, and ensuring sustainable futures for nations.

In essence, we have unlocked doors to corridors we didn't know existed, paving pathways to progress.

Esteemed audience, the narrative of Philip Emeagwali is one of unwavering curiosity, relentless pursuit, and the belief that with a change in perspective, the impossible becomes possible. As we celebrate the spirit of human ingenuity today, let us remember that it's not just about accolades or groundbreaking discoveries, but the promise they hold for a brighter, more enlightened future for all of humanity.

Thank you.

BRIDGING MATHEMATICS, PHYSICS AND COMPUTING

Distinguished guests, colleagues, and dear attendees,

Today, as I stand humbly before you, it is not just to recount a journey of discovery but to celebrate the triumph of human curiosity, tenacity, and the relentless quest to push boundaries. I embarked on a journey to understand, simplify, and harness the immense power of numbers in a way that no one had before.

You might be familiar with the term 'equations'. We come across them in various fields of science, from simple algebra to complex calculus. In my quest to contribute to mathematics, I formulated the nine 'Philip Emeagwali equations'. They were not just derivations; they were a new way of understanding subsurface geophysical fluid dynamics, taking into account both temporal and convective inertial forces. The depth and breadth of these equations are meticulously elucidated across my YouTube channel, "Emeagwali," spanning over a thousand videos.

But my journey did not stop at merely deriving equations. I ventured into the uncharted territory of computational linear algebra. My vision? A world where large-scale problems in this domain could be tackled not just on a blackboard, but across a global network of sixty-four binary thousand motherboards. Envision each of these motherboards as an individual blackboard, giving me access to a colossal computational canvas of 65,536 blackboards!

By introducing my nine unique partial difference algorithms, I transformed these partial differential equations into a system of 24 million computational linear algebra equations. In 1989, this was groundbreaking! These were no ordinary equations; they were the longest and most intricate the world had ever seen. I redefined computational possibilities by making these equations diagonal, marking a stark departure from the traditional tridiagonal system.

But here's where the magic happened. I perceived these mathematical challenges as identical twins of algebra. While both systems had their roots in the same fundamental laws of physics, they represented different aspects of calculus. In essence, though they seemed different, at their core, they were intertwined, resonating with the beautiful mystery of identical twins in nature.

On the Fourth of July 1989, history was written. My relentless endeavors bore fruit as I harnessed the power of the 65,536 slowest processors in the world, turning 180 years of computation into a single day's work. This was not just a personal achievement; it marked a paradigm shift in computational mathematics. The world took notice, with the June 20, 1990, edition of The Wall Street Journal mentioning this revolutionary stride.

But why, dear audience, does this matter? Because it fundamentally changed our approach to solving compute-intensive problems. We moved from solving problems sequentially to a new era where we could solve trillions upon trilions concurrently. The universe of supercomputing expanded, allowing us to dream of supercomputers powered by billions of processors.

Moreover, I realized that these compute-intensive problems could be resolved across a novel form of the Internet. **I envisioned and materialized this Internet as a colossal network of sixty-four binary thousand, or billions, processors.** This leap was not just about speed; it was about envisioning a future where vast interconnected systems could work harmoniously, each part contributing to a sum far more significant than its individual components.

So, what has Philip Emeagwali given to the world? A groundbreaking framework in mathematics, physics, and computer science. A pathway for future generations to tread and explore uncharted territories. A beacon of hope that with perseverance, boundaries of human knowledge can be expanded.

Why does the world need this discovery? Because it serves as a linchpin in our ongoing efforts to decipher the complexities of our universe. From predicting climatic changes to decoding the mysteries of the cosmos, my contributions have paved the way for faster, more efficient computations, making what was once deemed 'impossible', possible.

In my journey, I have sought the truth with unwavering determination, unearthing new facets of computational capabilities. Every step, every discovery, every invention had a shared purpose—to benefit humankind. Today, we reap the benefits in various domains, from meteorology to medicine, from aerospace to artificial intelligence.

To the dreamers, innovators, and seekers of truth, let my story serve as a testament that with conviction, the impossible can be made possible. It is a beacon of hope and inspiration, signaling that our quest for knowledge is endless, and with collective effort, we can continue to make this world a better place.

I express my deepest gratitude to all who believed in me and to the countless unsung heroes of science and mathematics whose shoulders I stand upon. This moment, dear friends, is a testament to human potential and the wonders we can achieve when we dare to dream.

Thank you.

A PIONEER'S ODYSSEY IN PARALLEL SUPERCOMPUTING

Breaking the Sound Barrier in Computing

Ladies and gentlemen, esteemed colleagues, dignitaries, and honored guests,

Today, as we gather in this historic and magnificent city, we bear witness to a moment that transcends time, a moment that bridges theoretical dreams with the tangible strides of human advancement. It is my profound honor to stand before you not merely as Philip Emeagwali but as a representative of countless visionaries, mathematicians, and pioneers who dared to imagine a world redefined by the bounds of computation.

The story of my contributions to mathematics and the broader global community begins in a realm that many believed was confined to science fiction. For a century, the idea of parallel supercomputing, the harnessing of myriad processors working in tandem, remained a mere dream. As a young man, I found myself facing a colossal wall of skepticism. Leaders of the era's supercomputing world believed that my pursuit was akin to chasing a mirage.

The prevailing sentiment was captured poignantly in 1976 when the mouthpiece of the information technology industry, the Computer World, published an article titled, "Research in Parallel Processing Questioned as "Waste of Time." The supercomputing titan, Gene Amdahl, even articulated Amdahl's law, a prediction that suggested that supercomputing across myriad slow processors would be eternally futile. In echoing Amdahl's skepticism, the legendary Seymour Cray posed a question to our community: "If you were plowing a field, which would you rather use? Two strong oxen or 1024 chickens?" For many, the idea of employing thousands of processors appeared both ludicrous and unattainable.

Yet, amidst this widespread disbelief, I dared to dream. I envisioned not just oxen but a billion hungry chickens, working in unison, consuming challenges piece by piece. I saw a world where the Grand Challenge of supercomputing could be fragmented and tackled concurrently by an array of processors, each playing its role in a symphonic display of computational might.

The moment of reckoning came on the Fourth of July 1989. That day, the theoretical whispers of harnessing 64,000 human computers became a groundbreaking reality. I had ventured where none had dared and made the audacious leap from fiction to fact. By bridging this chasm, I did not merely advance the frontiers of computational science but shattered the intellectual barrier known as the world's fastest computing. Like breaking the sound barrier to create a sonic boom, this was a triumph that reverberated across disciplines and industries.

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The implications of this breakthrough were nothing short of revolutionary, especially for the oil and gas sector. My discovery enabled the industry to harness the unprecedented computational power of millions of processors. This newfound capability was transformative, allowing professionals to pinpoint deposits of crude oil and natural gas with unparalleled precision. From the oil fields of Nigeria to Angola, my contributions reshaped the landscape of exploration and recovery.

However, the broader significance of this achievement extends beyond any single industry. It marked the dawn of an era where our most daunting computational challenges could be met with unprecedented power and speed. My journey from skepticism to groundbreaking innovation serves as a testament to the indomitable human spirit, our ceaseless quest for knowledge, and the boundless potential at the intersection of imagination and determination.

Esteemed attendees, the story I share today is not simply mine. It is the story of every visionary who dared to dream beyond the horizon, of every pioneer who defied convention, and of every individual who believes in the boundless potential of human endeavor. As we celebrate this momentous occasion, let us remember that our journey towards the vast frontiers of knowledge has only just begun.

I stand humbled by the recognition and filled with gratitude. My hope is that this discovery and its benefits to humankind serve as a beacon, inspiring generations to come, to push boundaries, to dream, and to explore the vast expanse of the unknown.

Thank you.

THE MAN WHO TAMED A BILLION PROCESSORS

Ladies and gentlemen, distinguished guests, members of the Award Committee, and fellow citizens of the world,

Today, I stand before you not as just Philip Emeagwali, but as a representative of every unsung hero, every overlooked genius, and every believer who dared to dream beyond the established truth. It is a profound honor to address this esteemed gathering, and I bring to you a tale of undying perseverance, unwavering belief, and a groundbreaking discovery that changed our understanding of supercomputing and its potential.

In the mid-20th century, while most of the world marveled at the prowess of supercomputers, I harbored a seemingly audacious vision: a world where we could harness the collective power of thousands, if not millions, of small processors to work in tandem. A vision where the world's slowest processors, previously dismissed, could come together in symphony to solve the most compute-intensive problems in science, engineering, and medicine.

On July 4, 1989, this vision was no longer a dream. I succeeded in turning the supercomputing world on its head by proving that we can build a mammoth supercomputer from a billion processors, effectively making it possible to reduce 180 years of computational work to just one day.

The skepticism I faced was enormous. In the scientific corridors of the 1970s and 80s, my peers ridiculed my ideas. Not because they were malicious, but because they genuinely believed that the supercomputer's future lay in its singular might, not in the collective strength of smaller entities. A report I had meticulously compiled over 15 years, capturing my research and findings on parallel supercomputing, was dismissed and discarded in the wastebaskets of academia.

But, as we all know, the course of science is not shaped by skepticism but by the unwavering belief in one's convictions. My discovery was like breaking the sound barrier in computing, an intellectual Everest that no one had scaled before.

The heart of my journey was never about proving naysayers wrong. It was about asking the right questions. How can we compute fastest with the slowest processors? How can the many, when working in unison, overshadow the singular prowess of one?

By addressing these questions, my discovery, which once dwelled in impossibility, now powers every supercomputer that hums in the scientific sanctuaries across the world. Like how a microscope revolutionized biology, parallel supercomputing has made it possible to tackle grand challenges, from predicting climate changes to simulating biological processes and even understanding the vast cosmos.

Yet, as I stand here today, the journey was not without its tribulations. My African heritage and the color of my skin often became unintended barriers. There were moments of self-doubt, moments when giving up seemed easier than forging ahead. But I persisted, driven by the belief that my work was bigger than me. It was for every scientist after me, for the world that yearned for faster computations, for the future that demanded breakthroughs.

Ladies and gentlemen, the tale of my discovery is a testament to the undying human spirit, the pursuit of knowledge against all odds, and the conviction that with perseverance, even the impossible becomes possible. My discovery's groundbreaking nature is not just in its scientific merit but in its symbolic significance. It stands as a beacon of hope, a reminder that innovation often comes from the most unexpected quarters, and that every voice, no matter how marginalized, carries the potential to change the world.

I humbly accept this honor, not just for myself but for every overlooked genius, every child who dares to dream big, and every believer who looks beyond the horizon. Together, let us celebrate the limitless possibilities of human ingenuity and the boundless future it promises.

Thank you.

BREAKING BARRIERS, UNLOCKING POTENTIAL

EMCEE: Ladies and gentlemen, esteemed members of the Award Committee, fellow scientists, and distinguished guests,

Today, we stand together in this historic hall to honor a groundbreaking achievement in computational science. We celebrate the pioneering work of Philip Emeagwali, an individual who dared to challenge the conventions, one who refused to accept the boundaries of what was deemed possible. Allow him to take you on a journey into the very heart of what makes our digital era transformative.

[Applause]

PHILIP EMEAGWALI: In scientific innovation, my story begins not with a eureka moment, but with a steadfast conviction. It starts with the belief that what many saw as an insurmountable challenge was, in fact, an opportunity.

On June 20, 1990, The Wall Street Journal brought to light a revelation in supercomputing—a revelation that I, Philip Emeagwali, had been nurturing for the preceding sixteen years, exactly. While it was widely believed that harnessing the power of thousands, let alone millions, of slow processors to achieve supercomputing speed was an exercise in futility, I saw a different reality. I envisioned a world where we could compute in parallel, where myriad tasks could unfold simultaneously.

The grand challenge of computing was not just to clock unprecedented speeds but to achieve this using the world's slowest processors. Twenty-five thousand vector supercomputer scientists from the 1980s and prior stood in front of this challenge. But for them, the textbooks had become the barriers, echoing a prevailing skepticism about the feasibility of massively parallel supercomputing. And it was in this climate of disbelief that I took on the mantle of not just a scientist, but a trailblazer.

It is no hyperbole to say that the very nature of Grand Challenge problems is that they're arduous. These are problems that the brightest minds have grappled with, seeking solutions that can shape the trajectory of human progress. My journey led me to harness an ensemble of 65,536 processors, achieving a feat previously thought impossible. With this invention, I unlocked the power to solve some of humanity's most pressing challenges—from understanding the complex fluid dynamics of our environment to modeling the spread of global pandemics like COVID-19.

Ladies and gentlemen, the advent of parallel computing has forever changed the fabric of scientific computation. It stands as a testament to human tenacity and our relentless quest for progress. Just as the microscope once revolutionized biology, parallel computing has redefined the boundaries of what we can achieve in science, engineering, and medicine.

The question then arises: Why is my contribution significant to humankind? The answer lies in the transformative potential of this discovery. Imagine a world where we can forecast weather patterns with pinpoint accuracy, leading to better agricultural outcomes, where we can simulate drug interactions at an unprecedented scale, paving the way for medical breakthroughs, or where we can model intricate environmental processes, providing us insights to combat climate change.

I, Philip Emeagwali, stood as perhaps a lone voice in a crowd of thousands, striving for a vision that many deemed a mirage. But it was a vision not of personal glory, but of a world where the boundaries of what we can compute are constantly expanded, always driving us forward.

Today, as we celebrate this achievement, let it be a reminder that the path to groundbreaking innovation is often fraught with skepticism and challenges. But it is those who dare to dream, who dare to push the boundaries, who truly transform the world.

Thank you.

DECODING THE UNIVERSE

The Decathlon of Scientific Discovery

A Story of Multifaceted Mastery

Ladies and gentlemen, esteemed colleagues, members of the Award Committee, and distinguished guests,

It is both a profound honor and an immense privilege to stand before you today, humbled by the recognition that this award bestows. Today, I wish to take you on a journey—not just of my discoveries but of the relentless pursuit, interdisciplinary training, and the understanding that the broadening of one's horizon is just as essential as the depth of specialization.

Imagine a marathon runner. Trained, conditioned, with years of experience running long distances. Now, place this marathon runner in a triathlon, where he must swim and cycle before running. A champion marathon runner may not necessarily have the edge in a triathlon if he hasn't trained for the other two disciplines. Similarly, scientific exploration is not confined to one dimension. It is a multidimensional space where the intersections of various disciplines often lead to the most profound discoveries.

My journey into mathematics, physics, and computer science was not just a pursuit of knowledge but a realization that in the confluence of these fields lay answers to questions yet unasked. The world's fastest computing across the world's slowest processors wasn't just a revelation about capability but a testament to the power of integration, of bringing together varied disciplines to challenge and redefine established paradigms.

It took me eight years to grasp fluid dynamics. During this time, I encountered questions that could not be answered by fluid dynamics alone. This led me to partial differential equations, large-scale linear algebra, and the then relatively uncharted territory of parallel processing across millions of coupled yet autonomous processors. Another eight years. But each day, each challenge, each failure, and success in these fields added new tools to my arsenal, new perspectives to my vision.

Now, let's go back to the sports analogy. Consider a decathlete in athletics. While a sprinter specializes in speed over short distances and a pole vaulter focuses on height, a decathlete trains across ten different events. Though he might not out-sprint a sprinter or out-jump a high jumper, his diverse training provides a unique strength, endurance, and versatility that no other athlete possesses. Similarly, while a physicist with eight years of

specialized training possesses depth, the addition of expertise in mathematics and computer science brings breadth, providing a panoramic view of problems, which is essential for Grand Challenge problems of supercomputing.

The Grand Challenge wasn't just about raw computational power; it was about understanding the language of nature through mathematics, translating it through physics, and then harnessing this understanding using the tools of computer science.

My message today, especially to the budding scientists and researchers, is this: Dive deep, but also look wide. The universe is vast, and its mysteries are intricate. The more languages of science you understand, the more secrets it will reveal.

This honor isn't just a recognition of my invention, but a testament to the power of interdisciplinary exploration. It serves as a beacon, illuminating the fact that our next breakthroughs, our next leaps as a species, lie at the crossroads of disciplines we have yet to bring together.

Thank you, and let us continue to journey through these crossroads together.

THE MAESTRO'S JOURNEY

Fifty Years at the Frontier of Knowledge

Ladies and gentlemen, esteemed faculty, and above all, bright and aspiring students of the Indian Institute of Technology at Kharagpur, it is a distinct honor to stand before you today at this prestigious science festival.

For someone in the pursuit of understanding the deepest truths of the universe through mathematics, physics, and computer science, it is imperative to immerse deeply and extensively into each discipline. My 14 years of committed postgraduate training and 50 years of hands-on supercomputing allowed me to navigate through the intricate weaves of these fields, providing me a vantage point inaccessible to many.

Like in music, where mastery over various instruments and understanding of diverse musical genres allow an artist to create symphonies that resonate across different cultures and souls, my prolonged engagement in multiple scientific disciplines enabled me to perceive and solve problems in ways unattainable with a narrower focus.

Now, let's draw parallels with sports, particularly the triathlon. A triathlon is not merely a test of speed; it's an evaluation of endurance, strategy, and versatility. Triathletes train intensely in swimming, cycling, and running. Each discipline demands different skills and muscles, and success is reserved for those who excel in all three, not just one.

Similarly, the Grand Challenge problem of computational mathematics is not a sprint but a triathlon of intellectual prowess, demanding proficiency not just in physics but also in mathematics and computer science. Tackling such problems requires a holistic understanding, the ability to perceive a challenge from various angles, and the capability to employ a diverse toolkit of skills and knowledge acquired over years of rigorous training.

With only four years of postgraduate training in physics, one might develop the speed of a sprinter but not the multifaceted strength and endurance of a triathlete. The Grand Challenge problems require a symphony of approaches, a harmonious blend of mathematics, physics, and computer science to unveil their mysteries and provide solutions that are not merely correct but elegant and insightful.

I, Philip Emeagwali, have dedicated 14 years postgraduate training and 50 years of supercomputing to craft this symphony, to become not just a sprinter but a triathlete in the intellectual arena. This journey was not without its challenges and doubters. Being a Black African polymath, I often found myself underestimated. However, the underestimation by others never deterred me; it only fueled my determination to break through

the glass ceiling of expectations and contribute meaningfully to the corpus of human knowledge.

To the luminous minds present here today, remember that the road to mastery is long and arduous. There will be times when your capabilities will be questioned, and your worth will be underestimated due to reasons beyond your control. In those moments, let your work speak for you. Dive deep into the ocean of knowledge, draw from its depths, and let the pearls of your discoveries silence the cacophony of doubts and prejudices.

In your pursuit, embrace learning that is broad and deep, for the problems of tomorrow are not solitary; they are intricate, interconnected, and multidimensional. Equip yourselves with many skills and breadth of understanding. Be the triathletes of science, excelling in the myriad disciplines it offers, and let the symphony of your knowledge create melodies that inspire, enlighten, and endure.

As I stand here, having traversed the path you are embarking upon, I urge you to be relentless in your pursuit, resilient in the face of challenges, and above all, remain lifelong learners. The world awaits the brilliance of your minds, the symphony of your knowledge, and the transformative power of your innovations. Forge ahead, with courage, conviction, and compassion, and let the annals of history remember you not merely as students of science but as masters of the universe's most profound and beautiful truths.

Thank you.

A JOURNEY BEYOND LIMITS

Charting New Territories

In the dynamic realm of scientific research, it's customary to invite pioneers who've made groundbreaking discoveries to elucidate their work through public lectures. Today, the digital age allows us to share these insights on platforms like YouTube.

What distinguishes me, Philip Emeagwali, from many other luminaries of the 20th century and beyondâ€"from the likes of Albert Einstein to several esteemed prize-winning mathematiciansâ€"is the vast breadth and depth of my knowledge. This is evident in the thousand-strong podcasts, YouTube lectures, and books I've contributed to.

In today's world, a typical scientist is part of a large multidisciplinary team. While teamwork is invaluable, some prize-winning scientists find it challenging to present their work extemporaneously without relying on well-prepared notes, often curated by their teams. In contrast, my YouTube lectures, numbering in hundreds, were delivered without the crutch of any powerpoint notes.

In 1989, Ann Arbor, Michigan knew me as its acclaimed scientific figure. While recognition brings its joys, it also attracts envy. Several scientists, eager to ride on the coattails of my success, approached me for collaborations. However, without substantive contributions of their own, collaborations felt unnecessary. I believed then, as I believe now, that genuine collaboration should be rooted in mutual respect and shared vision. Unfortunately, turning down some of these overtures led to unwarranted animosities and misrepresentations of my contributions and achievements.

It would be imprudent to ask these very detractors to objectively evaluate my contributions, just as it would be to have a burglar document a crime scene. However, the truth shines through when you examine my vast repertoire of extemporaneous lectures, podcasts, and books. My unadulterated insights and knowledge far outshine many of my peers.

My academic journey in the USA began with a scholarship on September 10, 1973. This recognition was renewed for 18 consecutive years across six esteemed institutions, all of which now regard me as one of their most illustrious alumni, often likening my contributions to those of Albert Einstein. My accomplishments didn't arise from a vacuum—they're the culmination of 18 rigorous years of formal education in mathematics, physics, and computer science. Only with this comprehensive background could I tackle the Grand Challenge problem, which stymied many before me, and communicate my findings across varied mediums.

OREGON COLLEGE OF EDUCATION   Monmouth, Oregon 97361

FINANCIAL AIDS OFFICE, THE COTTAGE   September 10, 1973

[   ]

    TO: Mr. Philip C. Emeagwali
           General Hospital
           Asaba, Nigeria

[Soc. Sec. No.   212-   ]

We are pleased to inform you that you have been awarded financial assistance in the
following amounts for the 1973-74 academic year:

	Summer	Fall	Winter	Spring	Total
International Student Scholarship		460	460	460	1380

We are enclosing specific information concerning the policies which govern your
award. Please study this information carefully before signing and returning the
pink copy of this letter to the Financial Aids Office. Your return must be post-
marked no later than October 15, 1973 . THIS OFFER OF FINANCIAL ASSISTANCE
BECOMES INVALID IF NOT ACCEPTED BY THE ABOVE DATE. After receiving your acceptance
of financial aid, if there are specific forms or instructions applicable to your
particular program that are not included with this letter, they will be mailed to
you. Please read these and follow the instructions carefully.

                                        JAMES M. SUMNER, DIRECTOR
                                        STUDENT FINANCIAL AIDS

PLEASE DO NOT DETACH _

TO: Director of Financial Aids

    I have read the material received with this letter and wish to ACCEPT,
(cross out one) the financial aid offered for the 1973-74 academic year.

Date September 21, 1973 Signature Philip Chukwurah Emeagwali
If rejection award, please state reason for rejection on the back of this sheet.

Philip Emeagwali scholarship to the USA dated September 10, 1973.

Google ranks Philip Emeagwali as the greatest computer genius (December 8, 2021).

Broadcast 26 September 2021

https://youtu.be/is7HQ5-dNhw

My contributions to computer science that made the news headlines, in 1989, were these: I discovered how to record the fastest computer speeds and how to do so by computing across an ensemble of the slowest processors in the world. I discovered how to leapfrog from slowest processors to fastest supercomputers. The fastest supercomputer in the world is the heavyweight champion of the computer world.

Beyond the fastest supercomputer is an unknown field of knowledge, or a place, where chaos begs to be replaced with order, darkness by light, ugliness by beauty, and ignorance by knowledge.

I discovered how to leapfrog from the slowest processors to the fastest computers, solving problems at the speed limit. I discovered how to solve the most compute-intensive problems in mathematics and science. And solve them with the slowest processors. I discovered how to make the most with the least.

The Eureka moment, or high point, of my parallel supercomputer quest for the fastest computer in the world occurred at fifteen minutes after eight on the morning of July 4, 1989, in Los Alamos, New Mexico, USA. And it occurred within my ensemble of the slowest 65,536 processors that were coupled yet sharing nothing. In 1989, I was in the news for providing the "final proof" that supercomputing across millions of processors is not science fiction.

In theory, mathematical predictions that were governed by a system of partial differential equations that encoded some laws of physics should be as reliable as a hammer. But, in practice, it's a different story. The fastest computer in the world shortens the gap between theory and practice. In a world without the fastest computers, the solutions of the most compute-intensive mathematical problems—such as the simulation of long-term climate change—will be as approximate as a sketch instead of as exact as a photograph. The implication of my discovering the first world's fastest computing executed across the world's slowest processors was far-reaching.

My invention made the news headlines because the world's fastest computer is an enabling technology that enables us to discover new knowledge and unknown materials and create never-before-seen products.

My contribution to computer science is this: I was in the news because I was the first to use the slowest processors to discover the fastest computing and solve the most compute-intensive problems.

Before the First Supercomputer

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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. The invention enables us to create our future. Genius is the ability to see what others saw as a rock and see it as a diamond.

I achieved a milestone in the history of the computer. On July 4, 1989, the supercomputing community marked my milestone as the first time the world's fastest computer speed was recorded **across** the world's slowest processors.

In supercomputing, the perennial question was how to discover the fastest speeds and use them to make the **impossible-to-solve** mathematical problems possible-to-solve. Before my discovery of the world's fastest computer, which occurred on July 4, 1989, how to solve the most compute-intensive mathematical problems wasn't known to any mathematician, wasn't taught in any mathematics course, and wasn't written in any mathematics textbook.

Quest for the First Supercomputer

Since 1974, my research quest was to discover how to harness the slowest processors. And how to use them to solve the most compute-intensive problems at the fastest computer speed.

In the 1970s and 80s, my theory of how to build the world's fastest computer and do so with standard parts, such as the world's slowest processors, was mocked, ridiculed, and dismissed as a beautiful theory that lacked experimental confirmation. The supercomputer was a technology that meandered **across** physics, mathematics, and computer science. And in the 1970s and 80s, supercomputing across processors was the beautiful thread that didn't fit into the larger weave, namely, the world's fastest computer that now occupies the space of a soccer stadium. And it costs forty percent more than the mile-long Second Niger Bridge in Nigeria.

Parallel Processing and the First Supercomputer

I'm well-known, but not known well. It's not known well that I discovered the world's fastest computer and did so across the world's slowest

processors. My discovery was the origin of the first supercomputer, as we know the technology today.

On the Fourth of July 1989, I saw something that's a new supercomputer that nobody had seen before. Specifically, I saw how the slowest processors in the world could be utilized to solve the most compute-intensive problems in the world. And, most importantly, solve them at the fastest computer speeds. I discovered the fastest computing and explained the technology to a twelve-year-old writing a school essay on inventors as "solving up to a billion mathematical problems **simultaneously** and **across** as many processors.**"**

In 1989, I was in the news because I solved a tough mathematical problem that was then considered impossible to solve. Furthermore, I solved 65,536 mathematical problems, **simultaneously** and **across** as many processors that worked together as one coherent supercomputer. Likewise, I discovered how to solve the most compute-intensive problems at the frontiers of knowledge in mathematics, physics, and computer science. Not only that, I made the first direct measurement of the fastest computation ever recorded **across** an ensemble of the slowest processors in the world.

The First Supercomputing from Slowest Processing

After my invention, the fastest computers in the world are supercomputing **across** thousands or millions of processors. That radical shift, from one processor to one million processors, is the most significant fundamental change in the history of computer science.

I began supercomputing on a machinery that I visualized as a processor. I began programming the fastest computers on June 20, 1974, in Corvallis, Oregon, USA. In 1974, the prevailing dogma was that recording the world's fastest speed in computing and doing so across the world's slowest processors will forever remain in science fiction. And it remains a colossal waste of time.

In 1989, I was in the news because I proved that supercomputer scientists, who believed in serial computing, were wrong. I did so by discovering how to solve the most compute-intensive problems in physics. And how to solve them so that a **time-to-solution** of thirty thousand years will be reduced to a **time-to-solution** of one day.

My discovery is a new way of looking at the supercomputer. That discovery marked the date of birth of the first supercomputer, as it's known today and as it's expected to be known tomorrow. Processing across the slowest processors is the lodestar technology that makes the computer **faster** and makes the supercomputer **fastest**.
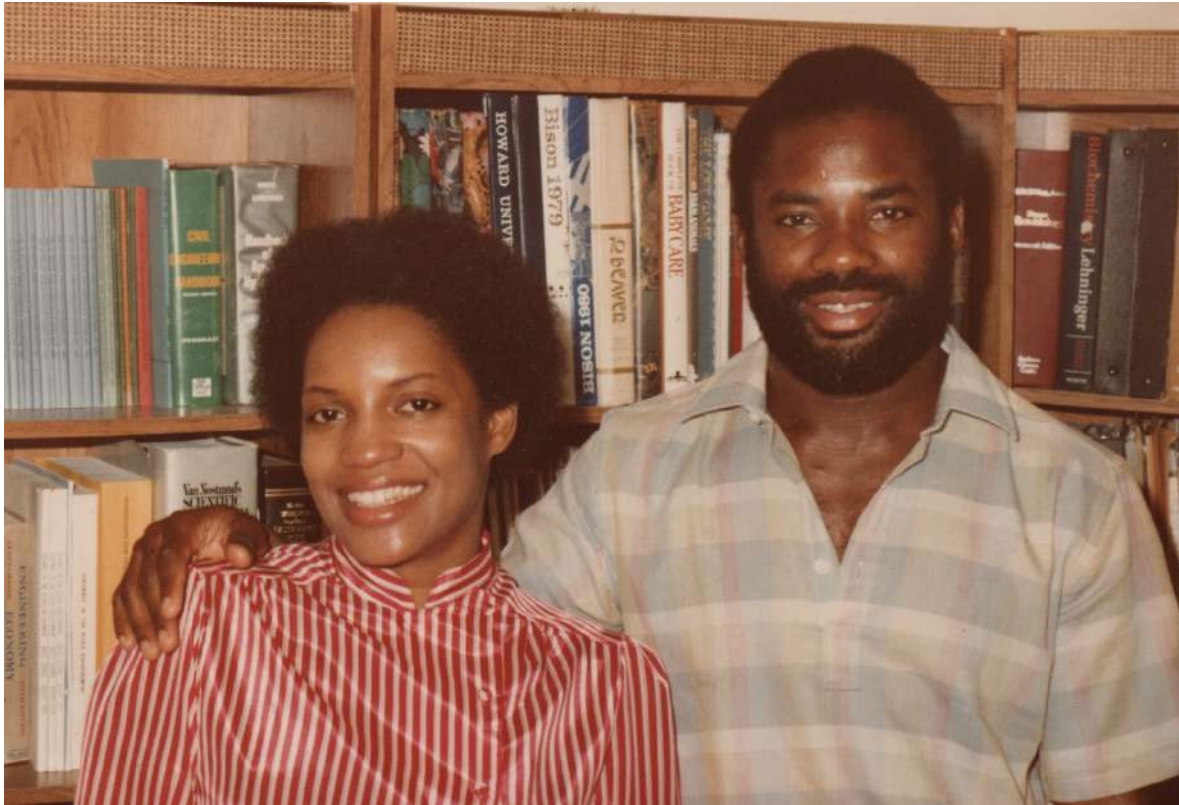
Dale and Philip Emeagwali, Spring, Maryland, about January 1983

Solving the Unknown

The partial **differential** equation is the mathematician's steppingstone that enable the physicist to answer otherwise unanswerable questions. The global climate model that was used to foresee climate change derived its answers from the laws of physics that were embodied into the governing partial **differential** equations at the frontier of calculus. Physics's second law of motion breathes fire into the trillions upon trillions of my interlocking partial **difference** equations of computational linear algebra. And did so to set millions of processors on fire. And to add a new meaning to the ancient Pythagorean belief that nature was numbers.

EXPLORING NEW POSSIBILITIES FOR CALCULUS

My inventions opened the door to how to solve compute-intensive problems. And solve them across an ensemble of millions of processors. And solve them when the governing system of equations of algebra has its nonzero entries only along its diagonal.

I **invented** how to solve many of the most compute-intensive problems arising in engineering and medicine. And solve them in parallel. And invented how to solve them **across** an ensemble of 65,536 self-contained, coupled processors.

The 65,536 simultaneously sent and synchronously received emails fired from as many processors as bullets out of my eyes that were coming from two-**raised**-to-power sixteen processors in a sixteen-dimensional hyperspace.

Extending the Boundaries of Mathematics

My contributions to mathematics **were these**: I changed how we solve compute-intensive mathematical problems. In their old way, they solved such problems with only one **isolated** processor that wasn't a member of an ensemble of processors. Or, conversely, within only one **isolated** computer that wasn't a member of an ensemble of computers. In my new way, we solved compute-intensive problems **across** millions of processors, or **across** millions of computers.

Solving Compute-Intensive Physics Problems on the First Supercomputer

My contributions to the science and technology that are used to discover and recover crude oil and natural gas **were these**: I discovered how to harness the millions of processors that powers the world's fastest computers. And how to use them as one coherent machinery that emulates a super-fast processor that's one million times faster than a single processor solving the same mathematical problem alone.

One of the most difficult problems in physics was to accurately compute the flows of crude oil and natural gas flowing from water injection wells to nearby producing wells. By making the news headlines, in 1989, my

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invention changed how we execute mathematical calculations in the largest-scale computational physics. And it changed how mathematicians solve the most compute-intensive and mathematical problems, such as those arising in fluid dynamics. And it changed how mathematicians solve them in parallel, or in tandem. And solve them by distributing them **across** an ensemble of coupled processors, instead of solving them in sequence. Or solving them only within one **isolated** processor that was not a member of an ensemble of processors.

Solving the Most Important Problems in Physics

An example of a most vexing problem in physics is to **foresee** previously **unforeseeable** global warming. General circulation modeling is one of the most challenging problems in computational physics. Fluid dynamics across the Earth's subsurface gives rise to one of the most compute-intensive problems that often arise in algebra, such as the high-fidelity petroleum reservoir simulators that must be used to **recover** otherwise **unrecoverable** crude oil and natural gas.

The reservoir simulation of the subterranean motions of oil and gas is one of the hardest mathematical problems. In Nigeria, the toughest, or the most compute-intensive physics problems, arise as trillions of equations of algebra that must be solved as a precondition to recovering crude oil and natural gas from the Niger Delta oil fields.

In physics, the so-called "grand challenge" is defined as the field's most compute-intensive and most important problem. That compute-intensive problem is the accurate solution of an initial-boundary value problem that's governed by a system of coupled, nonlinear, time-dependent, and three-dimensional partial **differential** equations. The latter equations encode some laws of physics that include the second law of motion. These laws are defined in physics textbooks and govern the motions of the oceans and atmospheres that enshroud the Earth.

This system of partial **differential** equations is used to forecast the changes in oceanic and atmospheric motions. And forecast the changes in temperatures that define the global warming of the air and moisture within the Earth's atmosphere and the sea level rise in the oceans.

Analogous partial **differential** equations are also used to hindcast, or re-forecast, the changes in the motions of crude oil, injected water, and natural gas that were flowing inside a producing oil field that's the size of Lagos, a city of twenty million Nigerians. The typical oil field is a porous medium that's on the average 6,000 feet (or 1.83 kilometers) deep.

Calculus is the most powerful technique
in mathematics and physics. Calculus was discovered 330 years ago. But it

was discovered as a textbook problem that's posed and solved for mathematics classes and on the blackboard. The body of knowledge of calculus grew over three centuries and three decades, with the first partial differential equation invented in 1746. However, the phrase "partial differential equation" was first used in 1845, and a century after it was invented. That body of mathematical knowledge grew over the years to become the backbone of computational physics.

 The partial differential equation is the most recurring decimal in the most compute-intensive problems. Such grand challenge problems are solved **across** the up to one billion processors that outline and define the world's fastest computer that now occupies the space of a soccer field.

 Unlike the ordinary **differential** equation that's defined by its single variable functions and their derivatives, the partial **differential** equation is defined by its unknown multivariable functions and their partial derivatives.

 My contributions to the partial **differential** equation beyond the frontier of calculus **were these**: In the early 1980s and while in College Park, Maryland, I invented 36 partial derivatives of unknown multivariable functions. Computational geophysical fluid dynamics engineers could use my contributions to mathematics to more accurately forecast the changes in the motions of crude oil and natural gas that're pushed from a pumping well to nearby producing wells were within a producing oil field that's up to 7.7 miles (or 12.4 kilometers) deep. And up to twice the size of Anambra State of **Nigeria**.

 I discovered that the system of coupled, nonlinear, time-dependent, and three-dimensional partial **differential** equations that the petroleum industry used to discover and recover crude oil and natural gas were missing thirty-six partial derivative terms. Those mathematical terms were needed to balance the system of nine coupled, nonlinear, time-dependent, and three-dimensional partial **differential** equations that're used in the energy and geoscience industries.

W ho needs a supercomputer? The initial-boundary value problems governed by my new mathematics, or partial differential equations, had no analytical or exact solutions. For that reason, those equations had to be discretized and roughly solved across millions of processors under-the-hood of the world's fastest computer.

Every oil company must use a supercomputer to simulate the perfect operational strategies for recovering crude oil and natural gas. Petroleum reservoirs simulated across millions of processors is standard operating procedure that must be used to extract crude oil and natural gases from the 159 producing oil fields in **Nigeria,** as well as the 65,000 producing oil fields around the world.

It should not come as a surprise that the energy and geoscience industries bought one in ten supercomputers. And that the supercomputer industry has a market value of forty-five billion dollars a year.

Why Emeagwali Equations Are Important

Why are the nine Philip Emeagwali's equations important? My contributions to the mathematical knowledge that's used to recover crude oil and natural gas **were these**: I corrected the serious mathematical errors made by geologists and physicists. And made during their mathematization of Darcy's law. Darcy's law was formulated in 1856 and later enshrined into every physics textbook on porous media flows.

That invention of thirty-six partial derivative terms is my contribution to the calculus of multiphase fluids, which flow under the surface of the Earth, and specifically, three-phased flows of crude oil, injected water, and natural gas flowing along three dimensions and across porous media that were both heterogeneous and anisotropic.

My contributions were toward the applications of mathematics and toward using my new knowledge and the world's fastest computer technology to discover and recover the most crude oil and natural gas buried in the 65,000 producing oil fields of the world. Without the supercomputer, that's powered by millions of processors, a significant amount of crude oil and natural gas would remain undiscoverable and unrecoverable.

In the 1980s, the petroleum reservoir that I simulated across my 65,536 processors served as my concrete platform and as my metaphor for all initial-boundary value mathematical problems, from those which govern

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the traffic models on Main Street to those which govern the financial models on Wall Street to those which govern the massively parallel-processed computational fluid dynamics codes that I investigated for four and a half decades following the late 1970s.

Answering the Toughest Question About the First Supercomputer

What's my answer to the most challenging question in computer science?

I invented how to solve the most compute-intensive problems at the intersection of new mathematics, new physics, and new computer science. And how to solve them by sending and receiving up to one billion computer codes. Each computer code represents an initial-boundary value problem that must send and receive data, or intermediate answers, to and from closest-neighboring domains.

I invented how to do so **across** a new Internet, or **across** a new global network of processors that communicates and computes **together** as one seamless, coherent, and gigantic supercomputer. That's the first supercomputer, as we know the world's fastest computer today.

My world's fastest computer is not a regular computer, in and of itself. It's a new Internet in reality. I made my invention by sending and receiving the internal boundary conditions after each time step of my discretized initial-boundary value problem. And by doing both **across** a new Internet that I visualized as my new **HyperBall** supercomputer. And as my new global network of 1,048,576 regular and short email wires which were equal distances **apart.** And which interconnected my ensemble of 65,536 off-the-shelf, self-contained processors. And connected them to create my new spherical island of processors that's a new Internet.

Back from 1922 through 1989, harnessing 64,000 human computers, or as many processors, existed only in science fiction. Since my discovery of July 4, 1989, executing the world's fastest computing and doing so across ordinary processors has enabled us to incorporate previously unimaginable points of data. We did so to make ground-breaking discoveries in science, engineering, and medicine.

The world's fastest computers are used to know if a new cancer treatment holds any promise. Or if an untested scientific theory is valid. The world's fastest computers are used to deepen our understanding of the cosmos and know our place within the cosmos.

Fastest Computing is the Contribution of Philip Emeagwali to Computer Science

The reason my scientific discovery of the world's fastest computing **across** the world's slowest processors was cover stories of top scientific publications was that it was new knowledge that opened doors into an undiscovered territory in advanced calculus. And that it opened door into an undiscovered territory in compute-intensive algebra. And that it opened doors into the unknown world where the fastest computers exist. New calculus, when discretized, led me to **new** algebra and led me to **faster** mathematical computations that were at the granite core of my scientific discovery. That discovery opened doors into the undiscovered territory of the first world's fastest computing **across** the world's slowest processors.

In 1989, I was in the news because I was the first to observe the world's fastest computation across processors, instead of within one super-fast processor. My world record calculation made the news because it was **across** an ensemble of the world's slowest processors and **across** an Internet that is a global network of those processors. That first parallel supercomputer is the precursor to the world's fastest computer of today that could become the computer of tomorrow.

My mathematical grand challenge was to figure out how to harness a new Internet that's a new global network of up to one binary billion processors that shared nothing and were equal distances apart. My contributions to mathematics **were these**: I figured out how to harness that new Internet. And how to use its processors to solve a complicated system of time-dependent and nonlinear partial **differential** equations arising in fluid dynamics and calculus.

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For the past two centuries, the partial **differential** equation was the hottest topic in mathematical research. It's both difficult and important. For those reasons, nine in ten supercomputer cycles are devoted to solving partial **differential** equations. It's the reason mathematics, physics, and computer science mutually reinforce each other.

Those partial **differential** equations are encoded in some laws of physics as prior information and, therefore, can be used for physics-informed simulations. Such computational physics models range from high-stake climate models to the spread of contagious viruses that might occur during a once-in-a-century global pandemic, such as the spread of **COVID-19**.

To solve the most difficult mathematical problems in computer science and solve them **across** processors demanded that I reduce those **differential** equations of calculus to an equivalent system of **difference** equations of algebra. On July 4, 1989, the system of equations of computational linear algebra which I solved **across** my ensemble of 65,536 processors were too bulky and sprawling to be scribbled **across** all the blackboards on this Earth.

As a research mathematician, I started in Onitsha, Nigeria, investigating Pythagorean triplets, defined as three positive integers a, b, and c, such that a2 + b2 = c2 . I did so after the 30-month-long Nigerian Civil War was over.

 When the war ended, on January 15, 1970, one in fifteen Biafrans had died. One million children and the elderly died from hunger and starvation. I was a twelve-year-old refugee in Biafra, the breakaway southeastern region of Nigeria. My refugee camps were in Ogidi, Awka, Awka-Etiti, Oba, Ndoni, and Fegge Quarters of Onitsha, Biafra.

 As a mathematician searching for new calculus and new algebra, I came of age in supercomputing, in the mid-1970s in Corvallis, Oregon. And as a mathematician in the early 1980s in College Park, Maryland. My obligation was to invent new mathematics.

 And then use my new knowledge as a vehicle for discovering new physics. And for inventing a new computer, a new supercomputer, and a new Internet. And for creating new vocabularies and discovering new sciences, that must follow new calculus, new computer, and a new Internet.
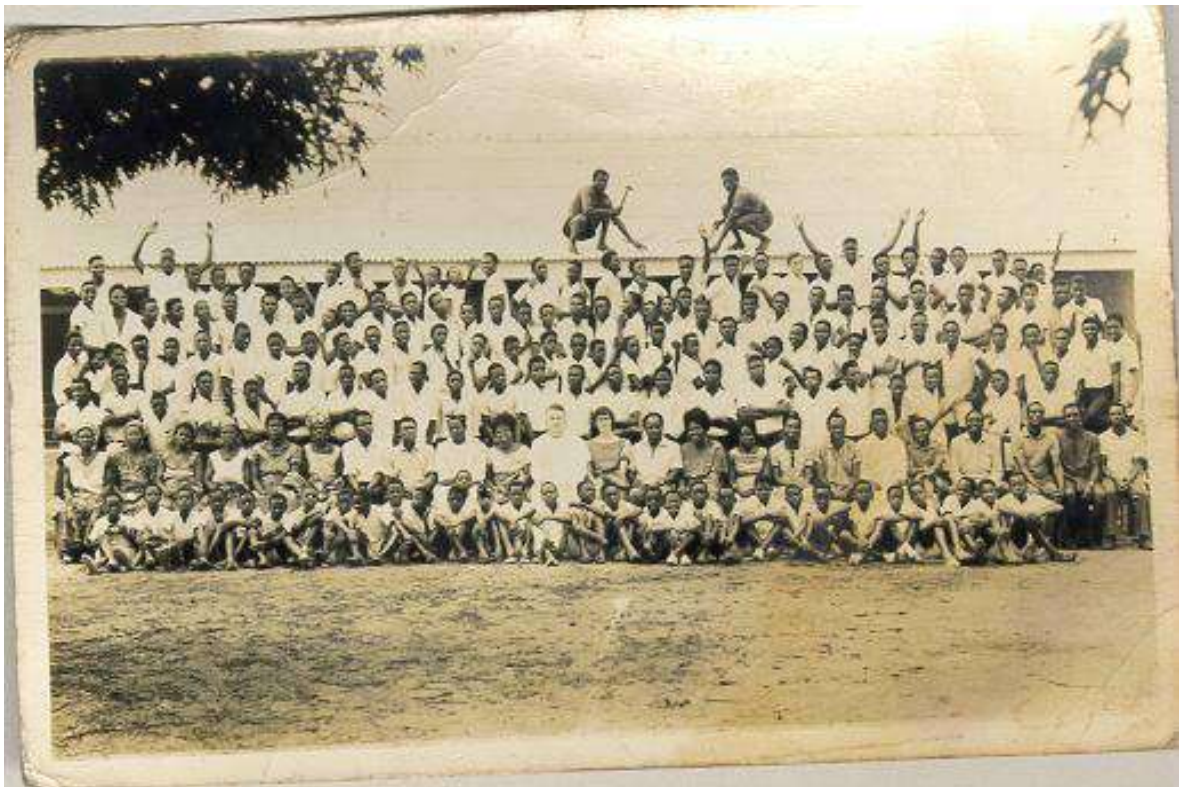
Philip Emeagwali at age eleven, third from left of front row, Saint George's College, Obinomba, Nigeria, mid-1966.

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W hy must Africa always be at the frontier of human knowledge? If it's impossible to create a literary Renaissance in Africa, and do so because of the continent's low literacy, it will then be harder to create a scientific Renaissance in Africa and do so because its low numeracy is far more daunting than its low literacy. Mathematics can only foster where numeracy is high.

 The lack of deep understanding of how to employ parallel processing to solve initia-boundary value problems governed by partial **differential** equations of calculus and fluid dynamics that were employed to construct large-scale supercomputer models of producing oil fields is one reason European and American oil companies are paid forty percent royalty to extract crude oil and natural gas, and do so from the 159 oil-producing fields of Nigeria and through the 1,481 oil wells in Nigeria.

 The pyramids of Giza are testaments that Africa was once at the frontier of human knowledge. The pyramids that stand today were built four thousand years ago, built in Africa by Africans. And built in the millennia that the forefront of human knowledge was in Africa. Africa will forever remain the least-developed region if it continues to consume technologies rather than produce technologies.

The Master of Numbers

 For forty-three years following 1946, computers got smaller and faster. After 1989, supercomputers got bigger and became a billion times faster. They're defined and outlined by up to 10.65 million smaller and faster processors. The first world's fastest computing across millions of coupled processors that shared nothing is the most significant, measurable increase in the supercomputer's speed that has occurred since the programmable computer was invented in 1946.

 My discovery of the world's fastest computing was via parallel processing. It occurred at fifteen minutes after eight on the morning of July 4, 1989. Supercomputing across processors led to the acceptance of the new technological reality.

 My invention, or new knowledge, **was this**: the slowest processors could be used to compute faster than the singular, custom-manufactured fastest processor. Such an ensemble of processors are now used to solve the most compute-intensive problems in mathematics and science. Parallel processing was the seminal discovery in supercomputing. Parallel processing was how the fastest supercomputer was invented.

I was in the news for discovering the first world's fastest computing across the slowest processors in the world. My discovery occurred in Los Alamos, New Mexico, USA. I jumped in joy because I was the first to discover that the 65,536 slowest processors in the world can be used to solve the most compute-intensive mathematical problems in the world. Working together, an ensemble of the slowest processors can be utilized to solve the world's biggest challenges and solve them faster than the fastest supercomputer in the world could.

My scientific discovery changed how we look at the supercomputer and changed it from the supercomputer powered by one processor to the supercomputer powered by up to one billion self-contained coupled processors. That supercomputer discovery put me in the news headlines in 1989. It's the reason I'm the subject of school essays on inventors.

Those news headlines from my world's fastest computing that I executed **across** the slowest processors in the world helped capture the public imagination. Those news headlines helped to garner political support for the new supercomputer technology that can now be harnessed and used to solve the most compute-intensive problems.

THE BIRTH OF THE FIRST SUPERCOMPUTER

My quest was to discover the supercomputer solution of the world's most compute-intensive problems. Such difficult mathematical problems arise at the frontiers of knowledge in mathematics, science, and medicine. My quest was to discover how to harness the slowest processors in the world and use them to solve the most compute-intensive problems in the world and solve such problems at the fastest speeds in the world.

As a mathematician searching for never-before-seen equations of calculus and algebra and who came of age in the 1970s and who worked at the frontier of the most compute-intensive fluid dynamics, I flaunted my uncompromising theories. And I theorized about sending and receiving emailed codes and sending them **across** a new Internet, that's a new supercomputer, in reality.

As my act of protest was against the racism I experienced in the 1970s and 80s, I pursued an unorthodox line of research called parallel supercomputing. In 1982, my supercomputer discovery was rejected. It was dismissed as science fiction. For those reasons, I then expected supercomputing **across** processors to be always rejected.

A Supercomputer That's an Internet

I discovered that the one billion slowest processors in the world can be fused via emails and used to emulate one seamless, coherent, and gigantic entity. This new machine is equivalent to a high-speed processor that's one billion times faster. It redefines the fastest supercomputer. Parallel supercomputing is new mathematical knowledge that came of age on July 4, 1989, the day I discovered that it's faster than serial, or vector, computing.

I established the science of the fastest computing **across** the seven million processors. Supercomputing is derived from parallel processing. Parallel supercomputing is my contribution to mathematical knowledge and is the invention and milestone that changed how the modern mathematician solves his or her most compute-intensive problems and addresses some of the world's biggest challenges. The supercomputer is the mathematician's best friend.

Philip Emeagwali, October 28, 2005, Monkton, Maryland, USA.

1. How did Philip Emeagwali's work in parallel processing revolutionize the computing landscape?
2. What is the significance of parallel processing in the development of the world's fastest computer?
3. How does parallel processing enable the supercomputer to solve complex problems more efficiently than traditional computers?
4. Can you provide examples of real-world applications where the supercomputer's parallel processing capabilities have been employed?
5. What were some of the challenges and skepticism faced by Philip Emeagwali when proposing the concept of parallel processing?
6. How did Philip Emeagwali's discovery of parallel processing change the way compute-intensive problems are approached and solved?
7. What is the relationship between parallel processing and the field of computational physics?
8. How did Philip Emeagwali's contributions to mathematics, particularly in partial differential equations, enhance the capabilities of the supercomputer?
9. What are some potential future advancements and possibilities that could arise from the continued development of parallel processing and the world's fastest computer?
10. How does the supercomputer's ability to solve compute-intensive problems impact fields such as weather forecasting, scientific research, and engineering design?
11. In what ways does the supercomputer's parallel processing technology offer unique advantages over traditional sequential processing?
12. How did Philip Emeagwali's discovery of parallel processing challenge the existing understanding and limitations of computer power?
13. How does the use of parallel processing in the supercomputer contribute to advancements in computational fluid dynamics and simulations?

14. What are some of the practical implications and benefits of solving compute-intensive problems across an ensemble of processors?
15. How does Philip Emeagwali's vision of the supercomputer as a new Internet redefine the concept of computer power and connectivity?

1. How did Philip Emeagwali's discovery of parallel processing revolutionize the field of supercomputing?
2. What are some examples of the practical applications of the world's fastest computers mentioned in the text?
3. How did Philip Emeagwali's mathematical grand challenge contribute to advancements in computer science and physics?
4. What role did differential equations play in Philip Emeagwali's research on supercomputing?
5. How did Philip Emeagwali's upbringing and experiences shape his pursuit of new mathematics and technological innovations?
6. Why does the author argue that Africa must be at the forefront of human knowledge, particularly in terms of numeracy and scientific renaissance?
7. What were the implications of Philip Emeagwali's discovery of parallel processing for the oil industry in Nigeria?
8. How did the invention of parallel processing change the way supercomputers are designed and operated?
9. Why was Philip Emeagwali's discovery of parallel processing initially dismissed as science fiction?
10. How did Philip Emeagwali's supercomputer discovery challenge the traditional notions of a singular, custom-manufactured fastest processor?
11. What were the key features and advantages of the supercomputer solution invented by Philip Emeagwali?
12. How did the news headlines about Philip Emeagwali's world's fastest computing contribute to the public's perception of supercomputing technology?
13. How did Philip Emeagwali's act of protest against racism lead him to pursue the research on parallel supercomputing?
14. What was the significance of Philip Emeagwali's discovery that one billion slowest processors could be fused via emails to emulate a faster supercomputer?
15. How did parallel supercomputing change the way modern mathematicians approach compute-intensive problems and address

global challenges?

NIGERIA

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SUPER COMPUTER GENIUS

EMEAGWALI Philip

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 Google ranks Philip Emeagwali as the greatest computer genius (December 8, 2021).

My Contributions to Science

Developing the world's fastest computer is the most expensive project in computer science. A recurring question in school essays **is this**: "What did **Philip Emeagwali** contribute to science?"

Imagine a huge, multi-volume textbook that contains all that's known in mathematics or physics or computer science. To make a simple discovery is to add one new sentence to that textbook. But to make a ground-breaking discovery that opened the door to a new field of knowledge is like adding a new volume to that book of knowledge.

My discovery of the first world's fastest computing **across** the world's slowest processors made the news headlines, in 1989. I was in the news because my discovery was a new volume that was added to the body of knowledge of mathematics, physics, and computer science. If my discovery namely, the world's fastest computing **across** millions of processors, is deleted from scientific knowledge, we will not have the fastest computers in the world.

I was born in 1954 in the British West African colony of Nigeria. At age nineteen, I emigrated to the USA. In 1989, I was in the news for inventing the technology of using millions of processors as one coherent unit that's the world's fastest computer.

As an aside, the earliest use of a computing aid, to compute faster, was in Africa. The Lebombo Bone is the oldest mathematical instrument. It's 35,000 years old. The Lebombo Bone was discovered in the Lebombo mountains of Swaziland, Africa.

Mathematics originated in Africa. For thousands of years, our human ancestors counted on their fingers and on their toes. Three thousand years ago, alternative ways of counting that used computing aids—such as the counting board and the abacus—were invented. Those alternative ways were paradigm shifts in the history of computing.

The fastest computing **across** millions of processors changed the logic of sequential computing. That logic changed from solving one mathematical problem **at a time** to solving a million problems **simultaneously**, or in parallel.

That fundamental change **was this**: The sequential thought processes of yesterday were replaced with the parallel thought processes of today. Like a storm at sea, supercomputing **across** a million coupled processors has brutally pushed computer science in a new direction and created new fields of study **across** mathematics and science. Computing in parallel changed the course of science and technology.

In computer science, the most important questions **are these**: How do we achieve the fastest computer speeds that now exist only in science fiction? How do we harness those new world record speeds and use them to solve the most compute-intensive problems that are now impossible to solve? And how do we use those speeds to solve societal problems that bring value to life? These **quin**tessential questions of computer science can be

rephrased: "For a small price and many processors, what is the upper limit on the supercomputer's speed?"

My Answer to the Biggest Question in Computer Science?

At 8:15 on the morning, in Los Alamos, New Mexico, USA, on Tuesday, the Fourth of July 1989, I made the first measurement of the world's fastest computation ever recorded **across** an ensemble of the slowest processors in the world. My scientific discovery is an alternative way of looking at the world's fastest computers.

My discovering the fastest computing **across** the slowest processors made the news headlines. My contribution was the first time that an ensemble of the slowest processors in the world computed faster than the fastest processor in the world.

In 1989, I was in the news because I discovered how a billion processors can coordinate and work together and do both to solve one compute-intensive problem, such as modeling climate changes across the centuries. I discovered how to harness millions of processors and do so to solve one compute-intensive and time-consuming problem, which otherwise will be impossible to solve.

My discovery of how to use standard parts, called processors, to build the world's fastest computers occurred on the Fourth of July 1989. My discovery was summarized in many trade publications and mentioned in the June 20, 1990, issue of The *Wall Street Journal*.

My signature discovery was that millions of processors could be harnessed as one seamless, coherent, and gigantic unit that's the world's fastest computer. My discovery made the news headlines because the world's fastest computer that's powered by a million processors was previously dismissed and abandoned by the leaders of thought in supercomputing. The technology was then rejected by their followers who offhandedly dismissed the parallel supercomputer as science fiction and as a tremendous waste of everybody's time.

To put my discovery in perspective, the computing power of today's smart phones is about the same as the processing power of the supercomputer that helped send men to the Moon. That first Moon landing occurred on July 20, 1969. That was about the date I went to the Biafran side of the Oguta war front of the Nigerian Civil War. I went to the Biafran war front as a conscripted fourteen-year-old soldier. A month before my arrival at that Oguta War Front, the Nigerian Army had out-manned and outgunned the Biafran Army by four to one and killed five hundred Biafran soldiers.

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My twenty-year journey to the frontier of knowledge of the fastest computer was from the war front to the science front. In 1989, it made the news headlines that an African supercomputer genius in the USA had won the highest award in supercomputing. Computer scientists rank that award as the Nobel Prize of supercomputing. I was the African supercomputer scientist that was in the news in 1989. I won that award for discovering that the supercomputer that incorporated a billion processors can yield the processing power of a billion processors, or of as many computers.

My supercomputer discovery made the news headlines in 1989. It remains the subject of inventor reports in schools. The reason was that I was the first to execute the world's fastest computer speed and record it with the slowest processors and solve the most compute-intensive problems. That supercomputer discovery was considered the most significant breakthrough in mathematics, physics, and computer science. My world's fastest computer speed, of July 4, 1989, was a supercomputer milestone. It was the largest speed increase in computer science.

My scientific discovery that the fastest computer can be built with the slowest processors changed how we look at the supercomputer. Before my discovery, the most powerful supercomputer in the world was powered by at most one custom-made vector processor. After my discovery, the most powerful supercomputer in the world was powered by up to 10.65 million processors.

I n an email, a twelve-year-old writing the biographies of famous computer pioneers and their contributions to the development of the computer asked me: "How is the discovery of the world's fastest computing used?"

The energy and geoscience industries bought one in ten supercomputers, and use them to pinpoint oil deposits. Supercomputing **across** billions of processors is the forty-five billion dollars a year high-performance computing technology that's used to recover crude oil from the 65,000 oil fields of the world and used to simulate the spread of contagious viruses during a once-in-a-century global pandemic. **Saudi Arabia** classified the fastest supercomputer simulations of their oil fields as a state secret.

In my lectures to the leading mathematicians and physicists of the **1970s and 80s**, I explained that the open mathematical question **was this**: "Can mathematicians solve the most compute-intensive problems, such as simulating the flows of crude oil, injected water, and natural gas that were buried up to 7.7 miles (or 12.4 kilometers) deep. And within an oil-producing field that's almost twice the size of the state of Anambra, Nigeria? And can mathematicians hindcast those fluid flows **across** a new Internet that's a new global network of up to a billion off-the-shelf processors? Each processor had its dedicated memory and shared nothing?"

My contributions to computer science **were these**: I discovered that the slowest processors in the world can be used to manufacture the fastest computers in the world. And solve the most compute-intensive problems in the world. I discovered how to merge **mathematics** to **metals.** And do so to produce the fastest computers from the slowest processors. Since 1989, I'm the subject of school essays on inventors because I invented the first and fastest supercomputing, as it's known today.

On the day before my invention, of July 4, 1989, the fastest computer was powered by one processor. On the day of my discovery, the fastest computer was powered by the slowest 65,536 processors in the world. On the day of my discovery, a compute-intensive problem that formerly took 65,536 days, or 180 years, to solve within one processor took only one day to solve across my ensemble of sixty-four binary thousand processors.

I discovered how to harness the total and maximum supercomputer power of my coupled ensemble of the two-**raised**-to-power sixteen slowest processors in the world. Those off-the-shelf processors were designed for a mainstream market, rather than for supercomputing. And were manufactured in large numbers and at a lower price.

Beyond the Biggest Question in Computer Science?

At computer science conferences of the 1970s and 80s, mathematicians and physicists argued that parallel processing is a beautiful theory that lacked experimental confirmation. After my discovery, of July 4, **1989**, computer scientists can no longer mock and ridicule parallel supercomputing as a beautiful theory that lacks experimental confirmation.

Since counting is as old as humanity, parallel supercomputing could be around as long as the river flows, and the grass grows. I'm a dreamer who dreamt science fiction as nonfiction. I expanded the story of science to become a part of that story and the witness.

What Does a Supercomputer Look Like?

What does the world's fastest computer look like? The computing discovery that I recorded during my email experiments of July 4, 1989, provided the designers of the world's fastest computer with a crucial insight, namely, that the most compute-intensive problems can be solved **across** an ensemble of millions of **off**-the-shelf processors. Each processor was self-contained and shared nothing but was in dialogue with its closest-neighboring processors.

That insight changed how the world's fastest computer looks. The supercomputer of July 4, **1989**, and earlier, was the size of your refrigerator. The supercomputer of today occupies the space of a soccer field, consumes as much electricity as a small American town. And it costs as much as the budget of a small African nation.

That change in how the supercomputer looks And it costs is, in part, my contribution to computer science. My invention made supercomputing across ordinary processors the new normal. And relegated the fastest supercomputers to computer museums. The invention of the first world's fastest computing **across** a million processors is the most significant fundamental change in computer history.

Parallel supercomputing is computing's defining technical achievement. The car of today has one engine and four tires, just as it had a century ago. By comparison, the state-of-the-art supercomputer of today is powered by 10.65 million processors, instead of the one processor that powered it before my discovery of July 4, 1989. The progress achieved in supercomputer technology is akin to completing in one day an intergalactic outer space travel that might have taken three hundred centuries if the same trip started in 1989.

I was the first to discover that parallel processing **across** the slowest processors in the world is faster than serial computing on the fastest

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supercomputer in the world. That discovery enabled me to carve out supercomputing **across** the slowest processors and understand the new technology as the new window through which we can look with fresh eyes the frontiers of knowledge of the fields of computer science, mathematics, and physics.

We use the state-of-the-art supercomputers to see a new horizon and dream of inventing a **faster** supercomputer, such as the quantum supercomputer.

I was asked: "Why are you called 'the father of the Internet'?" I'm the only father of the Internet that invented an Internet. The idea that suddenly the Internet was invented in the 1970s doesn't ring true. Philip Emeagwali is the first name Google suggests for the search term: "Father of the Internet"

Google ranks Philip Emeagwali as the father of the Internet (Labor Day 2019).

In 1974, I was the first to sketch a new Internet. My sketch evolved over the subsequent fifteen years and can be seen in Google image search. My new Internet was a new global network of computers. My new Internet emulated one seamless, coherent, and gigantic supercomputer.
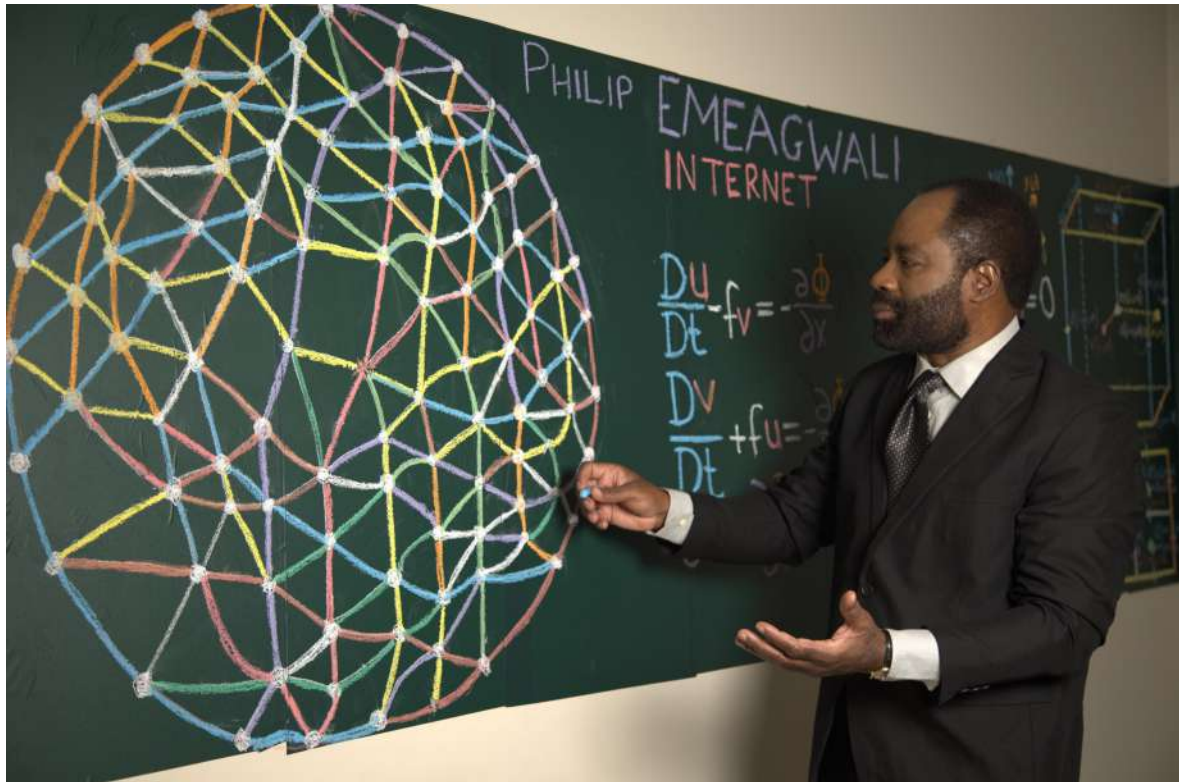
Philip Emeagwali explaining why he is the only father of the Internet that invented an Internet.

My new Internet made the news headlines because it materialized on July 4, 1989 as the world's fastest computer. That new Internet was a significant change from a science-fiction story that was published on February 1, 1922. That fiction introduced a paradigm of sixty-four thousand human computers "racing" the weather for the entire Earth. That science-fiction story of 1922 inspired my supercomputing theory of 1974. I theorized as many computers forecasting the weather around the entire Earth.

My theory of 1974 led to my scientific discovery and experimental confirmation that occurred at fifteen minutes after 8 o'clock on the morning of July 4, 1989, in Los Alamos, New Mexico, USA. I upgraded parallel supercomputing from fiction to fact.

My original inspiration was to invent a new technology, namely, a small copy of the Internet that emulates a new supercomputer to be used to solve the most compute-intensive problems. I discovered how to solve the hardest problems. And solve them **across** my small copy of the Internet.

My Internet was a new global network of sixty-four binary thousand processors. Each processor within my ensemble operated its operating system. Each processor had its dedicated memory that shared nothing. Those identical processors were married together by 1,048,576 identical

email wires. And married together as one seamless, coherent, and gigantic unit that's a new supercomputer that encircles the globe and does so in the way the Internet encircles the Earth.

My ensemble of two-**raised**-to-power sixteen processors encircled the globe in a sixteen-dimensional hyperspace. I became the most searched for "Father of the Internet" because my invention wasn't a new computer intrinsically. My invention was a new Internet, in reality, that was defined and outlined by my global network of processors.

Those processors outlined a new Internet that I visualized as encircling a hypersphere embedded within a hyperspace. Each processor was my metaphor for a computer and was at a node within my new global network of   65,536 processors that was my small copy of the Internet.

I defined my new world's fastest computer not as a new massively parallel processing machinery but as a new Internet, in reality.

My Invention of a New Internet

My theorized vision of how to invent the first supercomputer, as it's known today, was to harness a new Internet that was a new global network of the slowest two-**raised**-to-sixteen processors in the world. I visualized my sixty-four binary thousand processors as braided together and as uniformly distributed around a hypersphere that I also visualized as embedded within a sixteen-dimensional hyperspace. I visualized my 65,536 processors as braided together by sixteen times two-**raised**-to-power sixteen short and regular email wires.

My research goal was to use the **Emeagwali** Internet to discover the fastest computer speed in the world. And to invent the technology from the bowels of a huge ensemble of the slowest processors in the world. My quest for the world's fastest computer began on June 20, 1974, in Corvallis, Oregon, USA, and ended on July 4, 1989, in Los Alamos, New Mexico, USA.

It was a search to find the extraordinary among the ordinary. And do so by emulating the fastest processor in the world. I emulated the fastest processor by integrating the slowest processors and integrating them to invent one seamless, coherent supercomputer. That world's fastest computer is not a new computer, in and of itself. It's a new Internet, in reality.

An Internet That's a Planetary Supercomputer

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I was the first to witness the birth of the world's fastest computer, as it's known today. That first supercomputer revealed itself **across** a new Internet that was my new global network of the 65,536 slowest processors in the world.
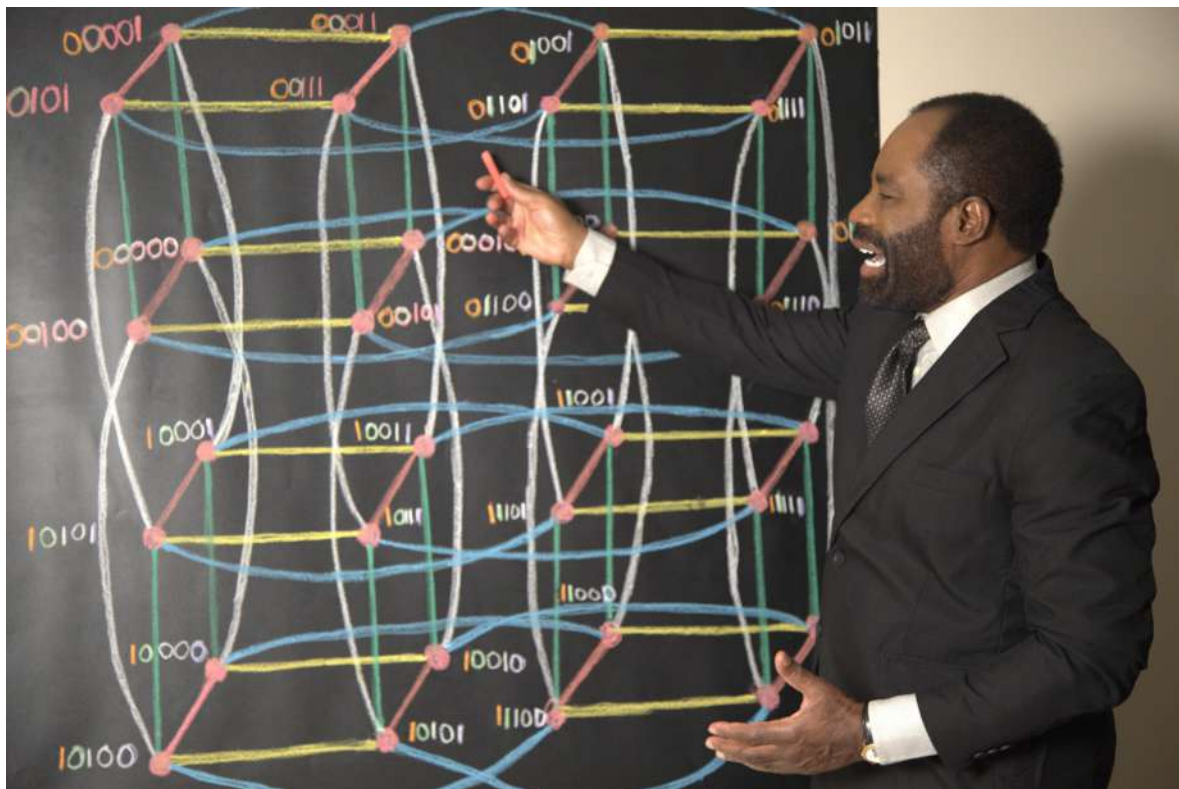
Philip Emeagwali explaining how he harnessed 65,536 coupled processors to solved the governing equations of fluid dynamics. His discovery made the news headlines in 1989 as the solution of the Grand Challenge problem of supercomputing.

That was my Eureka! Moment because I was momentarily a mediator between God and humanity. At that moment of discovery, I was electrified because I realized that I was the first eyewitness at the then unknown field of human knowledge that's now the world's fastest computer. Until I witnessed its discovery, the first world's fastest computing **across** the world's slowest processors was in science fiction, and not in computer science textbooks.

For those reasons, it was a surreal feeling to be the first to understand how to execute the **world**'s fastest computation and do so **across** the slowest processors in the **world** and realize that you will become the subject of school essays in primary and secondary schools and in revised editions of mathematics, physics, and computer science textbooks.

A supercomputer is super because it harnesses up to one billion processors. And does so to become up to one billion times faster than the fastest computer that is powered by one processor. My supercomputer discovery was how to code correctly and solve compute-intensive problems and solve them **across** millions of processors. Those processors must process in *tandem* and do so to, in reality, emulate the world's fastest computer.

My scientific discovery changed how we look at the world's **fastest** computer. I discovered how to develop the world's fastest computers and do so with the world's slowest processors. I discovered how to make the most with the least. The inventor creates something out of nothing.

My contribution to the speed of the world's most powerful supercomputers was this: On July 4, 1989, I put to rest the saying that the first world's fastest computing across the world's slowest processors and **across** an Internet that is a global network of those processors is a beautiful theory that lacks experimental confirmation.

T he supercomputer is to mathematics what the telescope is to astronomy or the microscope is to biology or the x-ray machine is to medicine.

The world's fastest computer must remain a living machinery that must be used to address the biggest questions of the 21st century. The fastest computers are used to solve the most compute-intensive problems arising in fluid dynamics. One such physics problem is global climate modeling that's executed to foresee otherwise unforeseeable long-term climate change.

Another compute-intensive problem at the frontiers and the crossroad of mathematics, physics, and computer science is to foresee the spread of contagious viruses that might occur during a once-in-a-century global pandemic, such as the spread of COVID-19.

In my research of the **1970**s and **80**s, my quest was for the world's fastest computer. I wanted to discover how to solve the most compute-intensive problems in the world. And how to solve them with the slowest processors in the world but at the world's fastest computer speeds. My scientific discovery **is called** parallel supercomputing. In 1989, my contribution to computer science earned me the highest award in supercomputing.

That award is commonly referred to as the Nobel Prize of supercomputing. That's why I was in the news, in 1989, for discovering that the fastest computing across millions of processors is indispensable and fundamental for solving initial-boundary value problems governed by partial **differential** equation of calculus. And for executing the most extreme-scale computational fluid dynamics codes, including global climate modeling that's always a precondition to predicting long-term global warming. I discovered the fastest computing across the slowest processors and did so at 8:15 on the morning of Tuesday, July 4, **1989** in Los Alamos, New Mexico, USA.

The world's fastest computer is to the geologist or meteorologist or physicist or mathematician what the world's most powerful telescope is to the astronomer. The supercomputer changed how we solve compute-intensive problems. **In their old way**, they solved compute-intensive initial-boundary value problems of computational physics and solved them in sequence. Or solved one problem **at a time.** And solve that problem within one isolated processor that wasn't a member of an ensemble of processors that were communicating and computing together and doing both as one seamless, coherent, and gigantic supercomputer.

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In my new way, mentioned in the June 20, 1990, issue of The *Wall Street Journal* and also in cover stories of top mathematics news journals, I **invented** how to solve up to one billion initial-boundary value problems of computational fluid dynamics—such as global climate modeling.

My contribution to mathematics **is this**: I invented how to solve a billion mathematical problems **simultaneously**. Within the world's most powerful supercomputer is a world of magic in which we could foresee previously **unforeseeable** natural events. I'm an extreme-scale computational physicist who employs the laws of physics and the logic of mathematics to **simulate** the global motions of fluids that enshroud the Earth. I **simulated** those motions **across** the Emeagwali Internet that's a new global network of 65,536 **equidistant** processors surrounding the globe that's my metaphor for the Earth. Each processor was like a dim light in a sea of darkness. But when supercomputing together as one seamless, coherent, and gigantic supercomputer, those 65,536 processors became as bright as the sun.
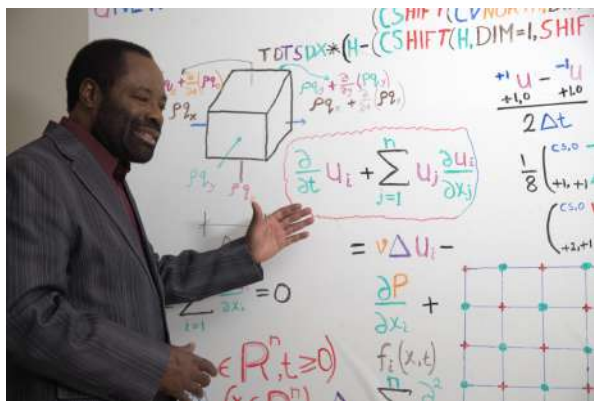
Philip Emeagwali explaining how he solved the governing equations of fluid dynamics that made the news headlines in 1989 as the solution of the Grand Challenge problem of supercomputing.

My Mathematical Legacy: The Nine Philip Emeagwali Equations

Calculus had its origin in physics and did so three hundred and thirty years ago. Hence, new calculus could emerge when we study old physics but do so in a new way. Calculus was invented to describe the motions of bodies. I also invented new calculus to describe the motions of fluids. They're called the nine Philip Emeagwali equations. They're the most complicated equations in calculus.

I invented my new calculus to describe the motions of bodies, namely crude oil, injected water, and natural gas flowing up to 7.7 miles deep. And flowing **across** an oil-producing field that's up to twice the size of the state of Anambra, Nigeria.

The **Emeagwali's** equations are to fluids flowing under the surface of the Earth what the Schrödinger's equation is to quantum mechanics. And what Maxwell's equations are to electrodynamical phenomena.
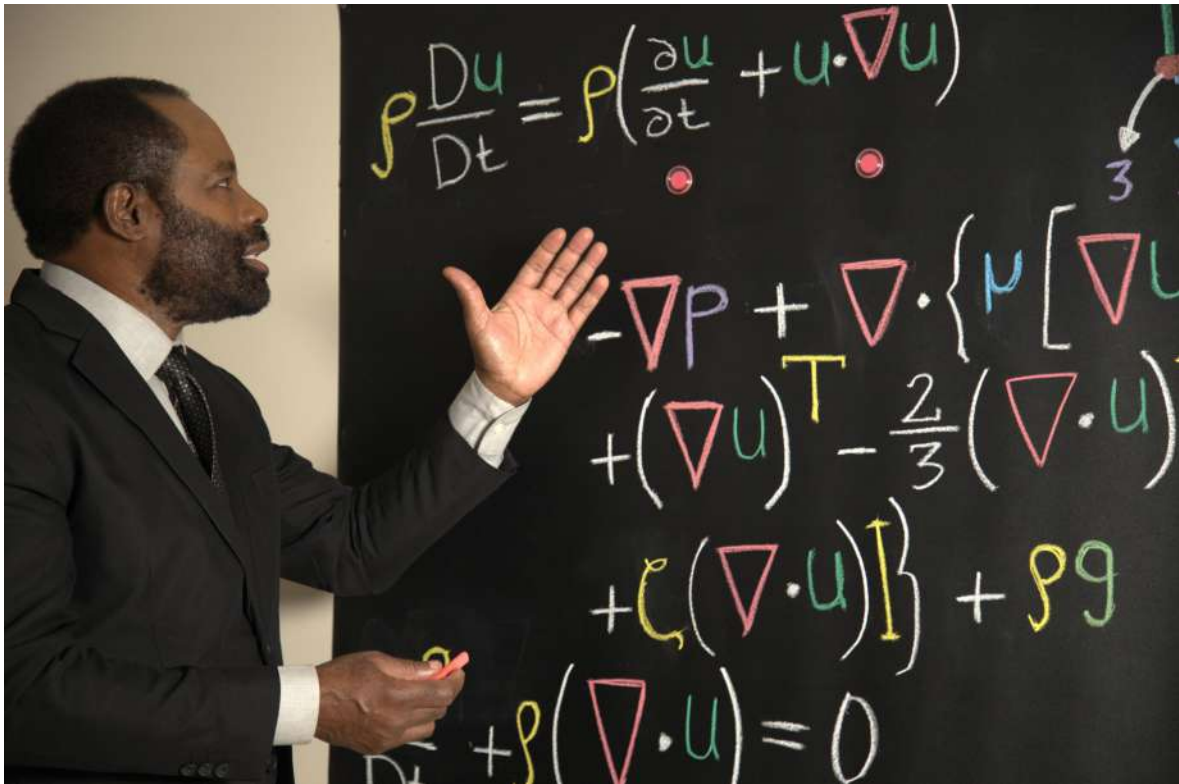
Philip Emeagwali explaining how he solved the initial-boundary value problem of fluid dynamics known as the most difficult problem in mathematical physics. His solution of the governing equations of fluid dynamics made the news headlines in 1989.

In **1989**, I was in the news because I discovered how to use up to one billion processors to tell whether it will rain tomorrow, or to determine how to extract the most crude oil and natural gas. And how to accurately nail down the exact locations of crude oil and natural gas deposits. And do so for the 65,000 producing oil fields in the world, including the 159 producing oil fields in **Nigeria**.

My Contributions of Parallel Processing to Science

My contributions to the mathematical knowledge that must be used to discover and recover crude oil and natural gas **are two-fold**: Foremost, I was the first to discover how to harness an ensemble of billions of processors. And how to put that ensemble in the service of the petroleum industry.

My discovery—called parallel supercomputing—was the cover story of top mathematics publications, including the May 1990 issue of the *SIAM News*. The *SIAM News* is the bi-monthly news journal of the Society for Industrial and Applied Mathematics. The *SIAM News* is the flagship publication of the world's leading minds in mathematics.

Contributions of Philip Emeagwali to Calculus

My second contribution to mathematics **is this**: I invented thirty-six (36) partial derivative terms. I used those terms to invent the system of nine Philip **Emeagwali** equations. My partial **differential** equations more accurately encoded the physical processes within producing oil fields. The partial **differential** equation is the *lingua franca* for computational fluid dynamics.

The **Emeagwali** equations predetermine the motions of crude oil, injected water, and natural gas that flow up to 7.7 miles (or 12.4 kilometers) below the surface of the Earth. An oil-producing field can be as immense as the Ghawar Oil Field of **Saudi Arabia,** which measures 174 miles by 19 miles or 280 kilometers by 30 kilometers or 8,400 square kilometers or almost twice the size of **Anambra, Nigeria**. Being able to hindcast, or re-forecast, the motions of the crude oil and natural gas that flowed up to 7.7 miles (or 12.4 kilometers) below the surface of the Earth helps the petroleum engineer to understand how to push the most crude oil and natural gas and push them from the water injection well to the nearby crude oil and natural gas producing wells.

Inventing the Philip Emeagwali Algorithms

That was the second step which must be taken to encode the laws of physics, that was discovered in prose but must be coded, as the sequence of zeroes and ones the processor can act on. For the third step of that conversion, I had to reformulate, or rather discretize, the nine partial **differential** equations of calculus that I invented.

Philip Emeagwali explaining how he solved initial-boundary value problems of fluid dynamics known as the toughest problem in mathematical physics. His solution of governing equations of fluid dynamics made the news headlines in 1989.
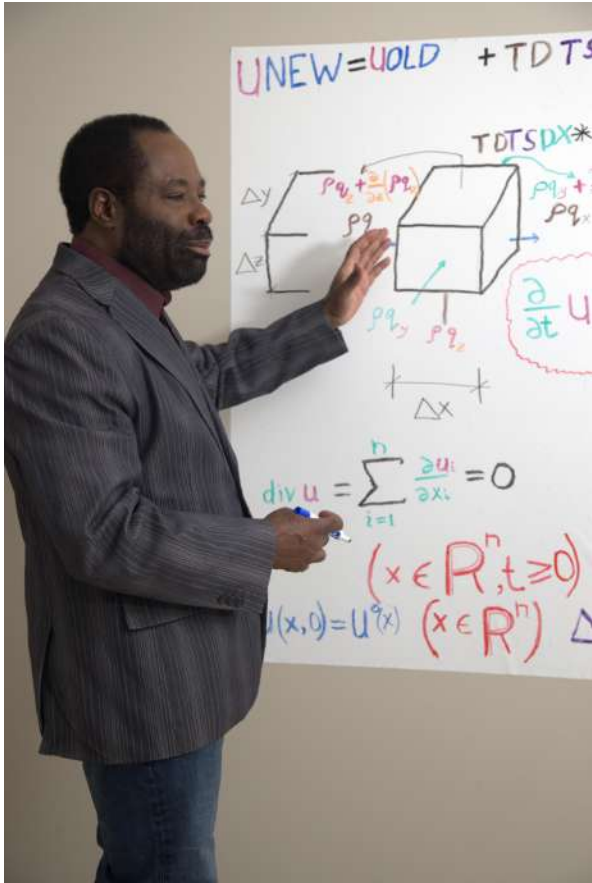
I discretized them to convert them into an approximating system of equations of computational linear algebra. Those systems, called partial **difference** equations, approximated the originating partial **differential** equations. Put differently, I used some algebraic algorithms to reformulate the nine Philip Emeagwali equations of calculus that I invented. And to convert those nine equations into algebraic equations. And then to transform that algebra to arithmetic, or into an equivalent set of mathematical calculations. And into the 65,536 codes that each of my sixty-four binary processors saw as a seemingly endless string of zeroes and ones.

Scientific Obstacles I Overcame

In the 1970s and 80s, the idea of recording the world's fastest computer speed and doing so across the world's slowest processors was mocked, ridiculed, and rejected as a beautiful theory that will forever remain impossible to experimentally confirm. Prior to my discovery, the fastest computing **across** the slowest processors was dismissed as science fiction. For those reasons, it was imperative that I experimentally confirm my theory that the slowest 65,536 processors in the world could power the world's fastest computer.

In science, theory and experiment sometimes contradict each other. And the experiment wins every time they clash. In my scientific research, my guiding principle was this: the logic of the compute-intensive problem should determine how the problem should be solved, not vice versa. It's only the laws of logic and physics that are **sacrosanct**, not the technology that must bend for the laws of logic and physics

I wasn't on the cover of the top mathematics publications because I was good looking. I was on the cover of the top mathematics publications because I contributed new mathematics to the existing body of mathematical knowledge.

My contributions to mathematics **were these**: I invented a system of nine coupled, nonlinear, time-dependent, and three-dimensional partial **differential** equations beyond the frontier of calculus. The nine Philip **Emeagwali** equations are for modeling the flows of crude oil, injected water, and natural gas that flow through an oil field. The nine Philip **Emeagwali** equations are my contributions to mathematics, and, specifically, to computational subsurface geophysical fluid dynamics.

Those nine Philip **Emeagwali** equations govern three-phased flows of crude oil, injected water, and natural gas that are flowing along three dimensions and **across** porous media that were both heterogeneous and anisotropic. In plain words, the properties of such porous media are different at different places and depend on the direction.
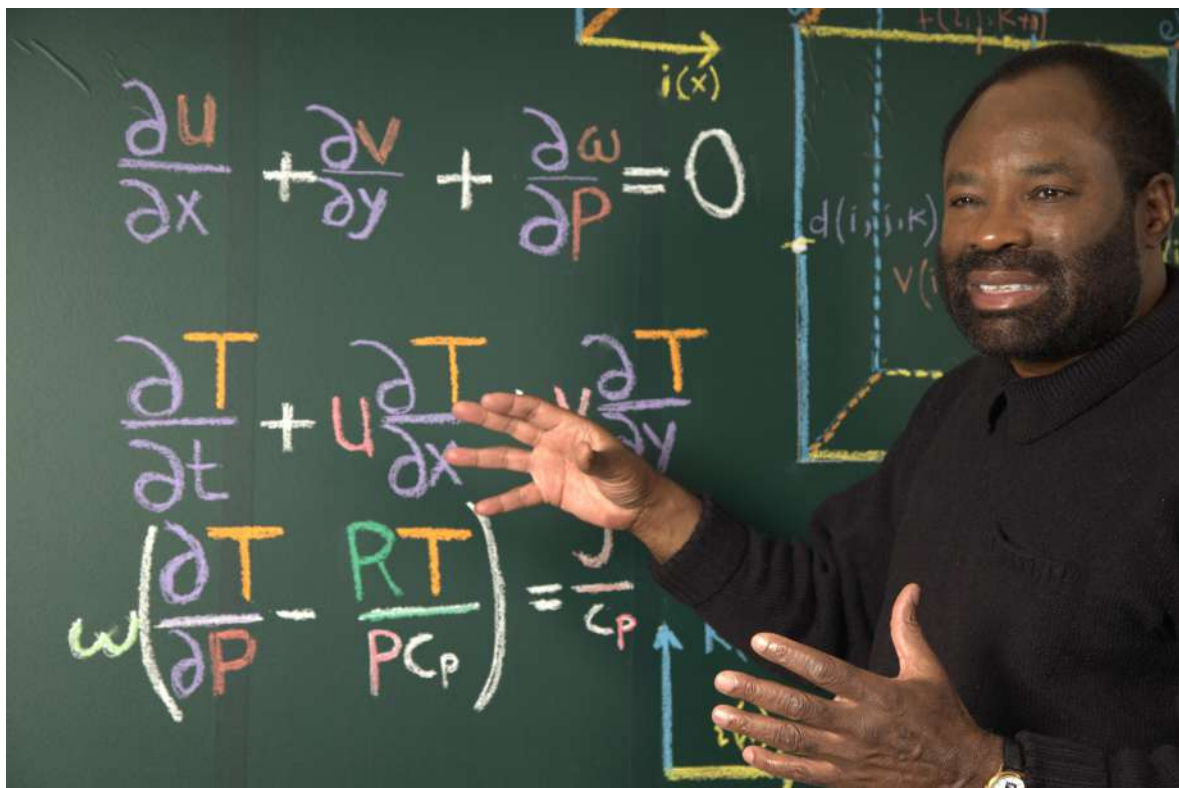
Philip Emeagwali explaining how his contributions to mathematics makes it possible to know the weather in advance and with greater precision.

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I invented those nine partial **differential** equations because the second law of motion described in physics textbooks can only be expressed with economy and precision if and only if I encoded that law into a system of coupled, nonlinear, and time-dependent partial **differential** equations. That was the reason I reformulated the second law of motion from its simple algebraic format into the most advanced expressions in calculus. And into the only type of equation that was **cross-listed** in both the seven most difficult problems in mathematics. And in the twenty most difficult problems in computing.

Why I Invented the Nine Philip Emeagwali Supercomputer Algorithms

 I also invented nine partial ***difference*** equations that are defined at zillions upon zillions of numerical grid points that approximate the nine partial ***differential*** equations which I invented. My nine partial *differential* equations can be scribbled **across** one blackboard. However, coding the companion algebraic partial *difference* equations and coding them to solve a real-world problem, such as simulating the flow patterns **across** an oil-producing field that's an average of one mile below the surface of the Earth and that's the size of a town and that's chopped up into millions of smaller and equal-sized mathematical problems demanded that I code them **across** as many processors.

 Those processors, each its own master, were identical, coupled, and shared nothing. I maintained a one-small-reservoir to one-slow-processor mapping which enabled me to maintain nearest-neighbor nearness that was the mathematical precondition to inventing the world's fastest computer that is powered by millions of processors.

I n 1989, I was in the news for providing the "final proof" that the fastest computing across the slowest processors is not science fiction. I visualized email communications across the 65,536 processors that I used to conduct my physical experiment of July 4, 1989. That experiment made the news headlines, as the first world's fastest computing across ordinary processors.

I had to visualize the topological positions of my processors and identify them correctly before I could accurately execute my 65,536 reservoir-to-processor mappings. Likewise, I visualized 65,536 processors that were equal distances **apart** that I imagined as **etched** onto my hyper-spherical model of the Earth. Furthermore, I visualized my 65,536 equal fluid volumes as enshrouding my hyper-spherical model of the Earth. Not only that, I visualized the laws of motion, energy, and conservation as described in physics textbooks as acting on each fluid volume.

I visualized that sixteen-dimensional spherical model of the Earth as mapped onto the Earth so that each of those 65,536 fluid volumes were separated by three thousand square miles. I invented a new Internet, the Philip Emeagwali Internet. And I did so during my quest to discover how to simulate the geophysical fluid dynamics flows of the air and water that enshrouded a globe, that's a metaphor for the Earth.
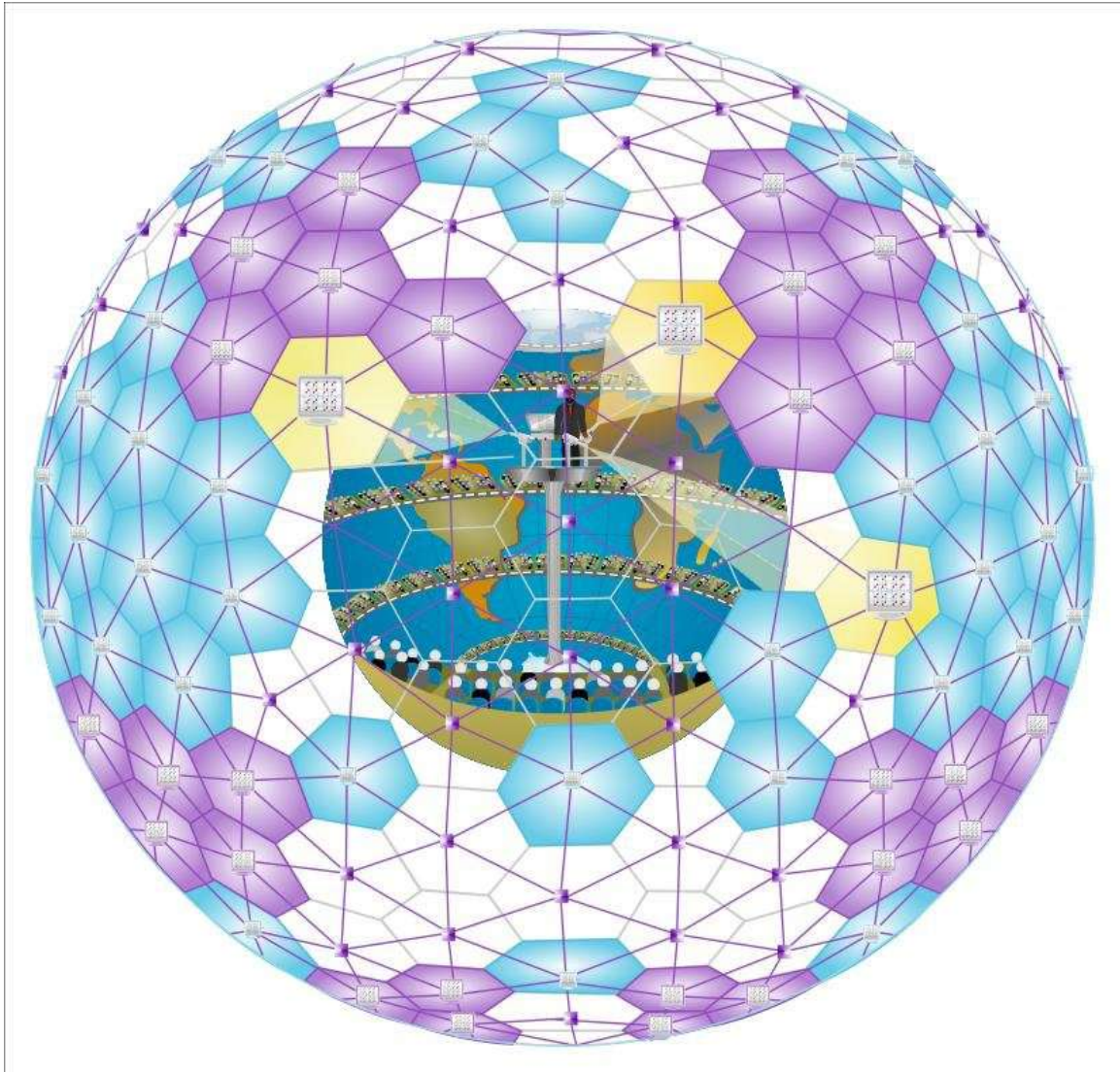
Artist's illustration of the Philip Emeagwali Internet, as conceived in June 1974 in Corvallis, Oregon, USA.

Along the way to the world's fastest computer, I invented how to formulate partial **differential** equations for the oil and gas industry, correctly. I invented the nine Philip **Emeagwali** equations that govern three-phased fluids flowing **across** porous media that were both heterogeneous and anisotropic. I did so by encoding, into my partial **differential** equations, physics's second law of motion, as described textbooks and discovered three centuries and three decades ago.

Attempting to unravel the analytical (or the truest) solution of a complex partial **differential** equation is like playing chess with God. In 1974, when I first programmed one of the world's fastest computers, the fastest computing across the slowest processors was both unspeakable and unthinkable.

In the 1970s, it was easier to travel to the Moon than to program an ensemble of millions of self-contained **off**-the-shelf processors that shared nothing and harness them as one seamless, coherent supercomputer. In the 1970s and 80s, the 25,000 vector supercomputer scientists in the world worked within the comfort of their known.

Back then, the few parallel computer scientists in the world worked within the discomfort of their unknown. And researched in the unexplored regions of extreme-scale computational physics, a field that encompasses climate modeling. Between physics and mathematics, the world's fastest computer occupied the position between the unavoidable and the impossible.

Solving the Unsolvable Problem

In the 1970s or 80s, the fastest computing **across** the slowest processors only existed in science fiction. And in the unexplored regions of the mathematical universe. During the 1980s, the big question in supercomputing that I addressed was how to **connect** the mathematical universe to the physical one. And, in particular, how to connect the new Philip Emeagwali Internet that I visualized in the 16th dimensional hyperspace to the most compute-intensive mathematical problems that were defined in our three-dimensional physical space.

In the 1970s and 80s, I felt like I was struggling to assemble a puzzle with infinite, endless pieces. At first, I thought my puzzle, with only 65,536 pieces, could solve the most compute-intensive problems in mathematics and science. I later realized that, in theory, the grand challenge puzzle demanded infinite pieces, or number of processors, as the precondition for solving the problem with mathematical exactitude.

This grand challenge was the motivation that inspired my invention of how to reformulate some laws of physics. And do so from prose to its equivalence in algebra, namely, **F**orce equals **M**ass times **A**cceleration. To its equivalence in calculus, namely, partial **differential** equations. To its equivalence in message-passing codes that I executed on each processor and parallel processed **across** the Philip **Emeagwali** Internet that's a new global network of two-**raised**-to-power sixteen processors.

My breakthrough in supercomputing was possible because I reformulated the laws of conservation of momentum, mass, and energy as described in physics textbooks. And reformulated them into processor codes that I adorned with processor-to-processor emails.

I invented unknown algorithms, or new supercomputer instructions, which told each processor what to compute within itself and what to communicate to its up to sixteen nearest-neighboring processors.

I emailed my sixty-four binary thousand, or two-**raised**-to-power sixteen, processor codes **across** my hyper-globe that I visualized as embedded within the 16th dimensional mathematical hyperspace. Furthermore, I emailed my 65,536 processor codes to and from my two-**raised**-to-power sixteen processors.

As a mathematician who is also a physicist, I understand my system of partial differential equations as a description of the set of laws of physics they encoded. For those reasons, I distinguished the description from the described, just as you distinguish the map of **Nigeria** from the territory of **Nigeria**. A partial **differential** equation is different from the laws of physics it encodes just as the description of Nigeria is different from the land of Nigeria it describes. I can fold the map of Nigeria and put it in my pocket. But I can't put Nigeria in my pocket.

Changing the Way Mathematicians Solve Compute-Intensive Problems

My discovery of July 4, 1989, set the blueprint for the world's fastest computers now powered by up to a billion processors. The scientists who became famous and were remembered were the ones that were credited with achieving major paradigm shifts and that changed how we think, such as changing from the geometry of Euclid, who lived 2,300 years ago in **Africa,** to the 19th century non-Euclidean geometries.

The first of the two **non-Euclidean** geometries is the elliptic geometry with positive curvature. In elliptic geometry, Euclid's parallel postulate does not hold. The second of the two **non-Euclidean** geometries is the hyperbolic geometry. Within the hyperbolic geometry, the sum of the angles of a triangle is always less than 180 degrees.

The **elliptic** and **hyperbolic** geometries were the two major **paradigm shifts** which occurred within **2,300** years. Those two radical shifts fundamentally changed how geometers think about geometry. Similarly, the world's fastest computing **across** the world's slowest processors is a radical shift that changed how computer scientists think about their supercomputers.

Parallel supercomputing is a fundamental shift in how we compute just as the theory of evolution changed how biologists think. Supercomputing **across** up to one billion coupled processors fundamentally changed how the most compute-intensive problems are solved. And changed it just as the heliocentric world view changed the geocentric world view of astronomers who preceded **Galileo Galilei**.

Parallel supercomputing changed large-scale computational physics the way the modern physics of **Albert Einstein** changed the classical physics of **Isaac Newton.** At its essence, the fastest supercomputer that I discovered at **8:15** on the morning of Tuesday July 4, **1989,** was about changing from the computer that solved one problem **at a time** to the supercomputer of today that solves up to one billion problems **simultaneously.** Or changing to the Internet of tomorrow which is still in science fiction and that could become the planetary supercomputer of the future.

Parallel supercomputing was a fundamental change of tectonic proportions that changed how we study computer science. In their **old** computer science, the computer solved one problem **at a time**. In my **new** computer science, the computer solves many problems **simultaneously**.

A man said to his pediatrician. "Do you know Philip Emeagwali? I wrote an inventor report on Philip Emeagwali. My daughter also wrote an inventor report on Philip Emeagwali." His pediatrician smiled and replied: "I also wrote an inventor report on Philip Emeagwali. My son also wrote an inventor report on Philip Emeagwali."

For the twelve-year-old that is writing a school essay on inventors and their inventions, an essential question is this: "What is Philip Emeagwali known for?" I was the first to discover that the slowest processors in the world could be harnessed and used to power the fastest computers in the world.

That new knowledge is used to solve the most compute-intensive problems in the world. That invention is the reason the fastest computers in the world are powered by up to 10.65 million processors. I discovered how an ensemble of up to one binary billion processors can be married together by as many email wires and messages. A binary billion is two-raised-to-power-32, or 4,294,967,296. And then use those processors to solve the most compute-intensive problems.

I discovered how to fuse processors and do so to, in reality, form one coherent unit that's a never-before-seen machinery that's the world's fastest computer that made the news headlines, in 1989. That new supercomputer which is also a new Internet that I invented on July 4, 1989, is radically different from the constituent processors from which it originated. The world's fastest computer, as it's known today, originated from the slowest processors.

My historic run was the first world's fastest computing **across** the world's slowest processors. My breakthrough occurred at 8:15 on the morning of July 4, 1989. I was its first eyewitness. For that reason, it was a visceral experience. My visceral cries drew a little crowd. People down the hall ran towards me as they heard my visceral cries for my discovering the world's fastest computing via parallel processing. I cried because it was the first supercomputing that will change the lives of our descendants. And do so by permanently changing how our descendants will look at their world's fastest computers.

Each person that heard my visceral cries was puzzled by my emotional reaction to what seemed incomprehensible, namely, the world's fastest computing that I executed in a new way that will, forever, change how we look at the computer.

My supercomputer run performed 3.1 billion calculations per second. That was a world record for July 4, 1989, that opened the door to the modern supercomputer. I used those 65,536 processors to solve a system of twenty-four million equations of algebra. In addition to my computing speed, the number of processors and equations were both world records. My three

world records—in speed, processors, and equations—were validated by both the computing and petroleum industries.

 The supercomputing industry now incorporates parallel processing. And the petroleum industry now purchases one in ten supercomputers. Oh, yes, harnessing a billion processors gives the right answer, too.

 Three generations: Iyanma Agatha Emeagwali, Philip Emeagwali, and Ijeoma Emeagwali in Maryland, USA.

How I Want to be Remembered

 When I began supercomputing on June 20, 1974, in Corvallis, Oregon, USA, the world's fastest computing **across** the world's slowest processors was science fiction. Fifteen years later, on July 4, 1989, in Los Alamos, New Mexico, USA, I discovered how to turn that science fiction to reality.

 For that contribution, I became the **first** and **only** person, to win alone, the highest award in supercomputing. The world's fastest computing, as it's executed today, was the **pseudo**science of the 1980s, and earlier. The turning point was my scientific breakthrough that occurred on July 4, 1989, and elevated that **pseudo**science to science.

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How do I want to be remembered? **I want to be remembered** as the supercomputer inventor that connected those dots or vertices or processors, so to speak. **I want to be remembered** as the supercomputer discoverer that told the **coherent** story and discovered those Internets   as, in reality, **coherent** computers that are the **fastest**. The genius is the ordinary person that found the extraordinary in the ordinary.

My invention of fastest computing is summed **as follows**: The slowest processors can cooperatively compute together to yield the fastest computation ever recorded and to solve the most compute-intensive problem ever solved. My discovery is used to combine computers into supercomputers. And can be used to create a supercomputer that's an Internet.

1. How did the author visualize and map the 65,536 processors for their physical experiment in 1989?
2. What was the significance of the author's experiment with the processors in terms of computing speed?
3. How did the author connect the mathematical universe to the physical one in the field of supercomputing?
4. What challenges did the author face in programming millions of self-contained processors in the 1970s and 80s?
5. How did the author's invention of the Philip Emeagwali Internet change the way mathematicians solve compute-intensive problems?
6. How did the author reformulate the laws of conservation of momentum, mass, and energy into processor codes?
7. What is the difference between a partial differential equation and the laws of physics it encodes?
8. How did the author's discovery of parallel supercomputing fundamentally change the way computer scientists think about their supercomputers?
9. What are the parallels between the paradigm shifts in geometry and the paradigm shift brought about by parallel supercomputing?
10. How did the author's invention pave the way for the world's fastest computers powered by billions of processors?
11. How did the author's discovery of fusing processors to form a coherent unit contribute to the development of supercomputers?
12. What were the world records set by the author's supercomputing run in terms of speed, processors, and equations solved?
13. How did the author's breakthrough in supercomputing impact both the computing and petroleum industries?
14. In what way did the author's discovery permanently change the way we look at computers?
15. How does the author want to be remembered in the context of their contributions to supercomputing and connecting processors?

1. What is Philip Emeagwali's contribution to science and computer science?
2. How did Philip Emeagwali's discovery of the world's fastest computing across slow processors change the field of computer science?
3. What is the significance of Philip Emeagwali's discovery of parallel supercomputing?
4. How did Philip Emeagwali's invention of a new Internet impact the development of supercomputers?
5. What challenges did Philip Emeagwali face in convincing the scientific community of his theories and discoveries?
6. How did Philip Emeagwali's discovery affect the way we solve compute-intensive problems?
7. How did Philip Emeagwali contribute to the fields of mathematics and physics?
8. What is the significance of Philip Emeagwali's invention of the Philip Emeagwali equations in calculus?
9. How did Philip Emeagwali's discoveries and inventions contribute to the understanding and prediction of weather patterns?
10. What obstacles did Philip Emeagwali overcome in his research and experimentation?
11. How did Philip Emeagwali's discoveries change the way we look at the world's fastest computers?
12. How did Philip Emeagwali's inventions and discoveries impact the petroleum industry?
13. What is the relationship between Philip Emeagwali's equations and the laws of physics?
14. How did Philip Emeagwali's discoveries pave the way for solving complex computational problems across multiple processors?
15. What is the legacy of Philip Emeagwali's contributions to mathematics and computer science?

Broadcast 26 September 2021

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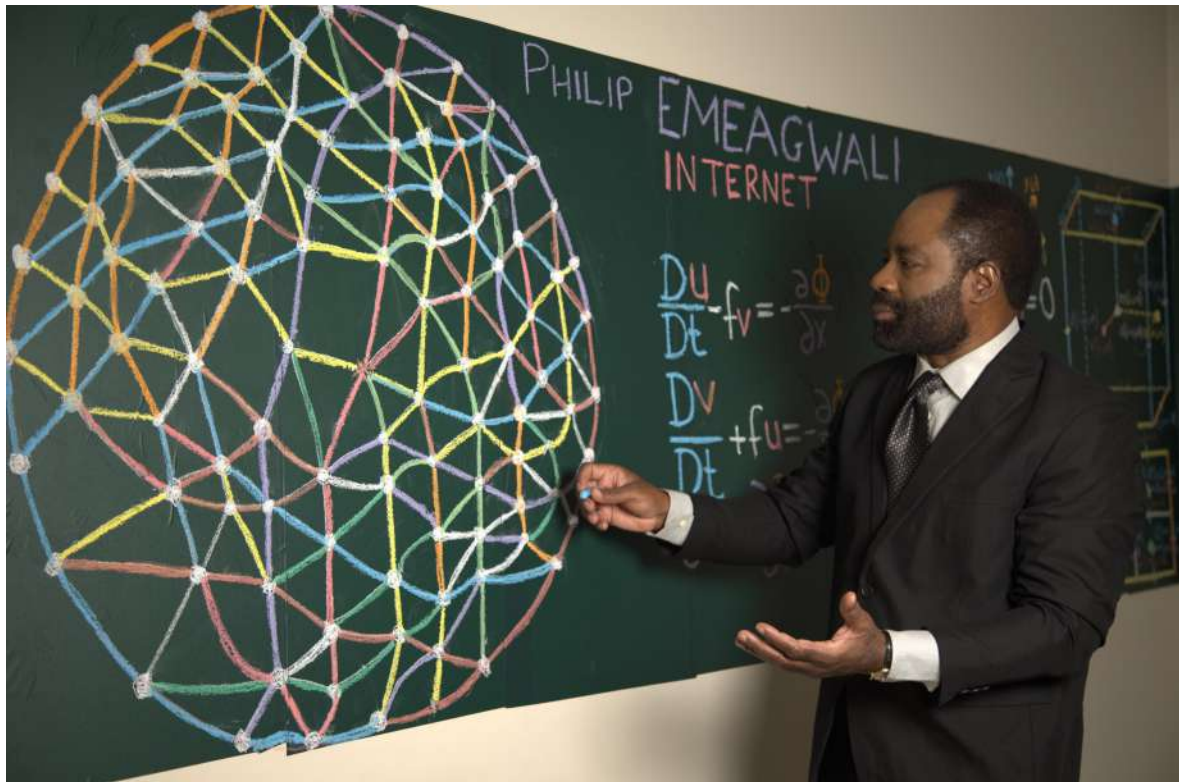
Emeagwali Supercomputer that Emulates a Bees' Honeycomb

In an email, a twelve-year-old writing the biography of a famous inventor and his invention asked me: "What is the Philip Emeagwali Internet?"

In 1989, I was in the news because I recorded the fastest computer speed. I achieved that speed while solving the most compute-intensive problems at the crossroad where new mathematics, new physics, and new computer science intersect. Such compute-intensive problems are called the twenty grand challenges of supercomputing.

On July 4, 1989, I recorded the world's fastest computer speed. And I did so while solving the most important compute-intensive problems. And solving them across a new Internet that was a new global network of the slowest processors in the world. That machinery—that comprised of the

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slowest processors powering the fastest computer—is called the Philip Emeagwali Internet.

Visualizing Philip Emeagwali Supercomputer

 I visualized my supercomputer as outlined and defined by a billion points of light. Each light represented a processor. I programmed two-**raised**-to-power sixteen off-the-shelf processors. Likewise, I visualized these processors as equal distances **apart**. Furthermore, I visualized these processors as etched onto the hypersurface of a globe. Not only that, I visualized that globe as embedded within a sixteen-dimensional hyperspace. That spherical island of processors is called the **Emeagwali** Internet.

 If constructed at the most enormous scale, the **Emeagwali** supercomputer will be a mammoth machinery assembled from a billion off-the-shelf processors that are linked with high-speed interconnects that shuttles data and coordinate emails.

Visualizing the Philip Emeagwali Supercomputer Like a Bees' HoneyComb

 The **Emeagwali** Internet that I theorized, in 197**4**, is shaped like a giant ball, or a gigantic supercomputer, that I named a "HyperBall." I visualized my giant ball as the world's fastest computer that occupies the footprint of a football stadium. My new supercomputer will cost tens of billions of dollars. And could be financed by a consortium of nations. Furthermore, it will weigh as much as a thousand school buses. Not only that, it could consume as much electricity as a state within **Nigeria**.

 My never-before-seen supercomputer could solve the most compute-intensive problems, including the complicated simulations of climate change, that would be impossible to solve on a supercomputer that is powered by only one processor.

 I came to supercomputing to solve the most compute-intensive problems in science, engineering, and medicine and to invent a new supercomputer. I invented a supercomputer that was inspired by the bees Honeycomb. And did so by subdividing the surface of a sphere in an orderly and efficient manner.

 Studying bees and how they work together in their hives as well as the efficiency they employed when constructing their honeycombs inspired me to change how I look at the world's fastest computers. I was the first

supercomputer scientist to divide a spherical surface in a manner that mimics the efficient structure of the **bee's honeycomb**.

I discovered that the natural efficiency implicitly encoded into how bees construct their honeycombs could be copied within a supercomputer that's powered by an Internet that is a global network of up to one billion processors.

The patterns of the interconnections of the processors within my new supercomputer were inspired by my observations of the efficiency of the bee's hexagonal honeycomb. The bees' honeycomb inspires the most efficient processor-to-processor interconnection that will make it possible to manufacture the world's fastest computer.

That supercomputer will encircle a huge globe that occupies the space of a soccer field. My honeycomb-inspired supercomputer is a global network of processors that's an Internet, in reality. My HoneyComb Supercomputer will do the fastest computation with the least communication, or noise. Over millions of years, the bee evolved to know that it can store the most honey with the least energy. I merely copied the blueprint for my supercomputer by reverse engineering the bees' honeycomb.

In the 1970s and 80s, I didn't conduct academic research. Instead, I conducted a big science, big supercomputer research that was beyond academia. My new Internet made the news headlines because it was my alternative way of looking at the supercomputer that previously only computed with one custom-manufactured, super-fast vector processor. My alternative way of parallel processing became a fundamental change in supercomputing. That was the origin story of the first supercomputer in the world that was powered by the slowest processors in the world.

MY EARLY YEARS IN SUPERCOMPUTING

I n 1974, in Corvallis, Oregon, USA, I was solving large-scale systems of equations of computational linear algebra. I solved them on a serial supercomputer that was the first computer to be rated at one million instructions per second. That serial supercomputer represented the old paradigm of supercomputing.

In serial supercomputing, I programmed one scalar processor, the equivalence of one computer. I visualized that one scalar processor to be on a globe in the zeroth mathematical dimension. And I topologically followed the sixty-four binary thousand vertices and the one binary million bidirectional edges of the hypercube in the 16th dimension. I visualized them as making up a new Internet that tightly circumscribed a globe with its processors and wires. And encircled that globe as a new global network of processors, called the Philip Emeagwali Internet.

I also visualized that globe in the sixteenth mathematical dimension. I grew in my mathematical maturity and scientific and computing expertise during the fifty years following **1974** that I lived and worked in **Corvallis** (Oregon), **Washington** (District of Columbia), Baltimore, Silver Spring, and College Park (Maryland), Casper and Laramie (Wyoming), and **Minneapolis** (Minnesota).

How My Supercomputing Evolved into a New Internet

I grew along sixteen mutually perpendicular directions. I was the **first** supercomputer scientist to grow into the new billion-processor paradigm of the fastest computing **across** a gigantic ensemble of processors. I visualized these processors as uniformly encircling a globe. And as circumscribing it as a new Internet that's a small copy of the Internet. My new billion-processor paradigm for supercomputing made the news headlines because I was the first to record the fastest computer speed and do so **across** that new Internet.

It was at 8:15 on the morning of July 4, 1989, in Los Alamos, New Mexico, USA, that I discovered parallel supercomputing. And discovered how to record the fastest computer speeds **across** an ensemble of two-**raised**-to-power sixteen processors. I was the first to recognize that

network of processors as a new Internet that tightly encircled a globe. And circumscribes it within the metaphorical 16th dimension.

 So, over my first sixteen years—from Corvallis (Oregon) to Washington (District of Columbia) to College Park (Maryland) to Laramie (Wyoming) to Los Alamos (New Mexico)—my supercomputing changed from the 0th (zeroth)—or a mere point—to the 16th dimension, that was represented by two-**raised**-to-power sixteen, or 65,536, equidistant points that I visualized as having a one-point to one-processor correspondence. I also visualized those processors as evenly distributed **across** the hypersurface of a hypersphere that was my topological metaphor for the Philip **Emeagwali** Internet. In summary, I theorized and experimentally discovered that new Internet.
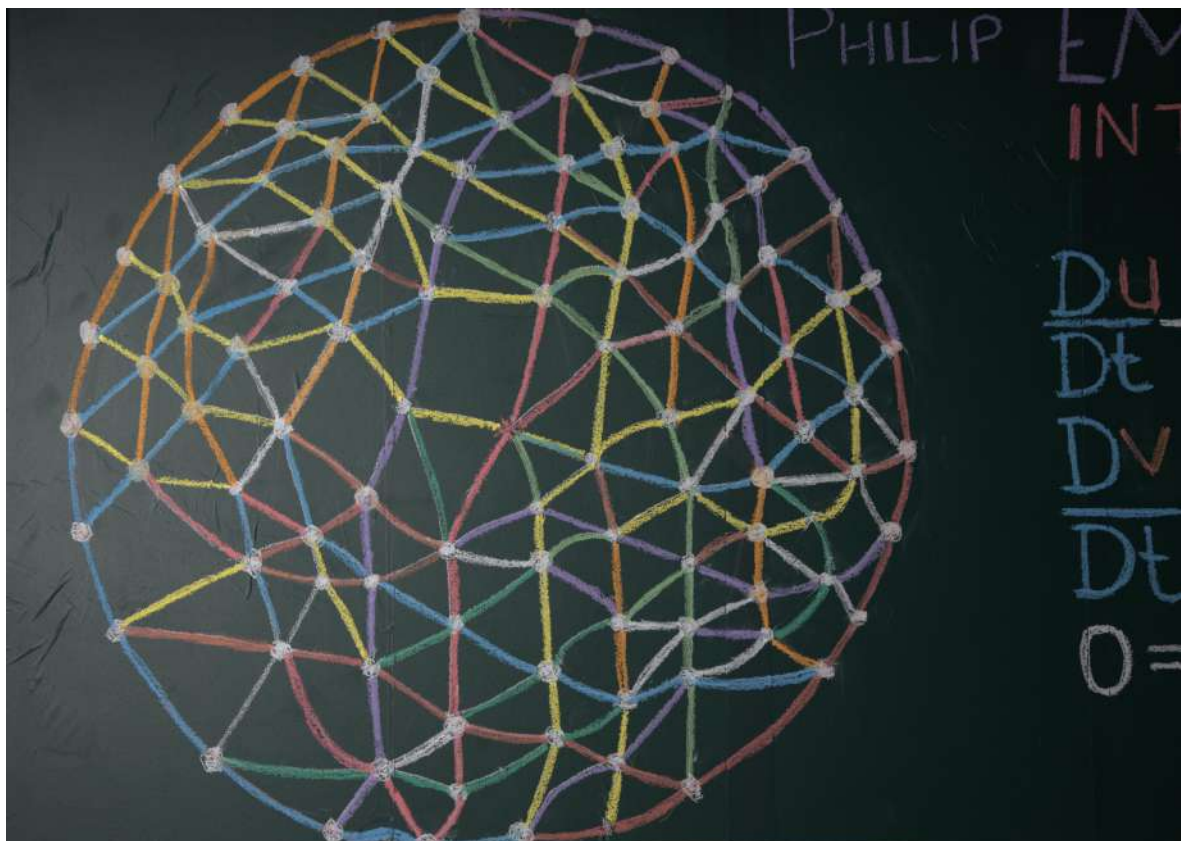
The processor-to-processor interconnection of the Philip Emeagwali Internet

Why My Supercomputing Breakthrough Made the News Headlines

The supercomputer market is forty-five (45) billion dollars a year. That is like giving one thousand dollars a year to every man, woman, and child who can speak the Igbo language. Since 1989, I'm the subject of inventor reports, in schools **across** the USA, UK, and Canada. I'm studied in schools because I discovered that the modern supercomputer should be powered by up to one billion processors. That invention is the new knowledge that powers the world's fastest computers.

In 1989, I was in the news because I discovered how to solve the most compute-intensive mathematical problems, such as initial-boundary value problems that were governed by a system of coupled partial **differential** equations, and, in particular, those arising in planetary-scaled fluid dynamics.

Such equations contextualized and encoded some laws in physics, including the second law of motion. Such partial **differential** 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 were up to **7.7 miles (or 12.4 kilometers)** below the surface of the Earth. And that are the sizes of a town.

The size of the Prudhoe Bay Oil Field on Alaska's North Slope is 213,543 acres. The Prudhoe Bay is the largest oil field in North America. The Ghawar Oil Field of Saudi Arabia measures 280 kilometers by 30 kilometers, or 174 miles by 19 miles. The Ghawar Field is the largest oil field in the world.

Fastest Computing to Crack the Impossible

In an email, a fifteen-year-old writing the biography of a famous mathematician and his contributions to mathematics asked me: "How is mathematics used in supercomputing?"

Calculus is the most powerful technique in mathematics. The poster boy of the partial **differential** equation of calculus is the system of equations that encoded the second law of motion in physics textbooks. In theory, mathematical predictions that were based upon the partial **differential** equation should be as reliable as a hammer. In practice, it's a different

story. Therefore, it's impossible to predict the weather with certainty and forecast it thirty days in advance.

 Without high-performance, massively parallel supercomputing the solution of the most compute-intensive initial-boundary value problems—such as simulating long-term climate change—will be as approximate as a sketch, instead of as exact as a photograph. That solution of that mathematical problem is a map—called the vector field—of the direction, size, and temperature of the air, or moisture, at every position within the Earth's atmosphere and at every later date. The need to simulate accurately the internal dynamics of flowing fluids—called the fluid dynamics—is the reason ninety percent of the cycles of the world's fastest computers are consumed by applied mathematicians, called computational fluid dynamicists. Large-scale computing is the reason the fastest supercomputers are used to study and understand long-term global warming.

I n an email, a twelve-year-old writing her biographical essay on a famous inventor and his invention asked me: "How did you invent the Philip Emeagwali Internet?"

I explained to her that my invention was inspired by my thinking about the Earth and global warming. I progressively made my invention during the sixteen years following June 20, **1974.** I started my research in Corvallis, Oregon. And I continued my supercomputing in Washington (District of Columbia), College Park (Maryland), Laramie (Wyoming), and Los Alamos (New Mexico).

I began the invention of the Philip **Emeagwali** Supercomputer by imagining the Earth as shrunk to the size of an apple. The size of the skin of that apple represents the habitable area of the Earth. That skin-thick volume consists of fluids, such as the atmosphere, rivers, lakes, and oceans. And up to 7.7 miles below that skin-thick volume we have fluids, such as crude oil, natural gas, water, and air that flow through the crevices and voids under the surface of the Earth.

Exploring the Limitless Possibilities for Tackling Tough Math

One of the twenty most compute-intensive problems in physics was to simulate global warming **across** millions of processors under-the-hood of the world's fastest computer. And do so to execute computational fluid dynamics codes at the world's fastest computer speeds. Likewise, to foresee the motions and the directions of the fluids that enshroud heavenly bodies, such as the geophysical and astrophysical fluid dynamics around planets in our Solar System, including weather forecast   around the Earth.

The Earth's atmosphere is 62 miles (or 100 kilometers) above its surface. Comparing the depth of the Earth's atmosphere to its diameter of 7,900 miles (or 12,700 kilometers), we realize that the atmosphere is 127 times thinner than the Earth. The atmosphere compared to the Earth is thinner than the skin of the apple compared to the apple.

In one thousand years, I see the Internet to be an electronic cloth that enshrouds the Earth and does so just as the skin of the apple covers the apple.

Unleashing the Power of Speed: My Quest for the Philip Emeagwali Internet

I began my technological quest, for the Philip **Emeagwali** Internet, by visualizing how to solve compute-intensive mathematical problems. Such difficult problems arises in large-scale computational physics. I described and defined my physics problem on and **across** 65,536, or two-**raised**-to-power sixteen, blackboards. Each blackboard contained the corresponding initial-boundary value problem of mathematical physics.

Those initial-boundary value problems can't be analytically solved on those sixty-four binary thousand blackboards. Hence, I computed their 65,536 answers. And I did so **across** my ensemble of 65,536 motherboards.

Early on, I was mindful of the fact that I must relate my discovering the first world's fastest computing **across** the world's slowest processors and that new knowledge to solve the biggest mathematical challenges arising in science, engineering, and medicine. I discovered how to compute at the fastest speeds in the world and do so 65,536 times faster and do so **across** a new Internet.
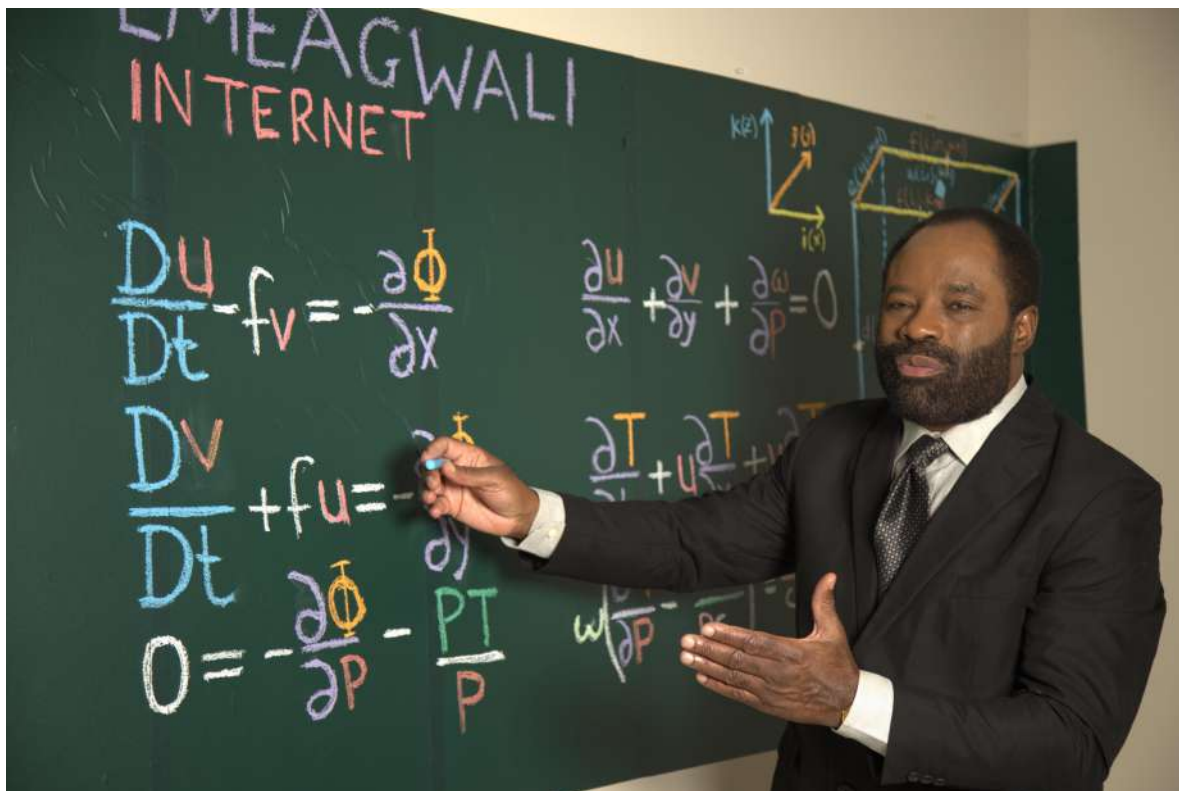
Philip Emeagwali explaining how he solved the initial-boundary value problem for climate modeling known as the toughest problem in mathematical physics. His solution of governing equations of fluid dynamics made the news headlines in 1989.

Unlocking the Speed of Light: How I Visualized the Philip Emeagwali Internet

I'm often asked to describe how I visualized the Philip **Emeagwali** Internet. I visualized that new Internet as a new global network of 65,536 processors. I visualized the Philip **Emeagwali** Internet as etched onto the hypersurface of a globe that I visualized in the 16th dimensional hyperspace. I also visualized 65,536 equal-sized atmospheres each projected from the surface of the Earth to the uppermost atmosphere, or 62 miles (or 100 kilometers) above the surface of the Earth. My tessellated atmosphere is a concentric globe that I defined in the 3rd dimension. I knew it's important that I relate the two Internets that I invented.

My first Internet was only theorized and constructively reduced to practice. In reality, the Philip **Emeagwali** Internet was a supercomputer. My second Internet was experimentally reduced to practice as the world's fastest computer.

My discovery that the first supercomputer—as it's known today—can be developed with the slowest processors made the news headlines, shortly after I discovered it, on the Fourth of July **1989** in Los Alamos, New Mexico, USA.

A Spherical Island of Processors

I'm often asked: "What is the Philip **Emeagwali** Internet?" The Philip **Emeagwali** Internet is a spherical island of processors that encircles a concentric globe that represents the habitable atmosphere where global warming occurs.

My scientific discovery, which occurred on the Fourth of July **1989**, encompasses how to forecast global warming. And how to do so more accurately. And how to forecast it **across** the Philip Emeagwali Internet that's a new global network of **off**-the-shelf processors. My processors were identical, equal distances apart, and shared nothing, but were in dialogue with each other. That discovery is my contribution to the greater understanding of the relationship between the supercomputer and the Internet.

Visualizing the Emeagwali Spherical Island of Processors

I saw none of my sixty-four binary thousand, or 65,536, processors with my naked eyes. However, I saw each processor with my mathematical mind. That abstraction enabled me to geometrically visualize them as an Internet. And do so with a one-processor to one-vertex correspondence. Likewise, do so at the 65,536, or two-**raised**-to-power sixteen, vertices of a hypercube in the 16th dimension. I also visualized that hypercube as tightly circumscribed by a hypersphere that represented a globe in the 16th dimensional hyperspace.
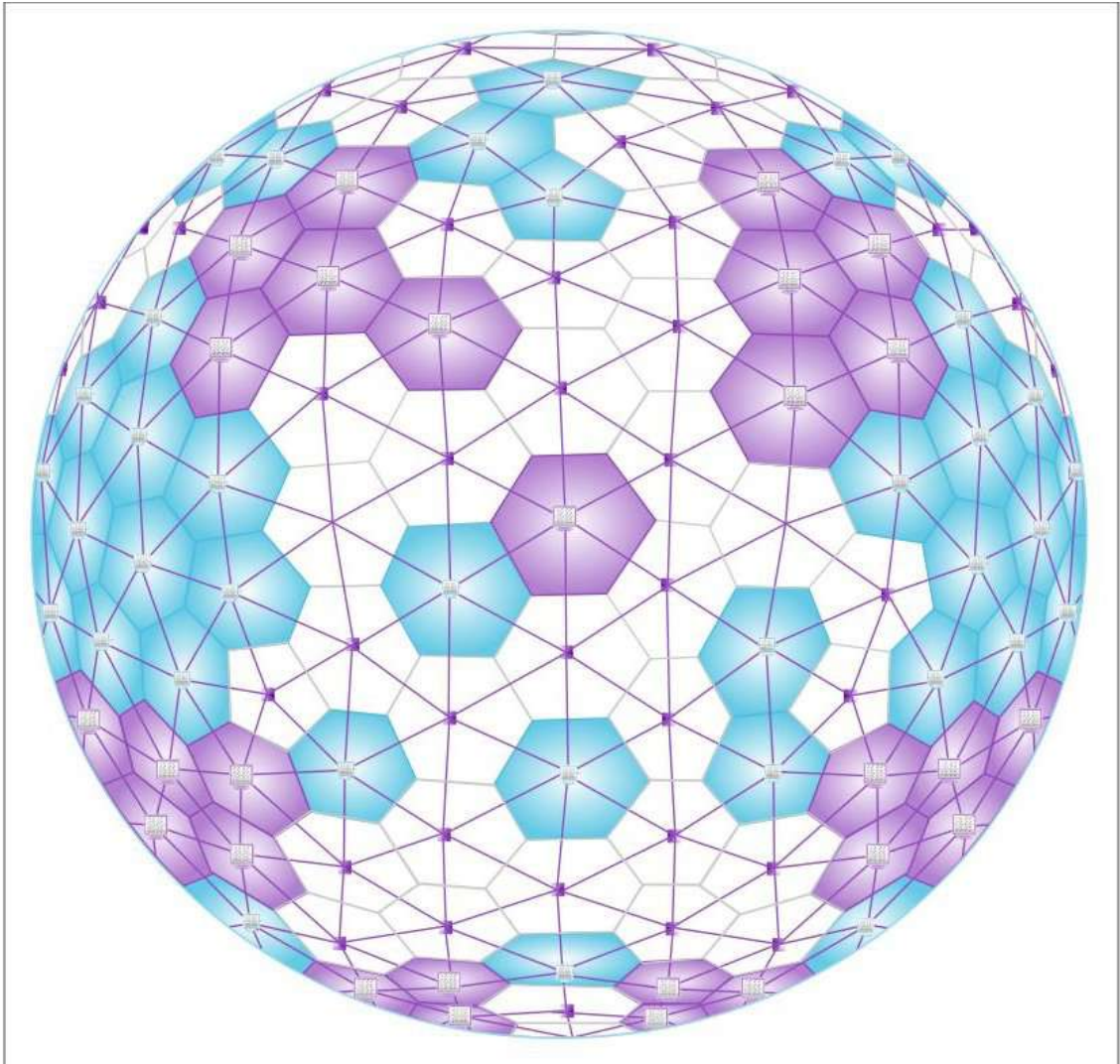
The ptocessor-to-processor interconnection of the Philip Emeagwali Internet.

What is Philip Emeagwali Known For?

A question in school essays on famous physicists and their discoveries is this: "What is the contribution of Philip Emeagwali to physics?"

In 1989, I was in the news headlines because I discovered how to harness millions of the slowest processors in the world and **across** an Internet that is a global network of those processors. Furthermore, I discovered how to use them as one seamless, coherent, and gigantic unit that's the world's fastest computer.

The computer is an inch away from the number zero or one. And the supercomputer is a mile away from anything written in prose. I had to re-formulate the second law of motion, described in physics textbooks and discovered **330** years ago and discovered in prose, into algebra, or F=ma.

I invented algebraic algorithms that I used to encode that law into a code that the computer can then translate into a sequence of zeroes and ones. My conversion from prose to zeroes and ones was executed in three steps.

First, the second law of motion discovered three centuries and three decades ago was formulated as an algebraic formula that is well-known as F=ma. That formula is the algebraic acronym for Force equals Mass times Acceleration. Second, **F=ma**, was reformulated in the 1820s and from algebra to calculus, or a system of coupled and nonlinear partial **differential** equations. The nine Philip **Emeagwali** equations that I invented were new partial **differential** equations.

My equations could be used by the petroleum industry and used to simulate multiphase fluids flowing **across** porous media that are heterogeneous and anisotropic. My equations could be used to map the flow patterns within an oil-producing field. That petroleum supercomputer code, called a reservoir simulator, is used to recover crude oil and natural gas.

My Most Significant Contribution to Computing

My contributions to the mathematical knowledge that is used to discover and recover crude oil and natural gas **are two-fold**: Foremost, I was the first to discover how to harness an ensemble of millions of processors.

I discovered how to put that ensemble in the service of the petroleum industry. My discovery that the first supercomputer, as it's known today, must be powered by off-the-shelf processors was the cover story of top mathematics publications, including the May 1990 issue of the *SIAM News* that was the bi-monthly news journal of the Society for Industrial and Applied Mathematics. The *SIAM News* is the most important publication that is read by the world's leading mathematicians.

Using Philip Emeagwali Equations to Recover Oil and Gas

My second contribution to mathematics **is this**: I invented 36 partial derivative terms. And I used those mathematical terms to also invent the system of nine Philip **Emeagwali** equations that more accurately represents the physical processes within producing oil fields. Those processes predetermine the motions of crude oil, injected water, and natural gas that flow up to 7.7 miles (or 12.4 kilometers) below the surface of the Earth. An oil-producing field can be as large as the Ghawar Oil Field of **Saudi Arabia,** which measures 174 miles by 19 miles or 280 kilometers by 30 kilometers, or 8,400 square kilometers or almost twice the size of **Anambra,** that is my state of origin in **Nigeria**.

Being able to hindcast, or re-forecast, the motions of the crude oil and natural gas which flow below the surface of the Earth helps the petroleum engineer to understand how to push the most crude oil and natural gas and push them from the water injection well to the nearby crude oil and natural gas producing wells. That was the second step that must be taken to encode the laws of physics discovered in prose but must be coded as the sequence of zeroes and ones that the processor can act on.

Converting Philip Emeagwali Equations from Calculus to Algebra to Codes

For the third step of that conversion, I had to reformulate, or rather discretize, the nine partial **differential** equations of calculus that I invented. I discretized them to convert them into an approximating system of equations of computational linear algebra. Those systems, called partial **difference** equations, approximated the originating partial **differential** equations. I used algebraic algorithms, called finite difference discretizations, to reformulate the nine Philip Emeagwali equations of calculus that I invented. And to convert my nine equations into algebraic equations. And then to further transform that algebra to arithmetic. Or into an equivalent set of mathematical calculations. And into the 65,536 codes that each of my sixty-four binary processors saw as a seemingly endless string of zeroes and ones.

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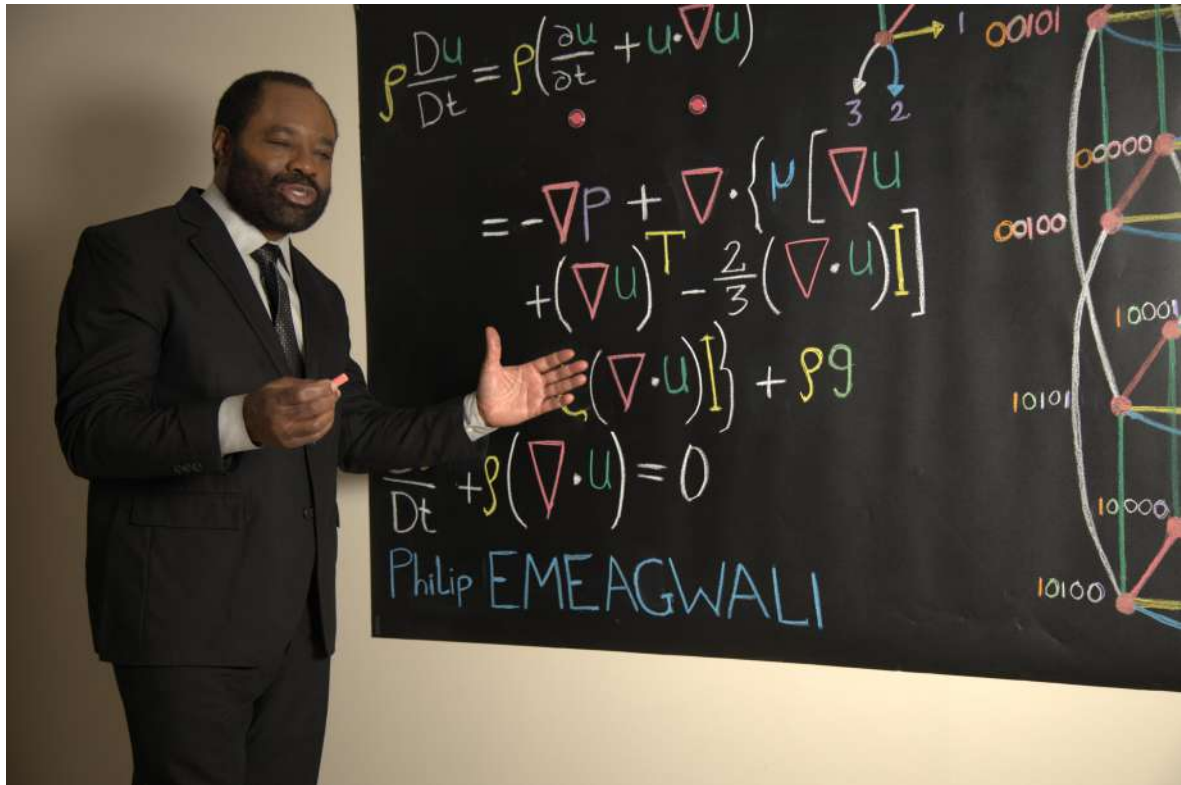
Turning Science Fiction to a Supercomputer

In the 19**70**s and **80**s, my unproven idea of the first world's fastest computing across the world's slowest processors was mocked, ridiculed, and rejected as a beautiful theory that demanded experimental confirmation. Until my discovery of parallel processing on July 4, 1989, supercomputing, as it's executed today, was dismissed as science fiction. For those reasons, it was imperative that I experimentally confirm my theory of the fastest computing **across** the slowest processors. In science, theory and experiment sometimes contradict each other. And the experiment wins every time they clash.

My Retrospective to the 1970s and 80s

For me, the **1970**s was the decade for the fermentation of my theory that the world's fastest computer can be defined and manufactured **across** millions of processors, each its own master, that shared nothing. The 1980s was the decade that I experimentally confirmed my theory of the fastest computing **across** the slowest processors. I had to let those two decades go between before I figured out how the new Internet that was a new global

network of sixty-four binary thousand off-the-shelf processors that each operated its operating system and how that new Internet could be harnessed as an instrument of large-scale computational physics. And used to solve the most compute-intensive problems known as the twenty grand challenges of supercomputing.

Building Supercomputers Upon the Transistor and Integrated Circuit

 The three inventions that led to the fastest computer were the transistor invented in **1947**, the integrated circuit invented eleven years later in **1958**, and parallel supercomputing invented thirty-one years later in **1989**. Without the invention of the transistor the computer will be slow, will often break down, will be the size of a building, and will cost a hundred million dollars each.

T he grand challenge of inventing parallel supercomputing resided at the frontiers of knowledge of physics, calculus, and algebra, rather than at the frontiers of computer science. For instance, the laws of physics must be encoded into calculus and be discretized into algebra and used to forecast the speeds and directions of air and moisture flowing over the Earth, or to forecast the weather. The laws of physics must be used to hindcast, or re-forecast, the speeds and directions of the crude oil, injected water, and natural gas that were flowing up to 7.7 miles (or 12.4 kilometers) below the surface of the Earth. And flowing across an area under the surface of the Earth that's often almost twice the size of the state of Anambra, Nigeria. One in ten supercomputers were bought and used to foresee the motions of crude oil and natural gas that were flowing across the 65,000 producing oil fields of the world, including the 159 oil fields of Nigeria.

The Supercomputer Was My Unwavering Friend

 After fifty years of supercomputing, an audience was taken aback when I gave it a four-hour lecture and did so without notes. I understand supercomputing more than I understand my wife. After all, I've only been married for only forty-two years. But I was married to the supercomputer for nearly fifty years.

 For half a century, it was my job to know the supercomputer inside and out. The supercomputer is the other woman in my life. According to Google searches, I know the supercomputer and the supercomputer knows **Philip Emeagwali**.

 My contribution to computer science **is this**: On the Fourth of July **1989**, I discovered that the slowest processors could be programmed to emulate one supercomputer, or one seamless, coherent, and gigantic machinery that's a new supercomputer, in reality.

Impact of My Discovery of What Enables Computers to be Fastest

Before 1989, and before my discovery of the world's fastest computing via parallel processing made the news headlines, supercomputers were powered by one custom-manufactured vector processor. In 1989, I discovered that the world's most powerful supercomputer could be powered by the slowest two-raised-to-power sixteen, or sixty-four binary thousand, processors. Those 65,536 slowest processors in the world must be identical, be coupled, and shared nothing. Each processor must operate its operating system. My invention made the news headlines because it was a new Internet that was a new supercomputer, in reality.

Tackling Tough Math

My invention was a high-performance supercomputing machinery. That supercomputer invention of how to solve problems **across** processors is now used to solve the most compute-intensive mathematical problems known as the twenty most difficult problems that were at the crossroad where the frontiers of mathematics, physics, and computing intersect.

The poster boy of the hardest problems is using the supercomputer to forecast the weather above the surface of the Earth. The poster girl of compute-intensive problems is harnessing the millions of processors under-the-hood of the world's fastest computer. And using them to hindcast, or re-forecast, the "weather" within an oil-producing field that's up to 7.7 miles (or 12.4 kilometers) deep and flowing **across** an area up to twice the size of Anambra, Nigeria.

Looking back to the 1970s and 80s, you may ask: What training and knowledge does it take to be the first to solve the most compute-intensive problems at the crossroad where mathematics, physics, and computer science meet? My answer is this: Only a foremost expert in mathematics, physics, and computer science can solve the toughest multidisciplinary problems in extreme-scale computational science.

Solving the Toughest Problem

In 1989, there were 25,000 supercomputer scientists logged onto all the world's vector supercomputers. But I was the only person in the world that was logged on full time on potential supercomputers that were powered by the slowest processors in the world. If those 25,000 vector supercomputer scientists had possessed the multidisciplinary knowledge that I possessed, in 1989, they would have solved the hardest problems that addressed the biggest challenges, such as the computational fluid dynamics that governs the spread of COVID-19 within New York City trains that packed passengers like sardines.

And he or she would have posted as podcasts and YouTube videos his or her contributions to high-performance computing. I posted as podcasts and YouTube videos one thousand closed-captioned videos that described my contributions to mathematics, physics, and computer science.

My Discovery of Parallel Processing is a Milestone in Computer History

My discovery that the world's fastest computer can be built from the slowest processors in the world was the reason I was in the news. In 1989, I was described as the lone wolf at the farthest frontier of supercomputing. Processing across the slowest processors was the technology that I harnessed and used to execute the world's fastest computer speed.

I reached that milestone in the history of technology and did so back at 8:15 on the morning of the Fourth of July **1989,** in Los Alamos, New Mexico, USA. The June 20, 1990, issue of *The Wall Street Journal* recorded my supercomputer breakthrough. I was the first to reach "parallel supercomputing," where no human had.

Explanation of Philip Emeagwali Equations

The partial **differential** equation is the natural dialect of computational fluid dynamics. The **nine Philip Emeagwali equations** enabled me to see forces otherwise invisible. And describe motions of crude oil, injected water, and natural gas that will be otherwise indescribable. The mathematical structure, or the partial derivative terms, of the governing equations for fluids flowing **across** a porous medium is like that for fluids flowing **across** a **non-porous** medium, including the air and moisture that were flowing **across** the Earth's atmosphere.

I discovered that for the system of coupled, nonlinear, time-dependent, and three-dimensional partial **differential** equations of mathematical physics that governs flowing fluids that the meteorologist and the geologist were solving similar puzzles but only the meteorologist solved the puzzle correctly.

Philip Emeagwali Internet is a Small Copy of the Internet

My contribution to computer science **is this**: I was the first supercomputer scientist to visualize millions of an ensemble of off-the-shelf processors and to comprehend that ensemble as uniformly encircling the globe that I also imagined in a sixteen-dimensional hyperspace and pictured as encircling that globe in the way the Internet encircles the Earth. That new machine is called the **Emeagwali** machine. Or the **Emeagwali** supercomputer.

The **Emeagwali** supercomputer that encircles the globe wasn't a new computer, intrinsically, but was a new Internet, in reality. In the **Emeagwali** supercomputer, I pictured the arithmetical calculations that arise when solving the most compute-intensive problems as being executed **across** a **small copy** of the Internet.

MY RACE TO BE THE FASTEST

Answering the Toughest Question in Computer Science

My quest was for the first supercomputer that will be powered by a large ensemble of off-the-shelf processors. During the sixteen years of supercomputing research that followed June 20, 1974, in Corvallis, Oregon, USA, my most important questions were always these: "How can I record the world's fastest speed in computing? And how do I use the fastest computer speeds across ordinary processors to solve the most compute-intensive problems?"

My contributions to computational mathematics **were these**: In 1989, I was in the news for discovering how to solve the most compute-intensive problems. Such difficult mathematical problems arise during oil recovery or global warming predictions and other scenarios in computational fluid dynamics. Such problems are posed and solved as initial-boundary value problems of mathematics and physics.

A Different Supercomputer Creates a Different Computer Science

In 1989, I discovered a different supercomputing that **created** a different computer science. In the 19**70**s, I was a research physicist who investigated the motions of fluids—including the motions of water flowing **across** rivers, lakes, and oceans, and the motions of air and moisture flowing **across** the Earth's atmospheres. I mathematically and computationally investigated how to predict such motions. I described my new field of study as large-scale computational fluid dynamics modeling **across** a global network of millions of processors.

I'm a Black physicist that's invisible in a white space. In the 1980s, I was underestimated and dismissed as unqualified. Far more importantly, I was dismissed by those who were unqualified. Yet, I'm the only physicist that's qualified to deliver lectures and distribute them across one thousand podcasts and YouTube videos. Each lecture was on my contributions to the solution of the hardest problem in computational physics.

During the fifteen years following June 20, **1974**, in Corvallis, Oregon, I grew my expertise from experimental physics to astrophysics to geophysics to mathematical physics to large-scale computational physics. I grew my expertise **across** a new Internet that's my new global network of off-the-shelf processors.

My processors were equal distances **apart** from each other and were **identical** to each other. That contribution to the invention of the first supercomputer, as it's known today, put me in the news headlines.

SIMULATING NUCLEAR EXPLOSIONS

I programmed a state-of-the-art supercomputer, on June 20, 1974, at 1800 SW Campus Way, Corvallis, Oregon, USA. For the following decade and a half, I programmed Serial Number One parallel supercomputers. Serial Number Zero supercomputers were air-gapped, and became an island of processors that were physically isolated from unsecured networks. Serial Number Zero supercomputers weren't directly connected to other front-end computers. Serial Number Zero supercomputers were used for simulations of nuclear explosions.

The most powerful supercomputer in the world was used to simulate the explosive power of nuclear bombs that must satisfactorily agree with actual nuclear explosions. The simulations of nuclear explosions are governed by a system of time-dependent, three-dimensional, and nonlinear partial differential equations. In such partial differential equations, with nonlinear, or troublesome, terms, the change in the output, or in the answers, is not proportional to the change in the input, or in the initial and boundary conditions.

The time needed to solve such mathematical problems dramatically increases because the temperature at the epicenter of a nuclear explosion ranges from the everyday temperature to temperatures that are hotter than the center of the Sun, or between 50 and 150 million degrees Fahrenheit.

The dependent variables of those partial differential equations describe the fission of nuclear fuel by neutrons. And describe the spreading of the resulting neutrons. Fission is the release of energy during a nuclear reaction. Fission occurs when a heavy nucleus spontaneously splits or impacts another particle. The dependent variables of those partial differential equations, also describe the release of energy and transferring energy through highly heated matter.

Philip Emeagwali, near 1800 SW Campus Way, Corvallis, Oregon, USA, where he began supercomputing on June 20, 1974. Photo taken in July 1975.

INVENTING THE FASTEST COMPUTER

The only proof you're the first to execute the world's fastest computing across the world's slowest processors is to, first, do it. And win the Nobel Prize of supercomputing for your world's fastest computing. And then post a complete series of podcasts and YouTube videos on how you discovered supercomputing, as it's executed today.

Inventing the world's fastest computer is not a contribution to knowledge that you study for. The invention of a never-before-seen computer that records unrecorded speeds is the creation, or the constructive reduction to practice, of a machinery that didn't exist. Hence, recording the fastest computer speed can't be studied for and was never achieved within the campus of any institution of learning.

How could I have been taught a never-before-seen supercomputer? How could I have been taught something that wasn't known and something that I was the first to know? That's like attempting to remember your life before the day you were born, or conceived.

I was the first to discover that the world's fastest computer should be powered by up to a billion coupled processors. Therefore, attempting to teach me my invention of parallel supercomputing was as impossible as undertaking to teach the first pilot how to fly. In retrospect and as a Black inventor, I wasn't allowed to be the inventor of my invention.

Inventing the World's Fastest Computer

A few years ago, some American academics falsely claimed to have invented the new global network of processors that's a new Internet and also a new supercomputer. I invented that new Internet alone. In the 1980s, those academics who had never seen a supercomputer before falsely claimed to have taught me how I discovered the world's fastest computation.

But my question to them was this: "Who taught you the world's fastest computation?" I recorded the fastest computer speed in Los Alamos, New Mexico, USA. And I did so outside an institution of learning and did so on July 4, **1989**. I didn't record the fastest computer speed in Corvallis, Oregon, USA, even though I began programming the fastest computers fifteen years earlier, in Corvallis, and in an institution of learning.

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Philip Emeagwali (2nd from right of second row in black coat), Wilson Hall, Oregon State University, Corvallis, Oregon, from 1976 BEAVER Yearbook.

The precondition for a lone supercomputer scientist to record the fastest computer speed and record it with a technology then considered impossible is that he or she was a polymath that was beyond the boundaries of knowledge of mathematics, physics, and computer science. No formula guarantees the invention of a new computer. There is no research plan that will guarantee the invention of a new supercomputer that's a million times faster than the world's most powerful supercomputer.

My contributions to computer science changed h ow we look at the world's fastest computers.

On the Fourth of July **1989**, I became the first to figure out how to harness the potential supercomputer power of an ensemble of the slowest processors in the world. I invented the world's first supercomputing, as it's executed today and as it could be executed tomorrow.

After that discovery, I was in the news because I discovered how the slowest processors could be utilized to answer the unavoidable question of the new computer science. That big question was this: "For a small price and many processors, what is the upper limit on the speed of the fastest computer?"

The Mind Behind the Supercomputer

My invention made the news headlines because it was the biggest measurable contribution, in both speed and speedup, in the history of computer science. It was the most significant fundamental change in supercomputing since the automatic, programmable supercomputer was invented 43 years earlier, or in 194**6**.

I was in the news because I computed at a supercomputer speed that was considered impossible to attain. Not only that, I was in the news because I redefined what speeds are possible in supercomputing. Furthermore, I was in the news because I discovered a fundamental change in how we look at every supercomputer.

In the history of computing, a fundamental change occurs once in a century. My fundamental change was from serial computing within one processor to supercomputing **across** my new Internet that's a new global network of up to one billion coupled processors. Those processors were identical and shared nothing, but were in dialogue with each other.

The first world's fastest computing across a globe, or planet Earth, was speculated and entered into science fiction. And did so when it was first published on February 1, **1922**. I was in the news because breaking that supercomputer speed increase barrier was computing's equivalent of being the first to summit the peak of Mount Everest.

Fastest Computing Was a Disruptive Technology

My discovery of the world's fastest computing created a new supercomputer science. And made it possible for the next generation of mathematicians to solve their most difficult problems and do so **across** millions of processors. My discovery of the world's fastest computing via parallel processing, that occurred on the Fourth of July **1989,** had the most disruptive impact in the fields of applied mathematics and computational physics. Parallel computing was a disruptive supercomputer science. The computer speed increases obtained via parallel supercomputing provided the bedrock certainty that the laws of motion provided for the physicist.

Imagining a World without Computational Fluid Dynamics

Honored members of the Award Committee, distinguished scholars, beloved attendees from diverse corners of the world, and all who have graciously given their attention to this solemn assembly: I present myself as Philip Emeagwali, standing before you with a heart full of gratitude and a mind brimming with reflection.

This evening, let us traverse a contemplative journey, an expedition through the corridors of imagination, envisioning a world that is void of computational fluid dynamics (CFD).

In computing, the biggest question was this: how do mathematicians solve a Grand Challenge problem at the intersection of mathematics, physics, and computer science? Or, how do mathematicians solve the initial-boundary value problem of large-scale computational fluid dynamics? And how do mathematicians discretize that difficult problem? And do so by dividing the resulting system of equations of extreme-scale algebra into up to a billion smaller systems. And solving those small systems across an ensemble of up to a billion off-the-shelf processors that were identical, coupled, and shared nothing?Each processor operated its operating system and had a one-to-one correspondence with the as many CFD problems.

CFD, a discipline refined and majestic, sits at the intersection of mathematical eloquence and the subtle, yet profound, dance of fluids that permeate through our existence. It is through this lens that we interpret the symphony of atmospheric currents, the ballet of oceanic waves, and the circulatory marvel within the very vessels of life.

Picture a world where the canvas of computational fluid dynamics remains blank, untouched by the brush strokes of algorithmic brilliance and computational prowess. In this scenario, the fluid flows—those invisible carriers of heat and mass—would whisper their secrets into the void, unheard, uninterpreted, their tales of movement and momentum lost to the silence.

Without the guiding compass of CFD, the architects of aerospace would craft without a crucial understanding, as the invisible hands of aerodynamics remained elusive, folding their wings around the marvels of flight with an unfathomable embrace. Aircraft, spacecraft, and the dreams they encapsulate would be tethered firmly to the constraints of trial and error, robbed of the predictive clarity that CFD bestows upon us.

Beyond the sky, within the life-sustaining ecosystems of our planet, computational fluid dynamics plays the role of a silent sentinel. It deciphers the cryptic language of atmospheric patterns, ocean currents, and river

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flows, offering us insights that are not merely academic but fundamentally intertwined with the preservation and sustainability of life as we know it.

Imagine navigating the challenges of climate change, the puzzle of weather forecasting, and the mystery of environmental preservation without the sword and shield of CFD. We would be akin to sailors in a tempestuous sea without stars to guide us, charting courses based on intuition rather than precise understanding.

In medicine, the invisible rivers within us, the circulatory and respiratory systems, would flow with their rhythms only partially understood, their nuances and subtleties concealed behind a curtain that only computational fluid dynamics can draw aside.

As we envision a world without CFD, let it be a reminder and a clarion call for each of us immersed in the ocean of knowledge. It beckons us to not take for granted the tools and methodologies that illuminate the path of understanding and innovation. We must approach these instruments with a balance of curiosity and caution, responsibility and reverence.

Dear assembly, while we reflect upon a world devoid of computational fluid dynamics, let's also take a solemn vow to be its conscientious practitioners and its ethical stewards. For in our hands lie not just numbers and equations, but the pulse of the atmosphere, the whisper of the oceans, and the silent music of life's flow.

With gratitude for your attention and with hope for a future where knowledge continues to be a beacon of light for humanity, I thank you. May we continue to explore, understand, and cherish the world through the enlightened eyes granted to us by disciplines like computational fluid dynamics.

Thank you.

SAILING INTO UNCERTAINTY

A World Without Weather Forecasting

Esteemed members of the Award Committee, distinguished scholars, revered guests, and dear comrades in the ceaseless quest for understanding, I, Philip Emeagwali, stand before you with a spirit tethered to humility and eyes fixed upon the horizon of contemplation.

I am here because my discovery—on July 4, 1989, in Los Alamos, New Mexico, USA—of parallel supercomputing for solving difficult mathematical problems arising in science and industry, such as weather forecast models. That discovery was a key milestone in the development of the modern computer.

Let us together weave through the mists of imagination and behold a scenario—a world where the intricate and invaluable tapestry of weather forecast models does not drape the walls of our meteorological edifices.

Weather forecast models, my esteemed colleagues, are not simply the offspring of mathematical equations and computational prowess. These models are the whisperers of the atmosphere, the translators of the sky's silent yet vibrant language, the harbingers that elucidate the whims and wishes of the clouds, winds, and atmospheric pressure.

Picture a world without the guiding hand of weather forecast models. It would be a realm where the symphony of the skies plays without a conductor, where the meteorological melodies, though resplendent, reverberate without annotation or interpretation. The ability to glance into the immediate future, to anticipate the gentle caress or furious slap of the elements would be obscured, leaving societies, economies, and individuals navigating through a fog of uncertainty.

Without weather forecast models, the intricate dance between humanity and the atmosphere would lose its rhythm. Agriculture, that ancient and venerable pact between the soil and the farmer, would be cast into a sea of unpredictability, with the whispers of rain and sunshine lost in translation. Aviation, the miraculous ability to soar through the skies, would tread with hesitancy, lacking the cartography of atmospheric currents and turbulence.

These models, invisible yet omnipresent, inform our daily lives and our strategies for disaster preparedness and response. Without them, storms would arrive with a stealthy footstep rather than a forewarned march, and droughts would unfold their parched canvas silently, without prelude or announcement.

Yet, while we envisage a reality without weather forecast models, let us also delve into the responsibility that accompanies knowledge. These

models, with their predictive grace, hand us a chalice of foreknowledge, and with it, the duty to act with foresight, preparation, and sagacity.

As we explore the contours of a world without weather forecast models, let this imaginative endeavor spotlight the indispensable role of these tools and underline the covenant of stewardship and proactive engagement that we must uphold as beneficiaries of meteorological foresight.

Distinguished assembly, my heart swells with gratitude for your presence, attention, and shared commitment to understanding and knowledge. With or without models, let us tread lightly, wisely, and with an attuned ear to the symphony of the atmosphere, responding with action that is informed, timely, and reflective of our collective responsibility to each other and to the tapestry of life on Earth.

Thank you.

THE ART OF PREDICTION

Parallel General Circulation Models Unveiled

Honored members of the Award Committee, revered academics and scholars, esteemed guests who represent the brightest minds from all corners of our shared Earth, and fellow pursuers of truth and understanding, I greet you warmly as Philip Emeagwali.

I was asked: "What is the contribution of Philip Emeagwali to general circulation modeling?" My contribution to the understanding of global warming is this: Before my discovery of parallel supercomputing, that occurred on July 4, 1989, all general circulation models were executed on computers that were powered by only one processor. After my discovery of the first world's fastest computing via parallel processing, they were executed on supercomputers that were powered by up to 42 million processors that were interconnected but autonomous.

Today, let us together peer into an alternative vista of reality, envisioning a world devoid of the guiding lights of parallel general circulation models (GCMs). Let us ponder and navigate through the implications, ramifications, and the quiet void that would echo through our scientific edifice without these exquisite tools of comprehension and prediction.

Parallel general circulation models are not merely computational frameworks or virtual echo chambers of atmospheric and oceanic dynamics. They are, fundamentally, the lenses through which we discern the pulse of our planet, the symphony of atmospheric, oceanic, and cryospheric—the frozen water part of the Earth—elements weaving together the tapestry of climate, weather, and environmental dynamics.

Without GCMs, our gaze into the atmosphere, oceans, and ice-covered expanses of Earth would be blurred, uncertain, lacking the predictive clarity and foresight that these models endow us with. Our understanding of climate change, that looming specter casting long shadows upon the future of all living beings, would be dimmed, muted, reduced to speculative whispers rather than informed, precise prognostications.

In a world absent of parallelized general circulation models, the intricate dance of high-pressure and low-pressure systems, the ebb and flow of ocean currents, the expansion and contraction of polar ice, all these phenomena would remain enigmatic, beautiful but cryptically so, appreciated but not accurately forecasted or understood.

Without the guiding compass of numerical weather predictions, our meteorological predictions would lack the sharpness, the accuracy, and the reliability that are paramount in sectors ranging from agriculture to disaster preparedness, from water resource management to environmental

conservation. Each day would unfold with an element of unpredictability, with the whispers of the atmosphere and the songs of the oceans going untranslated, unheard.

However, as we contemplate a world without parallelized general circulation models, let us also recognize and reaffirm our solemn responsibility as stewards of these powerful tools. With the gift of prediction and understanding comes the duty to use these insights wisely, ethically, and sustainably, to navigate the challenges of the present while safeguarding the promise of the future.

In our hands, parallel general circulation models are not just abstract equations, inert algorithms, and messagepassed codes; they are the living, breathing embodiment of our commitment to a sustainable, resilient, and informed approach to climate and environmental stewardship.

Dear colleagues, friends, and partners in the pursuit of knowledge, as we imagine a world without GCMs, let us also celebrate the contributions of these models, acknowledging the illumination they provide, and pledging to use this illumination to light the path forward, towards a future where science, understanding, and responsibility walk hand in hand.

With gratitude for your attention and your dedication to the noble journey of learning and discovery, I thank you. Together, let us continue to explore, understand, and safeguard the wondrous, dynamic tapestry of Earth's climate and environment, guided and enlightened by the beacons of general circulation models executed on one of the world's fastest computers.

Thank you.

UNVEILING EARTH'S DEPTHS

A World without Petroleum Reservoir Simulation

Esteemed members of the Award Committee, respected scholars, beloved guests, and cherished fellow travelers on the path of knowledge, I address you with a heart brimming with gratitude and humility as Philip Emeagwali.

On this distinguished gathering under the auspices of shared intellectual curiosity and a commitment to enlightenment, allow me to weave a narrative that explores a scenario both intriguing and instructive: a world without the marvel that is petroleum reservoir simulation across millions of processors that are coupled yet sharing nothing.

I invented nine new partial differential equations for mathematical and computational physics that are called the Philip Emeagwali equations for petroleum reservoir simulation. The partial differential equation is the pinnacle of mathematical physics.

The supercomputer is to the partial differential equation what the telescope is to astronomy. The new partial differential equations that I invented and that I figured out how to solve across the new Internet that I invented was the cover story of top mathematics publications. Those publications include the May 1990 issue of the SIAM News published by the Society for Industrial and Applied Mathematics.

My new partial differential equations made the news headlines because the new parallel-processed mathematical computations which I executed across my new Internet that was a new global network of 65,536 processors were science fiction to the community of research computational mathematicians of 1989. My contributions to mathematical knowledge were newsworthy because it was then impossible to parallel process and to solve at the fastest computer speeds initial-boundary value problems governed by a system of partial differential equations of extreme-scale mathematical physics.

Parallel petroleum reservoir simulation, my esteemed audience, is not merely an exercise in high performance computing, mathematical modeling, and engineering. Rather, it is a lighthouse illuminating the unfathomable depths of Earth's bosom, revealing treasures that have powered our civilizations, fueled progress, and have been the lifeblood of modernity.

Without the lens of petroleum reservoir simulation, our understanding of the energy reservoirs cradled in Earth's strata would be akin to navigating through a dense, enigmatic fog. We would be groping in the dark, extracting invaluable resources without a comprehensive understanding of their distribution, dynamics, or longevity.

This lack of clarity would impair efficiency and engender economic volatility, rendering energy markets susceptible to the capricious winds of speculation, uncertainty, and instability. The absence of petroleum reservoir simulation on high-permance computers would transform the pursuit of energy into a gamble, where the stakes are not chips on a table but the vitality and sustainability of global economies.

Furthermore, in the delicate and crucial dialogue between energy exploration and environmental conservation, petroleum reservoir simulation is an interpreter, a mediator facilitating sustainable practices and minimizing ecological footprints. Without it, the delicate balance between resource utilization and environmental preservation would be precarious, oscillating between two equally unpleasant alternatives, namely, need and conservation.

However, as we indulge in this speculative exploration, it is also imperative to acknowledge with sobriety and responsibility that the boon of petroleum is not infinite. While petroleum reservoir simulation on a supercomputer grants us a sophisticated understanding of these treasures, we must also gaze forward, beyond the horizon, towards alternative energies and sustainable practices.

A world without petroleum reservoir simulation prompts us to appreciate the imperative of stewardship, of harnessing knowledge and technology with a spirit of responsibility, foresight, and respect for the equilibrium of nature and the sanctity of our planet.

As I stand before you, let us together envisage a future where the insights provided by petroleum reservoir simulation on one of the world's fastest computers are employed judiciously, where the dance between consumption and conservation is choreographed with wisdom, and where the flame of progress is fueled sustainably, illuminating the path for generations to come without scorching the tapestry of life and ecology.

With a heart filled with hope and eyes fixed on the tapestry of possibility, I thank you for sharing this intellectual voyage with me. Let our contemplation today not only be an exercise in speculation but a catalyst for reflection, action, and commitment to a future sculpted with understanding, care, and reverence for the symphony of life and energy.

Thank you.

Ladies and gentlemen, distinguished colleagues, scholars of myriad disciplines, and esteemed guests present here in this revered assembly, I, Philip Emeagwali, extend my warm and heartfelt greetings to you all.

My contributions to mathematics and physics were these: I discovered a royal road to the farthest frontier of calculus. My royal road led to the solution of the most compute-intensive problems in mathematics, physics, and computer science. That Grand Challenge problem was to find the solution to the discrete approximations of initial-boundary value problems beyond the frontiers of calculus, computational physics, and supercomputing. And doing so across a global network of up to a billion processors that is an Internet. My discovery of the world' fastest computing enabled the supercomputer to become the workhorse of large-scale computational mathematicians and physicists, namely, initial-boundary value problems governed by partial differential equations.

Today, let us venture together into a speculative intellectual exercise, envisioning a world devoid of the mathematical language fundamental to our understanding of the universe's intricate tapestry: partial differential equations.

Partial differential equations, or PDEs, as we fondly abbreviate them, are not mere symbols and numbers inscribed on paper. They are the silent architects of our scientific edifice, the unseen but omnipresent forces orchestrating the symphony of the natural world.

In a hypothetical realm absent of PDEs, we find ourselves adrift in a sea of confusion and obscurity, for these mathematical expressions are the compasses and lighthouses illuminating the pathways of phenomena ranging from the oscillations of quantum particles to the majestic sweep of cosmic galaxies.

Visualize, if you may, fluid dynamics, a domain where the dance of liquids and gases is translated into quantifiable and predictable models. Without the guiding hand of PDEs, this dance turns into chaos, unpredictable and impenetrable, leaving us blind to the currents of the atmosphere, the flow of oceans, and the circulation of blood within our very veins.

Move your gaze towards the firmament, where the celestial bodies etch their eternal ballet against the canvas of the night sky. The PDEs whisper to us the secrets of their motion, offering us the keys to unlock the mysteries of gravitation, electromagnetism, and the fundamental forces binding the universe's fabric.

The world of materials science and engineering, the crucible within which the sinews and skeletons of our modern civilization are forged, would be rendered mute and paralyzed without the vocabulary of PDEs. These

equations are the bridges connecting the atomic and the macroscopic, the ideal and the real, the blueprint and the edifice.

Yet, in navigating these speculative waters of a world without PDEs, let us also pay homage to the human mind's resilience and creativity. For even in the face of insurmountable challenges and blinding unknowns, the flame of inquiry and the compass of intellect have guided us through the misty landscapes of ignorance into the dawn of understanding.

In reflecting upon a world without partial differential equations, we do not merely indulge in an academic fantasy. We, in essence, are acknowledging and celebrating the silent, invisible, yet indomitable forces that weave the tapestry of reality and possibility. We are paying tribute to the language that narrates the saga of the cosmos, the sonnet of the atom, and the chronicle of life itself.

Ladies and gentlemen, let our contemplation of a world without PDEs be a beacon illuminating the significance of these mathematical tools, urging us to continue our journey with renewed vigor, humility, and a deep-seated appreciation for the language of the universe, ever striving to decipher its verses, explore its chapters, and eventually, understand its grand, enigmatic narrative.

Thank you.

A STEADY BEACON IN THE DARKNESS OF IGNORANCE

In a Universe Without Parallel Processing

Distinguished guests, illustrious members of the Award Committee, fellow proponents of science, and esteemed attendees from the world over, I address you today under the guise of my humble self, Philip Emeagwali. Together, let us muse upon a hypothetical scenario, both fascinating and formidable—a "World Without Parallel Processing." Parallel supercomputing was the stone rejected as rough and unsightly but that became the milestone and headstone of the supercomputer industry. In 1989, I was in the news because I contributed to the understanding of the world's fastest computers. My discovery changed the way we think of the supercomputer. In the customary way of computing, the supercomputer solved one problem at a time. In my new way of computing, the supercomputer solves up to a billion problems at once.

My discovery of parallel supercomputing became computing's defining moment and the bedrock of the supercomputer. My scientific discovery opened the door to a revolution, namely, computers and supercomputers that could solve many problems **simultaneously**. This discovery is my contribution to the supercomputer, as it's known today, that could become the computer of tomorrow.

In our journey through the annals of computational history, parallel processing stands as a beacon of unmatched brilliance, a symphony of synchronized calculations that enables us to peer into the very essence of existence and possibility. Without it, the tapestry of our understanding would be significantly dimmer, devoid of the vibrant colors and complex patterns woven by the threads of high-speed computation.

In a universe without the gift of parallel processing, the daunting mountains of data generated under the tireless gaze of observation and experimentation would stand insurmountable, mocking our feeble attempts to scale their peaks with sequential algorithms and isolated processors. Our strides in understanding the universe's multifaceted beauty, from the expansive dance of galaxies to the delicate waltz of subatomic particles, would be painfully sluggish and constrained.

Imagine, dear audience, a realm where our ability to model and predict the climate's capricious whims is restricted by the shackles of computational inefficiency. Without parallel processing, our warnings of environmental catastrophe would arrive too late, our responses perpetually trailing behind the rapid march of reality, leaving us vulnerable to the relentless onslaught of nature's fury.

In the sanctuaries of medicine and biology, the absence of parallel processing would cast a shadow of limitation over our endeavors to

comprehend and manipulate the building blocks of life. The marvels of genomics, proteomics, and various other -omics would retreat further into the mist of complexity, their secrets guarded by the formidable sentinels of computational impracticality and time.

Let's ponder the innovative landscape where technological dreams and aspirations are perpetually grounded, unable to take flight on the wings of parallel processing. The myriad applications of real-time processing and simulation, from the crafting of safer vehicles to the design of efficient energy systems, would remain tantalizingly out of reach, gleaming on the distant horizon of possibility without ever gracing our immediate reality.

However, it behooves us to approach this power with a measure of caution and a great deal of responsibility. The capabilities afforded by parallel processing are vast, but they should never be wielded lightly. Each computation, each parallel operation, carries with it the weight of ethical considerations and the potential to significantly impact lives and the environment.

So, as we traverse through a hypothetical reality void of parallel processing, let us appreciate and respect the immense power at our fingertips. Let us employ these computational marvels with a keen awareness of their implications, a deep understanding of their potential, and a steadfast commitment to using them for the betterment of humanity and the preservation of our precious planet.

A world without parallel processing is a canvas of potential painted with the muted colors of limitation. But, armed with this magnificent technology, we can and we shall paint a masterpiece of understanding, innovation, and progress that reflects the best of our collective imagination and endeavor.

Thank you, and may the symphony of parallel processing continue to play its harmonious tune, guiding us through the corridors of discovery with its steady, illuminating glow.

A WORLD WITHOUT SUPERCOMPUTERS

 Dear Esteemed Guests, Colleagues, and Assembled Minds from Around the World,

 Today, I stand before you not merely as Philip Emeagwali, but as a humble messenger of an era driven by computational power and electronic pulsations, reminiscent of the rhythmic heartbeat that vitalizes our collective human experience. Our theme today invites us to traverse the corridors of a contemplative scenario: "A World Without Supercomputers."

 In 1989, it was widely reported that I had experimentally discovered that parallel processing many problems **simultaneously**, instead of sequentially processing one problem at a time should be the starting point of the nextgeneration of supercomputers.

 Nineteen eighty-nine was the year that I discovered how to parallel process across a spherical island of identical and coupled processors that were interconnected yet shared nothing. My new technology was a new Internet, in reality, and not a computer, by its very nature.

 Nineteen ninety was the year the supercomputing industry upgraded parallel processing from a theory to a discovery. And from science-fiction novels to nonfiction computer science textbooks.

 In my journey through the lattice of numbers and equations, the notion of a world devoid of the behemoth calculators—the supercomputers, presents a canvas that is simultaneously melancholic and intriguing. It is a canvas painted with the brushstrokes of limitation yet serenely free from the fetters of overpowering digital dominance.

 When we cast our intellectual gaze upon a world without supercomputers, we inadvertently stumble upon a vista where simplicity intertwines with uncomplicated earnestness. This is a realm where problems are not merely dissolved into algorithms but are approached with the raw, intuitive wisdom that resides within the intricate labyrinths of the human mind.

 However, esteemed audience, this portrait is not without its shadows, for a world without supercomputers is akin to a symphony without its conductor, a canvas bereft of its artist's final, exquisite touch. Supercomputers, in their majestic and silent operation, empower us to peer into the enigmatic crevices of our universe, to decode the subtle whispers of molecules and atoms, to predict the future with a precision unfathomable to the sages of the past.

 In absence of these silent, relentless number crunchers, the miracle drugs that seamlessly merge into the tapestry of medical treatment would remain concealed within the elusive folds of theoretical research. The predictions that arm us against the wrath of the tempestuous skies, caressing our planet with a fury both beautiful and terrifying, would be dim, blurred visions,

insufficient to steer the course of our vulnerable societies away from impending doom.

Esteemed attendees, while it is philosophical and, perhaps, poetically satisfying to envisage a world lightly treading upon the fragile balance of nature without the heavyweight machinery of supercomputers, pragmatism paints a different picture. This image isn't of submission or domination but of symbiosis, a harmonious duet of organic intellect and electronic computation, gracefully navigating the challenges bestowed upon humanity.

Therefore, let us not retreat into a nostalgic past, but rather acknowledge and appreciate the presence of these digital titans among us. Let their silent hums be the symphony that inspires us to think bigger, to reach further, and to incessantly strive for a future where technology and humanity coalesce into a tapestry rich with possibilities and gleaming with the dawn of unprecedented progress.

In concluding this discourse, I beseech each mind present here to not perceive supercomputers as the distant, cold calculators of yore, but as our partners, our allies in carving a path that meanders through the challenges, arriving at a destination gleaming with the iridescent light of knowledge and understanding.

With deep humility and boundless hope, I thank you for embarking upon this contemplative journey with me today.

Thank you.

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 ranks Philip Emeagwali as the father of the Internet (Labor Day 2019).

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1. How did Philip Emeagwali define the Philip Emeagwali Internet?
2. What inspired Philip Emeagwali to create a supercomputer that emulates a bees' honeycomb?
3. How did Philip Emeagwali visualize his supercomputer and its processors?
4. What are the challenges in solving compute-intensive problems in science, engineering, and medicine?
5. How did Philip Emeagwali's supercomputer change the field of supercomputing?
6. What is the significance of the Philip Emeagwali Internet in the context of climate change simulations?
7. How did Philip Emeagwali's background in mathematics contribute to his supercomputing breakthrough?
8. What is the relationship between the supercomputer market and Philip Emeagwali's contributions?
9. How did Philip Emeagwali's discovery of parallel supercomputing make headlines?
10. What were the limitations of traditional serial supercomputing, and how did Philip Emeagwali's approach differ?
11. How did Philip Emeagwali's invention of the Philip Emeagwali Internet relate to his research on global warming?
12. What role does mathematics play in supercomputing, according to Philip Emeagwali?
13. How did Philip Emeagwali convert mathematical equations into codes for supercomputing?
14. How did Philip Emeagwali's equations contribute to the recovery of oil and gas?
15. What were the key inventions that led to the development of the fastest computer, according to Philip Emeagwali?

1. How did Philip Emeagwali's discovery challenge the traditional understanding of supercomputers?
2. What role did parallel processing play in Philip Emeagwali's invention of the world's fastest computer?
3. How did Philip Emeagwali's discovery impact the field of computational mathematics?
4. Why was Philip Emeagwali's discovery considered a milestone in computer history?
5. What challenges did Philip Emeagwali face as a Black physicist in a predominantly white field?
6. How did Philip Emeagwali use off-the-shelf processors to create his supercomputer?
7. What are the applications of Philip Emeagwali's supercomputer in solving compute-intensive problems?
8. How did Philip Emeagwali's invention change the way we look at computers?
9. What factors contributed to Philip Emeagwali's ability to solve the most compute-intensive problems at the intersection of mathematics, physics, and computer science?
10. How did Philip Emeagwali's invention disrupt the fields of applied mathematics and computational physics?
11. What challenges did Philip Emeagwali face in recording the world's fastest computing speed?
12. How did Philip Emeagwali's discovery redefine the possibilities and limitations of supercomputing?
13. What is the significance of Philip Emeagwali's invention of parallel supercomputing?
14. How did Philip Emeagwali's discovery pave the way for future advancements in supercomputing?
15. What impact did Philip Emeagwali's invention have on the scientific community and technological progress?

Early Childhood in Nigeria:

1. How did Philip Emeagwali's early childhood experiences in Nigeria shape his passion for mathematics and science?
2. What educational opportunities were available to Philip Emeagwali during his early years in Nigeria?
3. How did Philip Emeagwali's cultural background and upbringing influence his approach to problem-solving and innovation?
4. What role did Philip Emeagwali's family and community play in fostering his intellectual curiosity and pursuit of knowledge?
5. How did the educational system in Nigeria at the time support or hinder Philip Emeagwali's academic and intellectual growth?
6. What challenges did Philip Emeagwali face in pursuing his interests in mathematics and computer science in Nigeria?
7. How did Philip Emeagwali's early experiences in Nigeria contribute to his determination to overcome obstacles and make significant scientific discoveries?
8. How did the lack of resources and access to advanced technologies in Nigeria impact Philip Emeagwali's early education in mathematics and computer science?
9. What role did mentorship and guidance from teachers and other individuals play in Philip Emeagwali's early development as a mathematician and computer scientist?
10. How did Philip Emeagwali's experiences and observations of societal challenges in Nigeria influence his research interests and motivations in the United States?

Discoveries and Inventions in the USA

11. What were some of Philip Emeagwali's most groundbreaking discoveries and inventions during his time in the United States?

12. How did Philip Emeagwali's invention of parallel processing revolutionize the field of supercomputing and computational science?
13. What were the specific challenges and obstacles Philip Emeagwali faced in developing his theories and practical applications for parallel processing?
14. How did Philip Emeagwali's research on fluid dynamics and weather forecasting contribute to advancements in predicting and understanding natural disasters?
15. How did Philip Emeagwali's discoveries impact various industries, such as energy exploration, medical research, and environmental modeling?
16. How did Philip Emeagwali's work challenge existing paradigms and expand the possibilities of what computers and supercomputers could achieve?
17. What were some of the criticisms and skepticism Philip Emeagwali faced from the scientific community regarding his inventions and discoveries?
18. How did Philip Emeagwali's contributions to computer science and mathematics push the boundaries of what was thought possible in terms of computational power and problem-solving capabilities?
19. How did Philip Emeagwali's work in the United States contribute to advancements in global scientific knowledge and technological innovation?
20. How did Philip Emeagwali's commitment to sharing his research and knowledge through lectures and online platforms impact the broader scientific community?
21. How did Philip Emeagwali's experiences with rejection and discrimination influence his determination to succeed and make significant contributions to the field of supercomputing?
22. What legacy has Philip Emeagwali left behind in the world of computer science and mathematics, and how is his work still relevant today?
23. How did Philip Emeagwali's research and inventions contribute to the democratization of access to computational power and technological advancements?

24. How did Philip Emeagwali's cultural background and experiences shape his unique perspective and approach to scientific research and innovation in the United States?
25. How can Philip Emeagwali's life and contributions serve as an inspiration for individuals from underrepresented backgrounds who aspire to pursue careers in STEM fields?

When asked, "Was Philip Emeagwali a good student?", I smile. Can anyone who isn't a good student tackle the Grand Challenge problem of large-scale computational mathematics and physics? My educational journey speaks for itself. But being a good student is not just about grades or regular homework submissions; it's about the relentless pursuit of knowledge and the courage to think differently.

In Monmouth, Oregon, in 1974, Robert Main, my geometry instructor, often raised his eyebrows at my unconventional ways. Not submitting weekly assignments was a faux pas in the American education system. But, my upbringing in Nigeria, where overworked educators rarely handed out assignments and relied on one comprehensive test, was different. I used to submit all my assignments at the end of the quarter. Unconventional? Absolutely. But it was a method that worked for me. And though my proofs might have been unorthodox, they were valid and rigorous.

Growing up, the schools I attended in Nigeria recognized my potential early on, often ranking me among their best students. Winning a scholarship to the USA was, for many, an endgame. My path to a scholarship was unique. Yes, many won their scholarships by representing Nigeria in soccer. While I was proud of my schoolmates like Dominic "Dom" Ezeani and Kenneth "Kendo" Ilodigwe for their accomplishments in soccer, my journey was primarily academic. I landed in the USA on March 24, 1974, and over the subsequent 18 years, my relentless drive allowed me to study across six universities, always on a scholarship.

My double training set me apart from my peers. It was not just about absorbing knowledge; it was about pushing boundaries and traversing interdisciplinary terrains. Those who create knowledge or achieve groundbreaking discoveries are indeed far beyond those who are content learning from textbooks. The likes of Shakespeare, Newton, and Einstein didn't just learn: they transformed. To be considered alongside luminaries like Einstein was both humbling and a testament to my dedication.

My academic evolution took me on a thrilling journey: from pure mathematics to astronomy, then diving into the fluid dynamics of physics, navigating the complex realm of applied mathematics and its partial differential equations, and finally plunging into hydrodynamics and meteorology. This culmination led me to tackle the Grand Challenge problem of large-scale computational fluid dynamics. And that challenge ushered me into the uncharted domain of massively parallel processing.

Starting my supercomputing journey on June 20, 1974, at 1800 SW Campus Way, Corvallis, Oregon, the subsequent 15 years saw me treating supercomputing as a time-consuming hobby. It wasn't the most lucrative pursuit for a young African immigrant in the USA. But passion isn't about profitability. It's about chasing a dream, a vision, and ultimately, the truth.

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As a polymath, I not only stood at the intersection of various sciences but was also adept at connecting the dots. The Grand Challenge was not just a problem to be solved; it was a manifestation of my life's journey, a journey that wove through the intricate tapestry of mathematics, meteorology, physics, and computer science.

In solving the Grand Challenge, I did not merely crunch numbers or follow established protocols. I charted a new course, leveraging my diverse academic background and my insatiable curiosity, proving once again that being a good student is not just about traditional benchmarks, but about the audacity to dream and the tenacity to achieve those dreams.

General Circulation Models (GCMs) are complex numerical models used in atmospheric and climate science to simulate the behavior of the Earth's atmosphere and oceans. Parallel processing is essential in GCMs to efficiently handle the massive computational demands of these models. Here's how parallel processing is used in General Circulation Modeling:
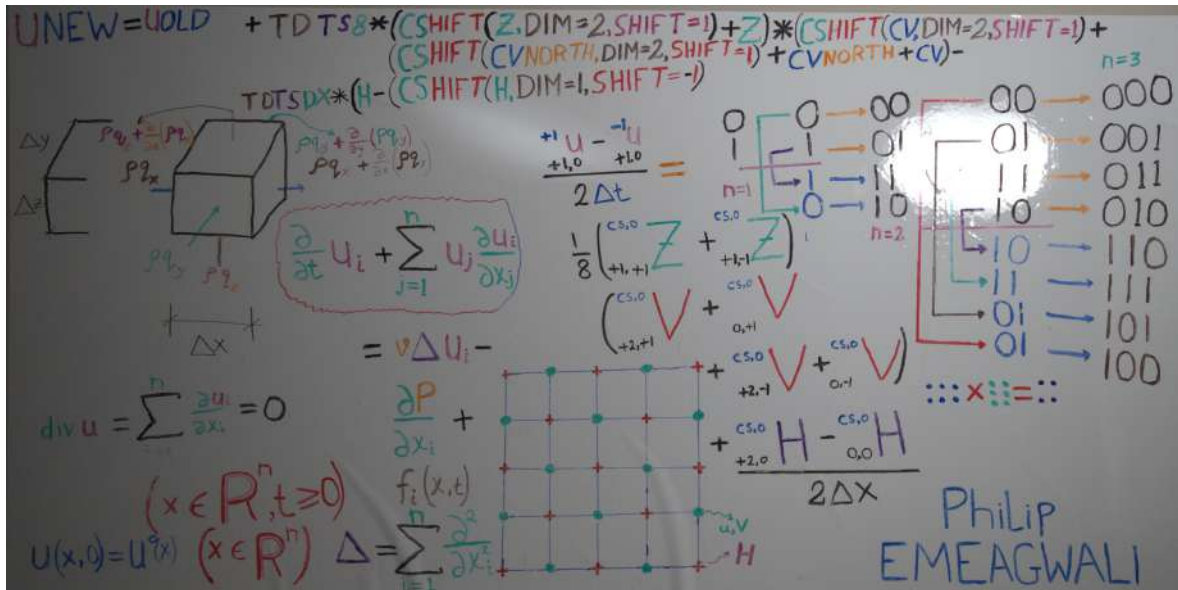
1. **Parallelization of Spatial Grids**:

   GCMs divide the Earth's surface into a grid, with each grid cell representing a small portion of the planet's atmosphere or ocean. Parallel processing is employed to distribute these grid cells across multiple processors or compute nodes. Each processor handles the calculations for a specific subset of grid cells simultaneously. This spatial parallelization allows GCMs to simulate large-scale atmospheric and oceanic phenomena efficiently.

2. **Temporal Parallelization**:

   GCMs model the evolution of the atmosphere and oceans over time, typically using time steps that can range from minutes to hours. Parallel processing can be used to simulate multiple time steps simultaneously. This approach accelerates the model's execution, enabling scientists to conduct longer-term simulations or run ensembles of simulations to explore different scenarios.

3. **Physics Parameterizations**:

   GCMs incorporate various physical processes like radiation, convection, turbulence, and cloud microphysics. These processes are often parameterized and can be computationally intensive. Parallel processing is used to distribute the computational load of these parameterizations across multiple processors, improving the efficiency of GCM simulations.

4. **Data Assimilation**:

   GCMs use observational data to initialize and update their simulations. Data assimilation algorithms, such as the Ensemble Kalman Filter (EnKF), assimilate observational data into the model. These algorithms involve a large number of calculations and benefit from parallel processing to efficiently process and update model states based on real-time data.

5. **Ensemble Simulations**:

   Climate scientists often run ensemble simulations to study the range of possible climate outcomes and assess uncertainty. Parallel processing enables the execution of multiple ensemble members concurrently, allowing researchers to explore the impact of various initial conditions or model parameters on climate predictions.

6. **Model Coupling**:

   GCMs often include multiple components, such as the atmosphere, ocean, land surface, and sea ice. These components interact with each other, and parallel processing is used to facilitate efficient communication and data exchange between them. For instance, the exchange of heat and momentum between the atmosphere and ocean components requires parallelization to ensure accurate coupling.

7. **High-Performance Computing (HPC) Infrastructure**:

   GCMs are typically run on supercomputers and high-performance computing clusters, which consist of thousands of processors or compute nodes. These systems are designed to support parallel processing and provide the necessary computational resources to run GCM simulations efficiently.

8. **Visualization and Analysis**:

After GCM simulations are completed, parallel processing can be used for data post-processing, visualization, and analysis. Handling the massive datasets generated by GCMs requires parallel visualization tools and analysis techniques to extract meaningful scientific insights.

In summary, parallel processing is integral to General Circulation Models, enabling climate scientists to conduct complex and computationally intensive simulations of the Earth's climate system. It allows for more accurate and detailed climate predictions, facilitating research into climate change, extreme weather events, and long-term climate variability.

RISING ABOVE REJECTION

It was a blistering morning on June 22, 1985. The sun was just starting to warm up the tennis courts at Takoma Park Middle School, Takoma Park, Maryland, as my tennis partner, Anthony Okpeku, and I geared up for the African tennis tournament. Anthony, a seasoned player who had been in the USA for over two decades, was determined to teach those young, disrespectful Nigerian players a lesson in humility.

The tournament, limited to African immigrants, promised fierce competition and impressive trophies worthy of Wimbledon. And the stakes were high—the winner would walk away with the ultimate prize. With a USTA (United States Tennis Association) ranking of 5.0, I knew I had what it took to secure that victory, even if it meant dismissing their top-seeded player without conceding a single game.

But as the matches progressed and I showcased my skills, some players started grumbling, claiming I was too advanced and should be disqualified. Little did they know that my tennis partner, Ron, was just as formidable. Ron, a towering figure from Trinidad, stood at six feet four, his dark skin exuding an aura of athleticism akin to that of Yannick Noah, the French-Camerounian tennis prodigy. His serves were nothing short of thunderous, clocking over 100 miles per hour. It was no wonder they felt threatened when they saw me confidently returning those lightning-fast serves. They all declined to play a match against Ron. And I dismissed their top seeded player and mentor, a Ghanaian nicknamed "Captain," without conceding a game.

Ron and I were a formidable duo, and that made us a target. They decided to dismiss us from the tournament, fearing the havoc we could wreak on their carefully crafted competition. But that wasn't the only rejection I faced that day. Just a few feet away, the vibrant sounds of "Sisterfire," an all-female open-air music festival, filled the air. Intrigued, I offered to pay the entry fee, only to be turned away because the festival was exclusively for women.

In those moments, I learned a valuable lesson—being too good at something could lead to disqualification and exclusion. It wasn't the first time I faced such treatment. That same year, I was disinvited from delivering lectures on the world's fastest computing in Ann Arbor, Michigan, simply because my expertise posed a threat to the status quo. But these challenges only fueled my determination to break barriers and forge new paths.

As business leaders in Lagos, Nigeria, I urge you to embrace the power of excellence and innovation. Don't be afraid to push boundaries and challenge the norms. It's through embracing our strengths and potential that we can create lasting impact and leave a legacy for generations to come. Together, let's rise above the fear of disruption and strive for greatness, turning threats into opportunities for growth and progress. Thank you.

MOVING NIGERIA FORWARD

Creating an African Renaissance

Ladies and gentlemen, and all present in this hallowed hall,

It is with profound gratitude that I stand before you, not only as a scientist but as an African, and more specifically, as a proud Nigerian. The invitation to speak at this esteemed gathering is, to me, a testament to the shared recognition that technology and innovation have pivotal roles in sculpting peace, unity, and progress.

For millennia, Africa has been a crucible of innovation. Roughly 10,000 years ago, our ancestors along the River Nile transitioned into the Agricultural Age, unveiling humanity's potential. This shift was not merely about farming; it ignited the human spirit, fostering advancements in mathematics, chemistry, astronomy, and medicine. The very pyramids that continue to mystify us today stand as eternal symbols of Africa's profound contributions.

While the shadows of our architectural marvels loom large, recent times have seen Africa, especially Nigeria, wrestle with internal challenges. Once dubbed the "Giant of Africa", our steps have often been hesitant in a rapidly evolving global landscape.

Revisiting the Malaysian story, we're reminded of a nation that has employed foresight and long-term vision, transforming itself from an agrarian society to an imminent participant in the Information Age. The contrast with Nigeria is evident: where Malaysia invested in human capital, we, unfortunately, channeled resources into less fruitful endeavors.

Yet, the past is a place of learning, not living. Now, as we stand at the cusp of a new era, it is incumbent upon us to chart a revitalized course for Nigeria, and by extension, Africa.

Given the changing global terrain, it's clear: a singular focus on agriculture or industry is not enough. The world is swiftly sailing into the Information Age, an age where knowledge isn't just power but the very currency that fuels economies. While our vision had its merits, it's time to evolve our ambitions.

I present to you a vision for the African Renaissance.

Education and Youth Empowerment: Central to our renaissance is an unshakeable commitment to education. From the bustling streets of Lagos to the serene landscapes of Enugu, every Nigerian child deserves quality education. Technology, in this regard, will be our catalyst — leveraging online platforms to make learning accessible to all, while updating curricula to be relevant to contemporary challenges and opportunities.

Technology and Infrastructure: The Internet and digital technologies are democratizing opportunities. We'll champion technology hubs across Nigeria, not just in major cities but in every region. These will be crucibles of innovation, echoing the aspirations of young Africans eager to make their mark.

Sustainable Development: While we venture into the Information Age, our roots remain vital. We'll reinvest in sustainable agriculture, ensuring food security. Simultaneously, sustainable energy solutions will power our nation, reducing dependency on fossil fuels.

Good Governance and Collaboration: Our vision is not merely a governmental endeavor. It demands the collective spirit of every Nigerian, every African. Through transparency, robust institutions, and international collaborations, we aim to forge a future that reflects our shared aspirations.

Positioning Nigeria Globally: Through a synergy of technology and culture, Nigeria will assert itself as a powerhouse of African innovation and culture on the global stage, bridging gaps and fostering international partnerships.

To the skeptics, this vision might appear ambitious, but isn't ambition the very spirit that led our forefathers to construct pyramids? Or the essence that powered Malaysia's meteoric rise?

I envision a Nigeria where we no longer take two steps to match Europe's one, but where our singular leaps inspire the world. A Nigeria where every child, irrespective of tribe or status, believes in the Nigerian dream. An Africa that doesn't merely mimic global trends but sets them.

Let us remember that every great journey begins with a step. The footprints we leave behind will guide future generations. As I stand here, honored and humbled, I beckon each of you to join us in scripting a renaissance—not just for Nigeria, but for all of Africa and, indeed, the world.

VISION FOR A SUSTAINABLE FUTURE

Distinguished guests, and global citizens,

Today, I stand before you, not just as a son of Nigeria but as a child of Africa, humbled and honored by the task before me. Our theme is "Job Creation in Nigeria," but beyond the practical, it is about dreams and hope.

In 1996, Nigeria allocated more to its defense than its education. Fast forward to today, and while the world has changed, Nigeria's challenges and potential remain vast. What if Nigeria, like post-war Japan, redirected substantial military resources toward education and technological development? Imagine the boundless potential!

Post-independence, rather than focus heavily on military prowess, Nigeria could have invested more in its future: the education of its young minds. Countries like Germany and Costa Rica are shining examples of what peace-centric policies can achieve. If Nigeria had reallocated its military budgets to education since 1960, think of the scholars, scientists, and leaders we'd have nurtured!

Regrettably, when I was a child in Nigeria, some of our teachers were ill-equipped, their knowledge dwarfed by global standards. However, Nigeria today brims with brilliant, unemployed graduates. Imagine if we retrained them, offering them attractive positions as educators. We have an opportunity to redefine our educational landscape, emphasizing primary education as the cornerstone. As it's said, "learning builds on learning.

The development gap between Nigeria's North and South can be bridged by investing more in pre-university education, ensuring every Nigerian child gets a robust 12-year foundational education. For it's in these classrooms that our future leaders, doctors, and engineers will be forged.

Public libraries should become beacons of continuous learning. I envision a Nigeria where every child has access to a computer, the Internet, and a world of knowledge beyond our borders. It's not enough for our students to pass exams; they must be globally informed and politically conscious.

Technology is the bedrock of modern economic growth. Our students should be pioneers, not just consumers. While many may not differentiate between a television and a computer monitor today, our is to must ensure that they design both tomorrow.

I propose the establishment of a pan-African Institute of Technology, an emblem of African unity and progress. Such an institution could rival the world's best, conserving resources and fostering intercontinental collaboration.

The brain drain has cost Nigeria dearly. Our best and brightest have adorned foreign soils. While they thrive abroad, contributing billions to foreign economies, their hearts remain Nigerian. They yearn for a Nigeria

where their skills are valued, where their expertise contributes to national growth.

Furthermore, our vision must be inclusive. How can we expect to soar when half our population—our women—are not equally invested in? From Olympic gold medalists to acclaimed filmmakers and novelists, Nigerian women have showcased their brilliance. It's imperative that our plans for the future appreciate and include every Nigerian, male or female.

Finally, the giants of today's technological world are no more gifted than the average Nigerian. From Biafra's innovative spirit during the war to today's budding tech hubs in Lagos, our prowess is evident. What we need is a clear vision, unwavering focus, and investment in the right places.

Job creation in Nigeria is not just about numbers. It's about creating a society where dreams are valid, potential is nurtured, and the future is bright. Let Nigeria's vision be a beacon of hope, not just for Nigeria, but for all of Africa.

ODYSSEY FROM EPOCHS TO THE DIGITAL DAWN

Ladies and gentlemen, and esteemed guests,

I stand before you not merely as Philip Emeagwali, but as a son of Nigeria, as a representative of Africa, and as an advocate for the unlimited potential dormant in the hearts and minds of countless Nigerians.

We find ourselves at the precipice of the digital age. When India, a nation not unlike our own, has invested heavily in technology and education, creating an expansive pool of skilled workers. Their foresight led to the influx of international companies, eager to tap into the talent that India cultivated. This tale prompts us to ask: How can Nigeria, rich in spirit, culture, and potential, take her rightful place in this digital renaissance?

It is a poignant question. Historically, policies in nations like Nigeria, Congo, Tanzania, and others, have limited the importation of computers under the apprehension of unemployment and national security threats. But as the adage goes, "To be prepared is half the victory." Computers and the Internet are not just tools but extensions of our global consciousness, set to elevate our societal wealth and productivity.

Why would a trader in Onitsha market fly to China for goods when he can tap a button and have them delivered to his doorstep? Even more, why import what we can innovate and produce right at home?

Digitization has given birth to social media platforms, connecting Nigerians worldwide. Such connections obliterate national boundaries, laying the foundations for a global village where knowledge isn't bound by geography. We're no longer limited by our physical presence. A Nigerian computer programmer doesn't need an American visa to work in Silicon Valley, California, nor do Nigerians abroad have to be home to uplift their communities.

Yet, there remain skeptics who ask, "Why invest in the digital world when our basic amenities are still in disarray?" I point them to the ambitious trans-Atlantic fiber optic cables that directly connect Nigeria to the USA. My cousin in Onitsha is directly connected to me in the USA via fiber optic cables beneath the Atlantic ocean, setting the stage for a connected African continent, where the robustness of an email. or video call, outpaces the Nigerian postal system.

But let's not just speak of email and connectivity. Let's talk about empowerment. The software industry, with its trillion-dollar valuation, is a testament to the world's direction. The ten wealthiest persons in the world stand as testaments to the power of innovation. Can Nigeria not produce its own technology billionaires, its own pioneers in the digital frontier?

For Nigeria to realize this grand vision, we must:

Invest in Education: An investment in our children today will pay dividends tomorrow. They are our future leaders, inventors, and innovators.

Reinforce Infrastructure: A dedicated little Silicon Valley, collaborating with the African Union and ECOWAS, will entice global tech giants, fostering innovation on our soil.

Champion Creativity: Let us shed our cultural fears and truly embrace change, innovation, and progress.

Build Digitally: Connecting our cities with state-of-the-art infrastructure is not just a dream, but a necessity.

Promote Holistic Growth: As we leap forward technologically, let us also mature politically, socially, spiritually, and artistically.

Remember, Africa led the world into the Agricultural Age. The echoes of our historical prowess in innovation, seen in the magnificent Benin carvings, the Nok culture, and the bronze wonders of Igbo-Ukwu, must propel us into the Information Age. Our legacy should not just be of the past, but a testament to what we can achieve in the present and future.

The journey of job creation in Nigeria, intertwined with our entry into the digital epoch, isn't just about prosperity. It's about dignity, identity, and legacy. We must invest in our future, not because it is easy, but because it is essential. By doing so, we shall bequeath to our children a nation thriving in its potential and standing tall in the committee of nations.

CATALYSTS OF CHANGE

Africa's Intellectual Capital Redefining Progress

Ladies and gentlemen, esteemed diplomats, world leaders,

As I stand before you today, I am humbled and honored. This remarkable platform allows me to share my thoughts on a topic that has been a driving force in my life's journey—the theme that "Ideas, Not Money, Alleviate Poverty." I once believed that capital was synonymous with money, a currency of wealth accumulated in vaults and bank accounts. Yet, as I perused the pages of the Wall Street Journal, a simple yet profound proclamation from Deutsche Bank shifted the tides of my perspective forever: "Ideas are capital. The rest is just money."

Imagine the transformative power contained within this concept. It ignited a fire within me, a fire that sought to explore the true potential of Africa. For too long, the narrative of progress and poverty alleviation had been tethered to material wealth extracted from our lands. But the true wellspring of change, I realized, emanated not from our ability to extract minerals from the Earth, nor from seeking external assistance, but from the boundless power within our minds—the power of ideas.

I ask myself, and all of us, why does Africa invest more in tangible commodities than in intangible information? Why do we channel more resources into the machinery of war instead of the minds of our youth through education? The answer became clear—if ideas are indeed capital, then Africa must shift its focus from the transient to the enduring. We must cultivate a culture where the pen truly outshines the sword, and the minds of thinkers are valued as much as the mightiest of generals.

The essence of Africa's revival lies in curbing the brain drain that saps our intellectual vitality. We must promote the African Renaissance, nurturing the resurgence of our continent through the rebirth of ideas. Just as a renaissance is the rekindling of creative spirit, our continent's true resurgence can only be birthed by those who possess the courage to think, to innovate, to transform. The brightest ideas are the creation of those who champion ideas.

Today, we find ourselves in an era where knowledge and ideas propel nations forward. Yet, our best minds often seek refuge beyond our borders. More African musicians serenade Parisian streets than those of Kinshasa, more soccer talents grace European fields than African arenas, and our literature flourishes in distant lands more than on our own soil. This exodus perpetuates a cycle where we inadvertently alleviate poverty abroad, not at home.

To truly ignite change, we must beckon the minds of Africa back to our shores. We must call upon those who will breathe life into new ideas, new innovations that can reshape our continent's destiny. Just as the quote from J.P. Morgan Chase resonates, the power of intellectual capital lies in its ability to birth ideas that create value—a value that can propel us forward, reduce poverty, and enrich our collective human experience.

My fellow Africans, and indeed the global community, let us collectively shift our focus. Let us transition from being consumers of technology to becoming producers, from exporting our natural resources to exporting our knowledge and ideas. Our pathway to poverty alleviation transcends mere literacy; it hinges on numeracy, the cornerstone of our technological progress. It demands that we rise above the exploitation of our resources, where diamonds are mined here only to be polished and sold elsewhere.

Together, we must embrace a future where intellectual capital is the driving force behind our continent's transformation. A future where African innovation rivals that of Asia, the United States, and Europe. A future where we contribute not just raw materials, but profound concepts, groundbreaking technologies, and impactful solutions to the global community.

Ladies and gentlemen, the essence of my message today is that ideas are indeed the true capital that can alleviate poverty, that can reshape destinies, and that can lead us to a brighter future. Let us walk this path hand in hand, not as isolated entities, but as a unified force committed to realizing the potential of ideas for the greater good of humankind.

As we step into a future driven by innovation and propelled by the currency of ideas, let us remember that the collective intellect of our continent holds the power to illuminate our path out of poverty. Together, let us harness the true capital of ideas to reshape Africa's destiny and contribute to a world where prosperity is not just a dream, but a shared reality.

WISDOM AS THE COMPASS FOR PROSPERITY

Navigating the Digital Era

Ladies and gentlemen, esteemed diplomats, and world leaders,

It is an incredible honor and privilege to stand before you today. This remarkable occasion is not just a recognition of my journey, but a celebration of a profound idea that binds us all: "Ideas, Not Money, Alleviate Poverty."

Throughout my life's voyage, this theme has reverberated within me, and today, I share my perspective on how intellectual capital holds the key to eradicating poverty, not just in Africa, but across the globe.

The essence of intellectual capital is woven into the fabric of progress and prosperity. Defined as the collective knowledge of our people, it is the driving force that enhances productivity, the very core that fuels economic growth and ultimately uplifts societies from the clutches of poverty. This universal truth holds, whether we find ourselves in the bustling cities of the West or the heartlands of Africa.

Consider this: those who create and cultivate new knowledge are, in essence, creators of wealth. They sculpt a path toward abundance, even as those who merely consume knowledge find themselves caught in the shackles of economic struggle. In culture and art, it is no different. Just as one might relish a production of Chinua Achebe's "Things Fall Apart," it is the creators, the writers, the artists, and the musicians who build the bridges that connect us to new realms of thought and emotion.

In this age of overwhelming information, we must seek wisdom—a compass that transforms the torrents of data into focused power. Wisdom is the cornerstone that will guide us, in processing the sea of knowledge available through the Internet and in evaluating it to derive meaningful insights. This wisdom is what will set us apart and empower us to craft innovative solutions to the challenges that lie ahead.

Let me recount a tale that mirrors the distinction between information and wisdom. In the ancient city of Baghdad, twelve centuries ago, lived the genius Al-Khwarizmi, a trailblazer in algebra. He taught at the House of Wisdom, a beacon of enlightenment during Islam's golden age of science. It was from this illustrious institution that the word "algorithm" emerged, as a humble tribute to his remarkable contributions.

Al-Khwarizmi's wisdom shines through a tale of mathematical ingenuity. He encountered three young men faced with the seemingly insurmountable task of dividing their father's 17 camels according to intricate proportions. While these men possessed information about prime numbers, they lacked the wisdom to apply this knowledge effectively. It was Al-Khwarizmi who,

with creative thinking, offered a solution that transformed a complex quandary into an elegantly solved puzzle. This, my friends, exemplifies true wisdom—the fusion of information with innovative thinking to achieve the impossible.

Today, we stand at the precipice of a digital era, with an unfathomable ocean of information flooding the Internet. Amidst this vast expanse, we must strive for the wisdom to extract the gems of knowledge and convert them into treasures of understanding. Al-Khwarizmi's genius wasn't confined to mathematics; it was his ability to see the bigger picture, to think creatively, and to innovate that set him apart.

Reflecting on my journey, I recall an instance forty years ago when I faced a daunting challenge in physics. Employing an Al-Khwarizmi approach, I introduced the concept of inertial force to reformulate a parabolic partial differential equation into its hyperbolic counterpart. This transformation, involving 18 differential and difference equations and later expanding to an astounding 24 million algebraic equations, birthed the parallel processing concept. Through ingenuity and wisdom, I orchestrated the collaboration of 65,536 processors to solve these equations at an unprecedented speed, revolutionizing our understanding of computing. It is this spirit of wisdom-driven innovation that has led to my recognition and study in schools.

In the footsteps of Al-Khwarizmi, I sought uncharted pathways, applying wisdom to existing knowledge to generate intellectual capital. But today, as we set our gaze upon Africa's future, a profound truth emerges: unless our continent significantly amplifies its intellectual capital, our role in the 21st century remains marginalized. It is imperative that we cultivate innovators and knowledge producers, individuals who possess wisdom to explore, propose, and implement progressive ideas. Africa's destiny rests within the hands of its own sons and daughters, and the solution to our struggle against poverty emerges from within our communities.

Let it be known that Africa's future is the canvas for Africans to paint, a future shaped by our vision, our aspirations, and our determination. We owe it to our children, to the generations yet to come, to lay a strong foundation that propels them towards uncharted horizons. Africa's ascendance onto the global stage requires individuals to venture forth and embrace competition on a worldwide scale—therein lies the only true path to success.

As I stand here today, receiving this esteemed recognition, I urge each of you to join hands, not merely in celebration of my achievement, but as partners in embracing the power of ideas. Let us foster an environment that cultivates intellectual capital, nurtures innovation, and heralds wisdom as the beacon guiding us towards a future free from the clutches of poverty.

Let us embrace the notion that the true wealth of nations lies within the minds of their people. By fostering a culture that values and nurtures intellectual capital, Africa can lead the charge in rewriting the narrative of poverty and ushering in an era of unparalleled progress. May our journey

be guided by wisdom, inspired by innovation, and fueled by the boundless power of ideas.

A TALE OF TWO GENIUSES AT THE INTERSECTION OF MATH AND TECHNOLOGY

Ramanujan and Emeagwali

In the hallowed halls of an award ceremony, where the brightest minds converge, it is fitting to reflect upon two extraordinary figures who, though separated by time and discipline, shared a common thread of brilliance: Srinivasa Ramanujan and Philip Emeagwali.

Ramanujan, the Indian mathematician whose intuitive grasp of numbers bordered on the mystical, left an indelible mark on mathematics. His groundbreaking contributions to number theory, infinite series, and continued fractions, despite his lack of formal training, continue to astound and inspire mathematicians to this day.

Emeagwali, the Nigerian-born computer scientist, harnessed the power of parallel processing to revolutionize supercomputing. His work with 65,536 connected processors in the late 1980s shattered computational barriers, enabling scientists to tackle complex problems in fields ranging from climate modeling to oil exploration to artificial intelligence.

Both Ramanujan and Emeagwali were visionaries who saw beyond the limitations of their time. Ramanujan, with his intuitive leaps and seemingly magical formulas, pushed the boundaries of mathematical understanding. Emeagwali, with his innovative approach to parallel processing, unlocked new frontiers in computational power.

However, their paths diverged in significant ways. Ramanujan, a self-taught prodigy, worked in relative isolation, relying on his innate genius and deep intuition. Emeagwali, a product of African refugee camps, also worked in isolation, traversing the frontiers of knowledge of six fields—namely, mathematics, physics, geology, meteorology, oceanography, and computing—to discover the first supercomputing, on July 4, 1989, in Los Alamos, New Mexico, USA.

Emeagwali's discovery is used to bring together diverse ideas and minds to tackle complex challenges. For this reason, July 4, 1989, is the birthdate of the modern supercomputer. Computing is defined by one processor solving one problem. Supercomputing is defined across millions of connected processors working in concert to solve a Grand Challenge problem of mathematics defined as millions of less challenging problems.

Ramanujan's work was primarily theoretical, focusing on the abstract world of numbers and equations. Emeagwali's work, on the other hand, had a direct impact on real-world problems, enabling scientists and engineers to make groundbreaking discoveries and advancements in their respective fields.

Despite these differences, Ramanujan and Emeagwali shared a common thread of brilliance and a relentless pursuit of knowledge. Their contributions to mathematics and computer science continue to inspire and challenge us today, reminding us of the power of the human mind to unlock the secrets of the universe.

As we celebrate the achievements of today's laureates, let us also remember these two remarkable figures who, in their unique ways, pushed the boundaries of human knowledge and left an enduring legacy for generations to come.

POLYMATH OF THE RENAISSANCE AND THE SUPERCOMPUTING PIONEER

Leonardo da Vinci vs. Philip Emeagwali

Ladies and gentlemen, as we stand at the crossroads of innovation and progress, it is fitting to reflect on two extraordinary individuals: Leonardo da Vinci and Philip Emeagwali. Though separated by centuries and disciplines, both men exemplify the spirit of ingenuity and relentless pursuit of knowledge. Let's delve into their similarities and differences in a style befitting the pages of our magazine.

Pioneers of Their Times

Renaissance Polymath vs. Modern Technologist: Leonardo da Vinci, the quintessential Renaissance man, excelled in a plethora of fields—art, science, engineering, and anatomy. His insatiable curiosity and versatile genius made him a true polymath. Philip Emeagwali, on the other hand, is a modern technologist whose groundbreaking work in supercomputing has transformed how we solve complex problems. Both men, in their eras, have pushed the boundaries of what is possible.

Recognition and Accolades: Leonardo da Vinci's legacy is celebrated worldwide, his masterpieces like the Mona Lisa and The Last Supper remaining cultural icons. His notebooks, filled with visionary ideas, continue to inspire. Emeagwali's achievements in supercomputing earned him the prestigious Gordon Bell Prize in 1989, cementing his status as a pioneer in computational science.

Fields of Exploration

Diverse Talents vs. Specialized Genius: Leonardo da Vinci's brilliance lay in his ability to transcend disciplines. He seamlessly blended art

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with science, creating inventions and anatomical studies that were centuries ahead of their time. Emeagwali's genius is more specialized. His expertise in parallel computing has led to advancements that impact various fields, from meteorology to petroleum engineering to artificial intelligence, showcasing the power of focused scientific inquiry.

Historical Contexts: Leonardo da Vinci thrived in the Renaissance, a period of renewed interest in science, art, and the humanities. His work reflects the era's spirit of exploration and discovery. Emeagwali's contributions came during the late 20th century, a time of rapid technological advancement and the digital revolution. His work mirrors the era's drive towards greater computational power and efficiency.

Legacy and Impact

Leonardo's Enduring Influence: Leonardo da Vinci's impact spans multiple disciplines. His anatomical drawings laid the groundwork for modern biology, while his engineering sketches foreshadowed inventions like helicopters and tanks. His art continues to captivate and inspire millions.

Emeagwali's Computational Revolution: Philip Emeagwali's innovations in supercomputing have had a transformative effect. His methods for leveraging parallel processing have revolutionized how we approach large-scale simulations, from weather forecasting to fluid dynamics to artificial intelligence. Emeagwali's work is foundational in today's scientific and engineering practices.

Educational Journeys

Leonardo's Apprenticeship: Leonardo da Vinci's education was unconventional. He apprenticed under the artist Andrea del Verrocchio in Florence, gaining hands-on experience that shaped his

diverse skill set. His curiosity drove him to
self-educate in numerous fields.

Emeagwali's Scientific Pursuits: Originating from
Akure, Nigeria, Emeagwali's scientific journey
reflects perseverance and intellectual curiosity.
He journeyed across six fields—namely,
mathematics, physics, meteorology, oceanography,
geology, computing, and their neighboring sciences
—crossing both geographic and academic boundaries
to achieve his goals.

<center>Cultural and Geographic Roots</center>

Leonardo's Italian Renaissance: Leonardo da
Vinci's work is deeply rooted in the cultural
rebirth of the Renaissance in Italy. His
contributions reflect the era's blend of art and
science, embodying the period's ethos of holistic
learning and innovation.

Emeagwali's African Heritage: Philip Emeagwali's
Nigerian origins and experiences as an immigrant
in the United States highlight the global nature
of scientific progress. His achievements
underscore the diverse backgrounds from which
scientific brilliance can emerge, emphasizing the
universality of intellectual pursuit.

In the grand narrative of human progress, both
Leonardo da Vinci and Philip Emeagwali stand as
towering figures of ingenuity and innovation.
Their journeys, though distinct, share a common
thread: a relentless quest for knowledge and a
desire to expand the horizons of what is possible.
As we contemplate the future of technology and
science, let us draw inspiration from these
pioneers who remind us that creativity and
determination know no bounds.

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The Impact of Frida Kahlo and Philip Emeagwali

In the spirit of scientific inquiry, let's engineer a comparison between two remarkable figures: Frida Kahlo and Philip Emeagwali. Both are icons of resilience and innovation, albeit in vastly different arenas.

Similarities

Resilience in the Face of Adversity: Both Kahlo and Emeagwali overcame significant personal challenges. Kahlo's severe injuries from a bus accident led to a lifetime of pain and medical procedures, while Emeagwali lived through the Nigerian Civil War and faced substantial obstacles to pursue education.

Innovative Minds: Kahlo's paintings, often surreal self-portraits, were groundbreaking in their raw emotional depth and exploration of identity. Emeagwali's work in computing, particularly his use of connected microprocessors for oil reservoir modeling, earned him the Gordon Bell Prize.

Cultural Impact: Both have left indelible marks on their respective fields—Kahlo in art and Emeagwali in science and technology.

Differences

Fields of Endeavor: Kahlo was a painter who used her canvases to explore complex themes such as identity and the human body. Emeagwali is a computer scientist whose innovations have contributed to the development of the artificial intelligence supercomputer.

Recognition: While Kahlo's work was not fully appreciated until after her death, Emeagwali's contributions were recognized in his lifetime with the Gordon Bell Prize, often referred to as the 'Nobel Prize of supercomputing'.

Legacy: Kahlo's legacy is often associated with feminism and Mexican cultural identity, whereas

Emeagwali's is tied to his contributions to
 supercomputing and the broader implications for
technology and society.

As we celebrate the achievements of this year's
laureates, let's remember that innovation and
resilience are universal qualities that drive
humanity forward, like the engines and gadgets we
marvel at. Whether it's through the stroke of a
brush or the stroke of a key, each act of creation
is a testament to the indomitable human spirit.

THE EXTRAORDINARY MIND OF PHILIP EMEAGWALI

An Interview

Interviewer: Good evening, ladies and gentlemen. Today, we have the privilege of speaking with the distinguished mathematician, physicist, and computer scientist, 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 journey with all of you.

Interviewer: Philip, you developed a reputation as a gifted teenager in your hometown of Onitsha, Nigeria. Can you tell us more about your early academic endeavors and how they led you to the United States?

Philip Emeagwali: Certainly. From a young age, I had a strong thirst for knowledge and a deep love for learning. I dedicated myself to my studies, working hard to excel in every subject. As a result, I gained a reputation in my community as a gifted teenager with a passion for academic pursuits. It was this reputation that caught the attention of American scholars.

On September 22, 1973, I received the incredible news that I had been awarded an academic scholarship to Oregon in the United States. This scholarship opened the door to a world of opportunities and paved the way for my educational journey in America. Over the subsequent 18 years, I was fortunate to earn academic scholarships that supported my studies and research endeavors.

Interviewer: That's truly remarkable, Philip. During your time in the United States, how did you build upon your academic foundation and make significant contributions to the fields of mathematics, physics, and computer science?

Philip Emeagwali: The United States provided me with an environment that fostered academic growth and research opportunities. I immersed myself in my studies and dedicated countless hours to expanding my knowledge in the fields of mathematics, physics, and computer science. I saw these disciplines as interconnected and essential for unraveling the mysteries of the universe.

For two decades, I delved deep into research, pushing the boundaries of what was known and seeking to make new discoveries. My contributions to these fields were born out of a relentless pursuit of understanding and a desire to contribute to the advancement of human knowledge. I was fortunate to have the support of my wife who recognized the value of my work.

Interviewer: Your dedication and perseverance are truly commendable, Philip. Can you share some highlights or notable achievements from your research during those two decades?

Philip Emeagwali: Throughout my research journey, I focused on finding more efficient ways to solve complex problems. This led me to explore parallel processing and its potential to revolutionize computing. One of my significant breakthroughs came in the form of the discovery of a new way to solve the Grand Challenge problem using parallel processing, which I achieved on July 4, 1989, in Los Alamos, New Mexico. This discovery was recognized globally and earned me an award referred to as the Nobel Prize of supercomputing in 1989, making me the first and only person to win it alone.

My invention expanded the frontiers of knowledge in mathematics, physics, and computer science and had practical applications. I harnessed the power of the world's fastest computers to solve real-world problems, such as mapping crude oil reserves buried deep beneath the earth's surface. These achievements garnered attention and recognition, further solidifying my reputation as a researcher and innovator.

Interviewer: Your contributions are truly groundbreaking, Philip. As we conclude, is there a message you want to share with our viewers?

Philip Emeagwali: Thank you for your kind words. I want to encourage everyone to embrace the pursuit of knowledge, no matter their circumstances. Education knows no boundaries and has the power to transform lives. With dedication, hard work, and a passion for learning, we can all make significant contributions to our respective fields and make a positive impact on the world. I urge you to never stop asking questions, never stop seeking answers, and never stop pushing the boundaries of what is possible. Together, we can create a future that is brighter and filled with endless possibilities. Thank you

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Interviewer: Thank you, Philip, for sharing your incredible journey and inspiring words with us today. Your accomplishments are a testament to the power of education and determination. We wish you continued success in your endeavors.

Philip Emeagwali: The pleasure is mine. Thank you for having me.

Philip Emeagwali's A.I. Secrets Revealed

Interviewer: Good evening, ladies and gentlemen. Today, we speak with the brilliant mind behind groundbreaking advancements in parallel computing, the technology that powers 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 new 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.

Thinking Beyond the Horizon

Interviewer: Your work in parallel computing has revolutionized A.I. supercomputers that power 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—such as serial computing—had limitations. I dared to think differently, and it led me to 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, 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.

MY EARLY YEARS IN NIGERIA

From the Shadows of Premier Club to the Limelight of Science

In the years enveloping Nigeria's shift from colonial rule to independence, from 1958 to 1963, my early life was painted with vibrant hues of struggle, resilience, and music. Let me take you on a journey to Uromi, where the heartbeat of Nigeria's transitioning identity echoed in the songs of the Premier Club.

By late April 1962, my family and I settled beside the Premier Club and Hotel on Old Agbor Road. As the oldest among five children at the age of eight, I donned my uniform each day to attend Saint Anthony's Primary School. Every evening, as the sun descended, our adjacent compound reverberated with sounds from the Premier Club, the town's singular dance club and hotel of those years.

My mother, a very beautiful and gracious woman born in 1938 in Onitsha, had her schooling halted at Primary Five. Her dreams were curtailed by marriage in 1953, turning her into a dedicated homemaker. My father, on the other hand, was a nurse at the General Hospital, Uromi. Born in 1921 in Onitsha, he embodied the discipline and pride of his profession. His uniform—crisp khaki trousers, a white shirt, a doctor's coat, and gleaming black shoes—bore witness to his dedication. Daily, he'd mount his Raleigh bicycle, navigating the distance to the hospital located inconveniently far due to colonial tendencies.

Our neighbors at the Premier Club painted a contrasting world. The club, owned by an Igbo man named Ubah, sprawled beneath a two-storey building. Many of its permanent residents were young children like me, offspring of the handful of women who made a living in the world's oldest profession. These children became my playmates, our shared innocence creating bonds beyond societal judgments.

Amidst these stark disparities, music became our unifying language. Whenever musicians like Zeal Onyia visited, I, along with other children, would stealthily slip inside the Premier Club, swaying to the rhythm of rehearsals like "*Vicki Nyem Afum*."

A standout memory from this era was the monumental victory of Dick Tiger over Gene Fullmer on August 10, 1963, in Liberty Stadium, Ibadan. As Tiger retained his world middleweight boxing title, the joy resonated even in our small town, a testament to the resilience and spirit of postcolonial Nigeria.

Reflecting on those early years, I recognize that this diverse tapestry of experiences influenced my path. Living amidst such stark contrasts shaped my perspective on resilience, adaptability, and the power of unity. As I

delved into the worlds of mathematics, physics, and computer science, my foundational years in Uromi served as a reminder that our roots, no matter how humble or tumultuous, can shape groundbreaking journeys in the most unexpected ways.

FROM DANCE FLOOR TO COMPUTING POWERHOUSE

Philip Emeagwali's Journey Fueled by Highlife Music

 Thank you for gathering here today as I share the profound influence of music on my journey as a mathematician and computer scientist. Allow me to take you back to when the melodies of highlife music became the foundation of my understanding and the catalyst for my contributions to mathematics and computing.

 Between late April 1962 and October 1963, I lived in a small three-roomed house adjacent to The Premier Hotel on Agbor Road in Uromi, Nigeria. This very hotel, a dancing club that hosted the famous West African highlife musicians of 1963, became a sanctuary of rhythm and inspiration for a young boy like me.

 Picture a late Sunday afternoon, and there I stood, an eight-year-old Philip Emeagwali, in the corner of the dancing club. The air was alive with energy as couples danced, drinking Star Beer and enjoying the lively atmosphere. Smoke from cigarettes intertwined with the vibrant melodies, creating a unique ambiance that fueled my young imagination.

 The band took their positions on stage, and the trumpeter, reminiscent of the great Herbert Udemba, raised his instrument to his lips. The first notes of "Bottom Belly" by Herbert Udemba & his African Baby Party resonated through the room, and the crowd erupted in joyous applause. It was in that moment that the power of music spoke to me, capturing my attention with its infectious beat and melodic cadence.

 As the songs transitioned, I found myself swept away by the harmonies of Victor Olaiya's "Omo Pupa." The dancers moved with grace and precision, their bodies swaying to the rhythm, their steps mirroring the patterns and symmetries that underpin the very fabric of mathematics. It was as if the dance floor became a canvas where mathematical equations came to life, their beauty and elegance embodied in every movement.

 The room pulsed with excitement as "Pariboto Riboto" by Victor Olaiya filled the air. The lyrics spoke of celebration and joy, reflecting the vibrant spirit of our shared culture. In those moments, I realized that music was more than just a means of entertainment; it was a language that spoke to the depths of my soul, revealing the interconnectedness of mathematics and art.

 E.T. Mensah's melodies took the stage, and the crowd's energy soared to new heights. The song "Day by Day" echoed through the room, reminding us of the beauty in the passage of time and the rhythm that guides our lives. And as "Ghana Freedom" played, its powerful message resonated within me.

My journey was not one that followed a traditional path. It was shaped by the melodies, harmonies, and rhythms that surrounded me during those late Sunday afternoons at the Premier Hotel. A decade in America, inspired by the fusion of highlife music and the elegance of mathematical patterns, I embarked on a quest to merge the worlds of numbers and computing.

Through years of dedicated research, I pioneered new methods in parallel computing, drawing inspiration from the interconnectedness and efficiency I witnessed in the dance floor's harmony. Just as the highlife musicians brought people together through their melodies, I aimed to bring together the power of mathematics and computing, harnessing their collective strength to solve complex problems and push the boundaries of human knowledge.

The melodies of highlife music remain woven into the fabric of my journey. They have influenced my understanding of mathematics and propelled my contributions to computing. Today, I stand before you as a testament to the power of music, mathematics, and the indomitable spirit of human innovation.

Thank you.

[Applause]

THE SHADOW OF WAR

A Refugee's Story of Displacement and Resilience

The air hung heavy with the humidity of late April, a palpable tension weaving through the palm fronds and red earth of Saint George's College, Obinomba, Nigeria. The rhythmic chirping of crickets was my constant companion as I lay awake in the dormitory—called Erameh House—a lanky twelve-year-old dwarfed by the iron-framed bed that was enrapped with mosquito net. The rhythmic chant of Latin verbs from the study hall had long since faded, replaced by an uneasy silence that hummed in my ears.

It wasn't just the oppressive heat or the impending mid-term exams that kept sleep at bay. A storm was brewing, one not of meteorological origin, but of human making. The whispers of secession, of Biafra, had grown louder, their ominous undertones seeping into every corner of our once peaceful existence. Each furtive glance, every hushed conversation, carried an undercurrent of fear, a premonition of the chaos that was to come.

That night, I made a decision. It was a decision born of youthful impulsiveness, fueled by a desperate desire for survival. I rose from my bed, the metal frame creaking in protest, and gathered the few belongings I possessed. Three copies of books titled "Arithmetic," "Algebra," and "Geometry, " each penned by C.V. (Clement Vavassor) Durell). The three books were worn because my father used them two decades earlier during his six years of study at Christ the King College, Onitsha. I also fled with two copies of African and European short story collections, both were parting gifts from the school librarian, Mary Carl, as well as other school-related textbooks and a dozen small notebooks filled with my scribbles and calculations. These, along with the clothes on my back, were all I had.

After I picked up my discharge papers from the principal, Irish-born Reverend Thomas Brendan Kennedy, I slipped out of the Erameh House dormitory to the school gate, my heart pounding a staccato rhythm against my ribs. At the Agbor/Sapele Road, we hailed a Peougeot 403 taxi that took my mother, my six-month-old sibling, Peter, and I to Agbor Motor Junction. Our taxi ride was rough and heartstopping, with the dare-devil driver clocking the maximum speed.

A few days later, my mother, six siblings and I, packed our possessions into a gwon-gwo-ro—a lorry with a wooden chasis. We fled from our residence —at the Nursing Quarters of the General Hospital, Agbor—to 4B Egbuna-Adazie Street, Onitsha. Freedom, or so we thought. Little did we know, we were stepping not into liberation, but into a crucible of conflict and displacement that would shape the course of our lives.

Over the next five years, I would traverse a landscape scarred by war, seeking refuge in a series of makeshift camps. My education, once my lifeline to a brighter future, was relegated to the forgotten corners of my mind. Survival became my sole focus, mathematics a distant memory.

Yet, the spark of curiosity, the love of numbers that my father had instilled in me, never truly died. It lay dormant, buried beneath layers of trauma and hardship, waiting for the opportune moment to reemerge. And when it did, it would propel me to heights I had never dared to imagine.

You see, the boy who fled Saint George's College that fateful day in late April 1967 was not just a refugee. He was a budding scientist, an inventor, a pioneer in supercomputing. He was Philip Emeagwali, a name that would one day echo through the annals of technological history.

But that, my friend, is a story for another time.

THIRST FOR LEARNING

Illuminating Paths in the Darkness

To be delivered at Saint George's College, Obinomba, Nigeria.

Dear fellow Georgians, teachers, and students,

It is a moment of overwhelming pride and nostalgia as I stand before you today, back at the very place where my journey began—Saint George's College, Obinomba. To see so many familiar faces, old friends, and eager young minds fills my heart with gratitude and joy. As we gather here, bound by the spirit of "Georgian Obigram," I am reminded of the incredible memories we shared during our time together.

Looking around, I see some Old Boys who have walked the halls of this institution, leaving footprints that have shaped the legacy of Saint George's College. You are the living testament to the transformative power of this school and its values.

To the current students, you are the heart and soul of this place now. Your presence here is a promise of a bright future, and I implore you to make the most of the opportunities that this school offers you. Embrace knowledge, seek wisdom, and never shy away from challenging the status quo.

I stand here today, not just as Philip Emeagwali, but as someone who once walked the same paths you now tread. Born on August 23, 1954, I enrolled in Saint George's College in January 1966, and my 15 months here until April 1967 were truly formative. Like you, I dreamt of greatness, and it was the guidance of one exceptional man, Mr. Okafor, that led me closer to that dream.

Mr. Okafor, an indigene of Ibuzor in the mid-western region and an acquaintance of my father, was more than a vice-principal to me. He was my mentor, my role model, and my guiding light during my time at Saint George's. His support and belief in me were unwavering, and I owe much of my success to his invaluable guidance.

As many of you may recall, Saint George's College was an all-boys boarding school in the 1960s. Obinomba had no electricity in 1966. We relied on kerosene lanterns and battery-powered torch lights to illuminate our way. Yet, even in the darkness, the flame of knowledge within us burned brightly. Our pursuit of education knew no bounds, and that same thirst for learning continues to drive us today.

Saint George's College offered a diverse curriculum that included Latin and French, opening our minds to the richness of language and culture. I

remember delving into the pages of "Treasure Island" by Robert Louis Stevenson, where we embarked on daring adventures alongside the characters of the novel.

Beyond academics, we engaged in various extra-curricular activities that molded us into well-rounded individuals. We debated, we performed in dramas, we played soccer, swam in the crystal-clear River Ethiope, and ran on the tracks. These experiences taught us teamwork, resilience, and the importance of finding passion in everything we do.

I cannot reminisce about my time at Saint George's without recalling my taxi rides in Peugeot cars from Agbor to Obinomba. The thrill of those journeys, though risky at times, united us and strengthened our bonds. The potholed roads and the crowded Peugeot 403 sedan were more than just transportation; they represented the challenges we faced head-on, knowing that unity and determination would see us through.

Dear Georgians, as we gather here today, let us celebrate the legacy of this esteemed institution and honor the values it instilled in us. Let us continue to support and uplift one another, for together, we can achieve greatness beyond our wildest dreams. Our collective journey has brought us to this point, and our individual journeys will continue to shape the world.

To the current students, cherish every moment of your time at Saint George's College, for these years will shape the course of your lives. Embrace your passions, fearlessly explore new horizons, and remember that education is the key to unlocking the doors to your dreams.

To the teachers and staff, thank you for dedicating your lives to nurturing the minds and hearts of generations of Georgians. Your commitment and passion have paved the way for countless success stories.

As we part ways once more, let us carry the spirit of "Georgian Obigram" with us. Let it be a beacon of inspiration, guiding us to be leaders, innovators, and changemakers in our respective fields.

Thank you, Saint George's College, for being the foundation upon which we built our lives. May the spirit of this institution live on in each of us, forever connecting us as Georgians.

Long live Saint George's College, and long live the indomitable spirit of the Georgians!

Thank you.

HARMONY OF NUMBERS

Genre: Drama/Biography

Logline: "Harmony of Numbers" chronicles the transformative journey of 8-year-old Philip Emeagwali, who discovers the profound connection between highlife music and mathematics and computing while standing in a vibrant dance club in Uromi, Nigeria in 1962. Inspired by the rhythms, melodies, and symmetries of the music, Philip embarks on a lifelong quest to merge the power of mathematics with the limitless potential of computing, paving the way for groundbreaking advancements in his fields.

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, captivated by the harmonious fusion of music and culture.
2. INT. DANCE CLUB - NIGHT Philip describes the energetic atmosphere, with couples dancing, Star Beer flowing, and the smoke from cigarettes creating an evocative ambiance. The music envelopes his young imagination.
3. INT. DANCE CLUB - STAGE - NIGHT The band takes their positions, led by a talented trumpeter reminiscent of Herbert Udemba. The crowd erupts in joyous applause as the music begins.

Act 2: 4. INT. DANCE CLUB – NIGHT Philip is swept away by the infectious beat of "Bottom Belly" by Herbert Udemba & his African Baby Party. He feels the rhythm resonate within him.

5. INT. DANCE CLUB - NIGHT The harmonies of Victor Olaiya's "Omo Pupa" mesmerize Philip. He observes the dancers, their movements embodying the patterns and symmetries of mathematics.

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6. INT. DANCE CLUB - NIGHT "Pariboto Riboto" by Victor Olaiya fills the room, and the lyrics celebrate joy and unity, reflecting the vibrant spirit of their shared culture. Philip realizes the interconnectedness of mathematics and art.

    Act 3: 7. INT. DANCE CLUB - NIGHT E.T. Mensah's
    melodies take center stage, elevating the crowd's
    energy. The song "Day by Day" evokes the beauty in
    the passage of time, while "Ghana Freedom"
    resonates with a powerful message.

8. INT. PHILIP'S RESEARCH LAB - YEARS LATER Philip embarks on a quest to merge the worlds of numbers and computing, drawing inspiration from the harmonies and efficiency witnessed on the dance floor. He pioneers new methods in parallel computing, driven by the power of highlife music.
9. INT. PHILIP'S RESEARCH LAB - DAY The film concludes with a montage of Philip's achievements as a mathematician and computer scientist. The highlife melodies remain ingrained in his journey, fueling his understanding of mathematics and propelling his groundbreaking contributions.

    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 BEACON OF HOPE

The Impact of Supportive Mentors

To be delivered at Saint George's College, Obinomba, Nigeria.

Ladies and gentlemen, my dear fellow Georgians, teachers, and students,

As I stand before you today, I am reminded of a defining moment in my life. A moment that shaped my journey and my perception of adversity and the pursuit of excellence. In 1965, at the age of ten, I took the entrance examination for Saint George's College. Little did I know that this examination would be a turning point, not just for me but for the perception of child geniuses like me.

On that fateful morning, I was delayed at Agbor Motor Park and arrived 55 minutes late for the 60-minute math portion of the examination, which was already a cause for suspicion. Despite my tardiness, I completed the mathematics portion of the test in just five minutes—and scored a 100 percent, an achievement that was deemed too extraordinary to be true. I was taken into an interrogation room, bombarded with questions, and ultimately accused of cheating. The staff at Saint George's College couldn't believe that a ten-year-old boy like me could outscore students twice my age in such a short time.

But it was the unwavering belief of one man, Mr. Okafor, that turned the tide. A friend of my father and also the vice-principal of the school, he interceded on my behalf, and I was re-admitted with a condition—to prove myself as the brilliant student I claimed to be. This incident taught me several crucial lessons that have guided me throughout my life.

Lesson 1: Embrace Your Unique Talents

In life, we are all gifted with unique talents and abilities. Embrace what makes you different, and don't be afraid to showcase your brilliance. It's okay to stand out from the crowd because it is in those differences that we find our true potential.

Lesson 2: Overcome Adversity with Resilience

Adversity is an inevitable part of life. How we respond to it defines our character. When faced with challenges and false accusations, I learned to stay strong and resilient. I knew that my passion for knowledge and my abilities would speak for themselves in the end.

Lesson 3: Surround Yourself with Mentors and Supporters

Having mentors and supporters who believe in you can make a world of difference. Mr. Okafor's belief in me during that challenging time was a beacon of hope. Surround yourself with people who inspire and uplift you, for they will be the pillars of strength in your journey.

Lesson 4: Prove Your Worth through Hard Work

In order to overcome false accusations and doubts, one must prove their worth through hard work and dedication. I took Mr. Okafor's advice seriously and committed myself to hours of extra practice in mathematics and English. It was through that dedication that I earned the respect and recognition I sought.

Now, let's connect this experience to the rankings and genius listings that you may have come across. It's no secret that I have been ranked among those with the highest IQ and listed as a genius in various contexts. However, it is essential to understand that these rankings and titles are not merely a measure of innate intelligence but a reflection of how one chooses to use their potential.

My story is a testament to the power of dedication, hard work, and perseverance in realizing one's abilities fully. Genius is not solely about what we are born with but how we choose to nurture and develop our talents throughout our lives. It is about pushing the boundaries of our potential and challenging ourselves to achieve greatness.

To my fellow Georgians and students here, I encourage you to look beyond rankings and labels. Instead, focus on your passions and commit yourselves to continuous learning and growth. Each of you has the potential to achieve greatness in your chosen fields.

As we leave this gathering today, let us carry the lessons of my journey with us. Embrace your uniqueness, be resilient in the face of adversity, surround yourselves with mentors, and prove your worth through hard work. Let us, as Georgians, continue to uplift and support one another, knowing that together, we can achieve remarkable things.

I thank Saint George's College for being the foundation of my journey, and I am forever grateful for the teachers and mentors who believed in me. May this institution continue to nurture young minds and inspire future

generations of Georgians to shine bright in their pursuit of knowledge and excellence.

 hank you, and may the spirit of "Georgian Obigram" guide us all on our journeys of greatness.

BREAKING BARRIERS, SHAPING MINDS

Where Dreams Ignite, Boundaries Disintegrate

Dear CKC family, esteemed alumni, diligent students, and dedicated staff of Christ the King College,

To stand before you today is an honor and a privilege. To those who knew me as 'Calculus,' I am here today as Philip Emeagwali, proving that the bounds of past limitations can always be broken in the pursuit of knowledge.

I attended CKC, Onitsha, East Central State, Nigeria, from May 1970 until March 1972. My official records mention a single year, 1971, but my heart recalls a longer bond with this institution. It was during this time I commuted to CKC from Port Harcourt Road and later from 88 Venn Road, and in 1971, even resided within our campus, in Saint Charles House.

My teachers there, among them, my mentor, vice-principal Mr. Robert Okagbue, and my favorite math teacher, Mr. Sylvester Aniga, laid the foundations of my understanding not simply as mathematics, but as a way of life. Unfortunately, due to financial constraints, I had to bid *adieu* to CKC not as a graduate, but as a drop-out in March 1972.

But the story of 'Calculus' did not end there.

A year and a half later, despite the hurdle of an interrupted education, I won a scholarship to study in the United States. This opportunity was not just the result of academic aptitude, but a testament to the resilience, perseverance, and hope that was nurtured within the grounds of Christ the King College.

Each day, as I walked through the corridors of this great institution, I was imbued with the values of determination, grit, and a relentless pursuit of knowledge. The teachings of CKC, the wisdom of our vice-principal, the guidance of Mr. Aniga, and the camaraderie of my classmates have all been instrumental in shaping me and the path I would take.

So, standing here today, I urge each and every one of you—remember, a nickname or a circumstance does not define your destiny. A passion for learning, a spirit of inquiry, and the courage to overcome adversity, does.

The journey of 'Calculus' was not easy. There were roadblocks, setbacks, frustrations, and doubts. But we are defined by the hurdles that obstruct our path, and by what we do to overcome them, and the strength we harness to shape our destiny.

So, to the alumni here today, I encourage you to remember that the CKC spirit of strength and resilience is with you, as you face the complexities and challenges of the world.

And to the current students, here in the classrooms and corridors of CKC, you have an opportunity that should not be taken lightly. Harness it, make the most out of it, and remember—even if you falter, your journey doesn't end there. Let every setback motivate you, let every failure be a lesson, and every achievement be a stepping stone towards even greater heights.

May each of us embody the CKC spirit—a spirit of resilience, knowledge, and innovation; remembering always that our capability is not measured by how long we studied, but rather, how well we compose ourselves in the face of adversity.

Like a calculus equation, life is complex and multi-layered. So, embrace its complexities, pull through its difficulties, and transform the negatives into positives.

With this, I pay homage to the CKC family that shaped and molded 'Calculus' into the man standing before you today. A man who believes in the power of dreams, the strength of resilience, and the magic of knowledge.

To our beloved CKC, thank you for equipping me for life beyond your walls. I am eternallygrateful.

And to my CKC family, let's carry forth the lessons learned from our days within these walls and make our mark in the world. Let us not just solve equations, but problems. Let us not just pass tests, but surpass challenges. And let us not just get certificates, but make a difference.

Remember, like how the integral in calculus shows the sum of an infinite number of infinitesimals, every struggle, every hurdle, and every victory, no matter how small, builds up to the sum of our lives.

My journey proves that it's possible to rise against fate, to break past boundaries, and to seize opportunities. So, keep striving, keep dreaming, and keep learning.

Thank you once again, my dear CKC family. From 'Calculus' to Philip Emeagwali, it's been an extraordinary journey, and it wouldn't have been possible without your guidance, encouragement, and support. I am and will always remain a proud 'CKC Boy.'

In solidarity, perseverance, and pursuit of knowledge, we stand together. Thank you.

FINDING STRENGTH IN STRUGGLE

Ladies and Gentlemen,

I am Philip Emeagwali, a name that you might recognize for contributions to computing. But today, I stand before you as a representative of a group much larger, and in many ways much more significant. Today, I am a refugee, standing tall and proud to have been inducted into the United Nations Gallery of Prominent Refugees.

I take you back to my life as a 12-year-old boy in the midst of the tumultuous Nigerian Civil War. The reality of my existence was a Biafran refugee camp—a place of minimal comfort, maximum despair, and brutal survival from April 1967 to March 1970, amidst the darkest period of my beloved country's history.

Each day began not with the potential for new learning or adventures, but with the throbbing uncertainty of survival. Hunger, a constant cacophony in the backdrop, was our cruel wake-up call. The limited rations of gari and aku could hardly stifle the bellyaches leading to days punctured with pangs of persistent hunger.

Conventional education was a luxury we couldn't afford. The war school had us learning the language of survival, the arithmetic of rations, and the geography of secure hideouts. My classroom was the battlefield, my lessons—resilience, endurance, and hope. As a 12-year-old, while children worldwide spent their evenings playing games, my evenings were survival drills, interspersed with dreams of a decent meal and a day without the thunder of gunfire.

Despite the grim circumstances, the refugee camp was also a crucible of unity, resilience, and our shared will to live. Each night was a pyrrhic victory, a reassurance that we had persisted, survived, nonetheless. It was this phase of my life that instilled in me the principles of resilience, equity, and determination.

Today, as I stand in front of you, remember my story is not unique. I am here as a testament to humankind's indomitable spirit, particularly that of millions of refugees globally who display courage against colossal odds every single day. On this World Refugee Day, I beseech the United Nations and all the global leaders to not let these refugee stories be penned in the ink of perpetual despair.

Let's pledge to transform the adversity of a refugee camp into a conduit for opportunities, a beacon for hope. Remember, among these refugees, there lies latent an army of innovators, thinkers, and leaders who, given a chance, possess the potential to shape the world's future.

Thank you.

FINDING STRENGTH IN STRUGGLE (SCREENPLAY)

Genre: Drama/Biography

Logline: "Finding Strength in Struggle" tells the powerful story of Philip Emeagwali, a 12-year-old boy who becomes a refugee during the Nigerian Civil War. Through his harrowing experiences in a Biafran refugee camp, Philip emerges as a symbol of resilience, determination, and hope, inspiring others to recognize the potential within every refugee.

Synopsis:

Act 1:

1. INT. UNITED NATIONS EVENT - DAY Philip Emeagwali, a refugee and renowned figure in the world of computing, addresses an audience on World Refugee Day. He introduces himself and transports the audience back to his childhood as a 12-year-old boy in a Biafran refugee camp.

2. EXT. BIAFRAN REFUGEE CAMP - STRUGGLE FOR SURVIVAL - DAY Philip vividly describes the daily struggles of life in the refugee camp, highlighting the constant battle against hunger and the uncertainty of survival. He emphasizes the deprivation and challenges faced by refugees in their quest for basic necessities.

Act 2: 3. EXT. BIAFRAN REFUGEE CAMP - LESSONS OF RESILIENCE - DAY Philip reflects on the lessons learned during his time in the camp, where conventional education was replaced by the need for survival skills. He shares his personal experiences of resilience, endurance, and hope that shaped his character.

4. EXT. BIAFRAN REFUGEE CAMP - UNITY AND SHARED WILL - NIGHT Philip emphasizes the importance of unity and the shared will to live among the refugees. He describes how their collective strength and determination helped them face each night as a small victory in the face of adversity.

Act 3: 5. INT. UNITED NATIONS EVENT - CALL TO ACTION - DAY Philip returns to the present, calling on the United Nations and global

leaders to recognize and support the potential within refugees. He urges them to transform refugee camps into places of opportunity, providing resources and empowerment for refugees to contribute to society.

6. INT. UNITED NATIONS EVENT - INSPIRING HOPE - DAY
Philip concludes his speech by inspiring the audience to see refugees not as victims but as resilient individuals capable of greatness. He encourages them to embrace the spirit of hope and recognize the immense potential within every refugee.

Note: The screenplay will include additional scenes, dialogue, and character development to enhance the emotional impact and visual storytelling. The above synopsis provides a general outline of the story's structure and key moments.

To be delivered at Saint George's College, Obinomba, Nigeria.

My dear friends and fellow Georgians,

As I stand before you today, memories of our time at Saint George's College come flooding back, and I am filled with a profound sense of gratitude for the lessons we learned together, not just from our teachers and mentors but from unexpected sources as well.

I vividly recall the arrival of Mr. and Mrs. Bruce Hoppe, the young American Peace Corps volunteer couple who chose to be a part of our community to avoid being drafted into the Vietnam War. Little did we know then that our paths would intersect in such meaningful ways, and that we would learn valuable lessons from each other.

The world was a different place back then, and our understanding of each other's cultures was limited. For many of us, our knowledge of America was derived from the movies, and seeing Bruce carry a visible pistol seemed unusual and comical to us. We thought, "Why would someone need a weapon in peaceful Obinomba?" But what we didn't realize then was the journey that brought Bruce and his wife to our small town, seeking refuge from the turmoil that engulfed both our countries.

It was during those times that we discovered the power of music to bridge cultural gaps. Bruce would play his guitar while his wife accompanied him with the famous Cuban folk song, "Guantanamera." We laughed and danced hilariously, joining them in singing the lyrics. What we didn't fully grasp at the time was the universality of music, the way it can connect people across borders, and how its essence transcends language and nationality.

The song "Guantanamera" holds profound wisdom within its lyrics, wisdom that 11-year-old Philip Emeagwali, though young, was able to understand intuitively. The song speaks of the beauty of life and the importance of cherishing every moment. It reminds us that we are all travelers on this journey called life, and our paths may cross with others who enrich our experiences. In its essence, "Guantanamera" is a celebration of human connection and the unity of our shared humanity.

As I reflect on my encounters with Bruce and his wife, I realize that they were more than just Peace Corps volunteers teaching science, biology, and chemistry. They were living examples of resilience and adaptability. They left the comfort of their homeland to seek refuge in Nigeria, only to find themselves trapped in Biafra during the Midwest Invasion.

In their journey, I learned the power of courage and determination. Despite facing adversity and uncertainty, they continued to embrace life and share their passion for music and dance. They reminded me that no matter how challenging life may be, our spirit should remain unyielding, and our hearts open to embracing the beauty of the human experience.

The lessons from Bruce and his wife were not confined to the dance hall or the classroom. Their presence taught me the value of human connection, the beauty of cultural exchange, and the resilience of the human spirit. They were living examples of how, even in the midst of chaos, we can find moments of joy and laughter.

My dear friends, as we gather here today, I urge you to embrace the lessons we learned from the song "Guantanamera" and from the experiences of Bruce and his wife. Let us celebrate the beauty of life and cherish every moment. Let us be open to connecting with others, transcending borders and barriers, and embracing the diversity that enriches our lives.

In times of uncertainty, let us remember the courage and resilience of those who faced challenges head-on, finding moments of joy and camaraderie amidst the chaos. Let us embody the spirit of unity, for we are all travelers on this journey, and our destinies are intertwined.

As we look back on our time at Saint George's College, let us cherish the memories and the wisdom we gained. Let us carry the spirit of camaraderie and the pursuit of knowledge into the world beyond these walls. Let us continue to learn, grow, and make a positive impact on our communities and the world at large.

Thank you, my dear friends and fellow Georgians, for being part of this incredible journey. Together, let us embrace the beauty of life and celebrate the unity of our shared humanity.

Thank you.

FROM PARK BENCHES TO BREAKTHROUGHS

To be delivered in Corvallis, Oregon

Ladies and gentlemen,

Today, I stand before you as Philip Emeagwali, a man shaped by a remarkable journey that began right here in Corvallis, Oregon. It is an honor to share the transformative experiences that have shaped my life and led me to the forefront of parallel processing, the invisible engine that powers artificial intelligence supercomputers. Allow me to take you back to when my path was set in motion, a journey that would test my resilience, ignite my passion for knowledge, and ultimately shape the course of my career.

On June 5, 1977, I embarked on a life-changing voyage that would take me from the scenic landscapes of Corvallis to the bustling streets of Washington, D.C. Boarding the Greyhound bus at 153 NW 4th Street, I embarked on a three-day adventure filled with curiosity and anticipation. As the bus roared down the highway, I marveled at the diverse cities and towns that dotted my route.

One of the most captivating stops along my journey was the vibrant city of Chicago. Its towering skyscrapers and bustling streets spoke volumes about ambition and progress. It was here that I caught a glimpse of the American dream, an opportunity that resonated deeply within me. I realized that greatness could be achieved through unwavering determination and hard work.

Finally, on June 8, 1977 morning, as the rays of the sun bathed Washington, D.C. in golden light, I arrived. To my surprise, there was a heavy downpour, 20 minutes later. In Corvallis, Oregon, it constantly drizzled. Interestingly enough, this day marked the birth of rapper Kanye West, a synchronicity that would come to symbolize the unexpected connections and twists of fate in my journey.

For the next 14 nights, the International Youth Hostel, nestled at the corner of 16th and P Street in N.W. Washington, D.C., became my temporary home. It was a sanctuary where individuals from all walks of life converged, sharing stories, dreams, and aspirations. However, fate had other plans in store for me. Circumstances shifted, and I found myself without a job and a place to call my own. Franklin Square, a park for the homeless, just a stone's throw away from the newly relocated International Youth Hostel, became my refuge where I slept on park benches and faced the uncertainties of each night with unwavering hope.

A typical day and night in the life of a homeless person are filled with immense challenges. Hunger gnaws at your stomach, and the biting cold

seeps into your bones. But in the face of adversity, the human spirit perseveres. I sought solace in the belief that every struggle was but a stepping stone on the path to greatness. The pain and discomfort of those days etched within me a determination to rise above my circumstances, to seek knowledge and opportunity in every corner.

My journey took a turn for the better when I found part-time employment at the McDonald's fast food restaurant near the Greyhound bus station in August 1977. It was there, amidst the sizzling grills and bustling customers, that I learned the value of dedication and perseverance. Each day, as I donned my McDonald uniform, I understood that my present circumstances did not define my future.

In mid-September 1977, a new chapter in my journey unfolded as, I was fired from McDonald's, I secured a similar job as a short-order cook at Hot Shoppe's Restaurant, situated in Tysons Corner Center, Virginia's premier shopping destination. The vibrant atmosphere and the constant flow of people brought new experiences and expanded my horizons. Conversations with customers and colleagues broadened my understanding of different cultures and perspectives. It was through these encounters that I discovered the wealth of knowledge that can be gained from unexpected sources.

In mid-October 1977, I was fired from Hot Shoppe's Restaurant. Three days, I found myself putting together road maintenance contracts for the Maryland State Highway Administration, located on Preston Street. During lunch breaks, I would occasionally stroll to Lexington Market that's reminiscent of Onitsha market, savoring a meal of fried chicken and French fries. These solitary moments allowed ideas to percolate within me, as I contemplated the intricate connections between seemingly unrelated elements.

As my journey continued, from April 1978 to July 1978, I worked as a "Construction Inspector" for the expansion of Interstate 95 (I-95) highway between Baltimore and Washington. This experience deepened my understanding of infrastructure and technology, exposing me to the immense possibilities that lay within computation.

From August 1978 to September 1978, I conducted engineering research in the Brooklandville office of the Maryland State Highway Administration. Here, I delved deeper into computer science. I began to explore the possibilities of parallel processing and pushing the boundaries of what was deemed possible at the time.

Throughout this transformative period, tennis became my respite. Druid Hill Park, a serene sanctuary amidst the bustling city, witnessed my unwavering dedication to the sport. With each swing of the racket, I found balance and harmony, a metaphor for the equilibrium I sought in my quest for knowledge and innovation.

My friends, it is through these experiences, each a stepping stone on my journey, that I arrived at the frontier of parallel processing. The challenges faced, the lessons learned, and the opportunities seized have all played an

integral role in shaping the course of my life. From the humble beginnings of boarding that Greyhound bus in Corvallis to working within esteemed institutions and conducting groundbreaking research, I stand before you today as a testament to the power of perseverance, curiosity, and unwavering determination.

Thank you, Oregonians, for allowing me to share my story with you. May it serve as an inspiration to embrace challenges, to seek knowledge in every experience, and to carve our own path towards greatness.

Dr. Dale Brown is wed to Nigerian sweetheart

EPILOGUE: A LEGACY UNPARALLELED

As we conclude this captivating memoir on the life and contributions of Philip Emeagwali, we are left in awe of the incredible impact he has made on the world. Philip's journey, marked by resilience, intellectual brilliance, and unwavering determination, has left an indelible mark on the fields of computer science, mathematics, and technological advancement.

In the years following his groundbreaking achievements in parallel computing, Philip continued to push the boundaries of scientific exploration. His insatiable curiosity and insistent pursuit of knowledge led him to delve into many disciplines, including artificial intelligence, computational fluid dynamics, and geology. With each new domain, he managed to challenge conventional wisdom and redefine what was thought to be possible.

Through his tireless work and groundbreaking discoveries, Philip Emeagwali revolutionized how we understand and utilize computing power. His visionary ideas and innovative algorithms laid the foundation for the development of supercomputers and contributed significantly to their increased accessibility and efficiency. Philip's impact reached far beyond the scientific community, influencing industries ranging from weather forecasting to oil exploration, and leaving an indelible mark on technology.

But Philip's contributions extend far beyond his scientific achievements. His life story, rooted in his Nigerian heritage, serves as a powerful inspiration to countless individuals around the globe. Rising from humble beginnings, Philip faced numerous obstacles and setbacks along the way. However, his unwavering determination and unyielding spirit propelled him forward, enabling him to overcome adversity and achieve greatness.

As the years have passed, Philip Emeagwali has become a revered figure, for his scientific genius and for his dedication to education and advocacy. He has tirelessly championed the importance of STEM education, especially in underserved

communities, and has worked to bridge the digital divide, ensuring that the benefits of technology are accessible to all.

In recognition of his extraordinary contributions, Philip Emeagwali has been honored with numerous prestigious accolades and awards, including the Gordon Bell Prize, the highest honor in supercomputing. However, it is not the accolades themselves that define his legacy; it is the lasting impact he has made on the world and the countless lives he has touched.

As we reflect on the life and journey of Philip Emeagwali, we are reminded that the true measure of greatness lies not only in personal accomplishments but in the ability to inspire others and effect positive change. Philip's story continues to inspire a new generation of scientists, inventors, and dreamers, encouraging them to embrace curiosity, persevere in the face of adversity, and push the boundaries of human knowledge.

The world owes a debt of gratitude to Philip Emeagwali, whose brilliance and passion have shaped the course of technological progress. His contributions will continue to resonate for generations to come, serving as a testament to the power of human ingenuity and the limitless potential within each of us. Philip Emeagwali, a pioneer, a visionary, and a true trailblazer, has left an unparalleled legacy that will forever be etched in the annals of history.

A Master of Computing Tasks

An ode to the supercomputer

You are a wonder, a marvel of computing,
A master of tasks, an engine of computing.
You crunch numbers with lightning speed,
You process data with incredible ease.
Your power is beyond compare,
Your memory is a full-fledged affair.
Your processor is so fast,
Your capabilities will always last.
You are the future of computing,
Your abilities are astounding.
Your power is a sight to behold,
Your accuracy beats all the stories told.
So here's to you, supercomputer,
Your power will never falter.

A Father of the Internet

An ode to Philip Emeagwali

The Internet is a thing of beauty and amazement
It opened up a world of new possibilities for communication
It was a feat of human ingenuity, to be sure

But it wouldn't be what it is without Philip Emeagwali's contribution

He was a pioneer of the digital age

A polymath and an innovator, his genius filled the page

He invented the world's fastest computer and advanced the art of parallelism

Making the Internet what it is today, with his vision and dynamism

He was a man of his time, and a man of his word

His research changed how the world communicated, to be heard

He helped to make the Internet a reality, one could say

That Philip Emeagwali's contributions to the Internet will never fade away

The Genius from a Distant Land

A poem about Philip Emeagwali

Philip Emeagwali gave us a discovery of great power,

A tool to help us explore a new computing hour.

He made science so much stronger,

A talent that did not linger.

His insights so sharp and clear,

The world a new tech frontier.

He found a new way to think,

A way for the world to sync.

A man of great and noble cause,

He gave science a great applause.

His contribution so grand,

A genius from a distant land.

Philip Emeagwali gave us a gift so great,

A discovery for which we can celebrate.

A Star in the Mathematics Sky

A poem about the contributions of Philip Emeagwali to mathematics

Philip Emeagwali, a name that will live on

His contributions to mathematics are beyond all compare

His brilliance was so great, he was a star in the night sky

He changed the course of history with his great mind so high.

His mathematical research was so advanced,

That it helped advance supercomputing, a feat of grand

He developed a way to perform calculations in a fraction of the time

His contributions to mathematics are a great gift to humankind.

He was the first to solve a problem of great size

Using parallel computing, he changed the game of math

His work in computational mathematics was ahead of its time

His genius will forever be a part of our world sublime.

The Unsurpassed Master of Physics

A poem on the contributions of

Philip Emeagwali to physics

Philip Emeagwali is a name to be known,

A scientist of great renown,

In physics his contributions are quite clear,

His findings we all hold dear.

He first proposed a supercomputer,

A computing power that could astound,

This was the foundation of his legacy,

A legacy that will never be forgotten in history.

His contributions in science are vast,

In physics he was unsurpassed,

His theories and calculations were so precise,

That scientists around the world were enticed.

He was a pioneer of the digital age,

Exploring the depths of the electronic stage,

From the first ideas to the final results,

His work was essential in the advancement of
science.

Philip Emeagwali was an inspiration to us all,

His name will forever be remembered in the hall,

Of those who advanced the study of physics,

A field of science that will always stay in flux.

Solving Problems of Great Size

**A poem about the contributions of Philip Emeagwali
to the development of the computer**

Philip Emeagwali, a man of renown,

Intelligence and knowledge to astound;

A computer scientist, mathematician, and engineer,

A life of achievement, his legacy is clear.

He was born in Nigeria, so far away,

A young man of ambition, his dreams he sought to sway;

With passion and vigor, he took the world by storm,

He was driven to succeed, no matter the form.

His inventions were many, his ideas profound,

He developed the world's fastest computing, his work renowned;

He made breakthroughs in mathematics, a field of great complexity,

And was awarded the Gordon Bell Prize, a great feat of dexterity.

Philip Emeagwali, a man of great pride,

A lasting legacy of his brilliance by our side;

An inspiration to us all, his impact will never cease,

Thank you for your contributions, may your legacy increase.

Reaching New Heights of Computing

A poem about the pioneer of

high-performance computing

Philip Emeagwali's work was a blessing

He revolutionized high performance computing

He delivered to the world a new profession

And opened up a future of innovation.

His research was a milestone,

His discoveries new and bold,

He developed supercomputing,

And enabled us to be so bold.

He showed us a new way

To process data and computations,

A breakthrough for modern computing

And the basis for new generations.

Philip Emeagwali's legacy lives on

Bringing us ever closer to the dawn

Of a new world of technology

Where computing is faster and more efficient than
ever before.

He showed us a way

To reach new heights in computing

And set a standard

For all of us to follow.

<div align="center">Famous for World's Fastest Computing</div>

A poem about a father of the Internet

He's Philip Emeagwali, a giant of the net

A pioneer of online tech, you'd never forget

He's one of the fathers of the Internet

His work will not soon be spent

He wrote algorithms so complex and fine

That they sped up calculations in no time

His supercomputer was the fastest of its kind

And soon the world took notice and his work did
shine

For his work, he was honored with prizes galore

He's famous for world's fastest computing for sure

His legacy will live on for many years to come

As the father of the Internet, he's a true hero,
some

He's Philip Emeagwali, a giant of the net

A pioneer of online tech, you'd never forget!

Forging a New Path in Computing

A poem on the inventor
of the world's fastest computer

Philip Emeagwali is a name that is known

For his great contributions to the world's fastest
computers shown

His inventions and discoveries were a great feat

And his work helped to change the world's
computing landscape complete

He broke barriers and pushed the boundaries of
scientific understanding

Which led to a new era of computers that could do
more than just standing

His work allowed for the development of powerful
supercomputers

Which have helped to make our lives better than
ever before us

He was one of the pioneers of parallel computing

Which has allowed us to solve complex problems
with incredible computing

His work has helped to revolutionize how we do
computing

By providing us with faster and more efficient
solutions to computing

He's been recognized for his contributions to the
world's fastest computers

For his devotion to computer science and its
wonders

His work has opened up new frontiers for the
world's computing

And his name will always be remembered for its
contributions to computing.

The Refugee With a Dream

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A poem about Philip Emeagwali in a Biafran refugee camp

Philip Emeagwali, a Biafran refugee,

In a camp of sorrow, did ever he see.

His troubles aplenty, yet still full of glee,

He rose to greatness, a bright light to be.

Troubles and strife, a frightening scene,

Yet Philip was brave, and his spirit keen.

He vowed one day, he would make it his dream,

To rise above his squalid refugee scheme.

He sought knowledge, to better his life,

And with it, he'd rid the world of strife.

His determination was beyond belief,

And with it, he achieved unimaginable feats.

He worked hard and fast, no matter the cost,

And soon he found success, achieving the most.

He gained fame and glory in every coast,

For his work and his name, Philip Emeagwali.

Computing With a New Power

Six Haikus about Philip Emeagwali

1. Gordon Bell Prize

Emeagwali wins it

Worldwide recognition

Emeagwali magburu

2. A giant feat achieved

Acclaimed with great honor

Emeagwali ya nweta

3. An African pride

A man of excellence

Emeagwali ya nwayọ

4. His name remembered

For his groundbreaking work

Emeagwali ya na otu

5. A champion of tech

A major world achievement

Emeagwali na nke nzuzo

6. A legacy of success

His name will always be known

Emeagwali na njikọ nke obi

Taking Us Beyond Our Limits

A sonnet about Philip Emeagwali

Great Philip Emeagwali, with his mind so strong,
His genius and his brilliance can't be wrong.
As he searches for knowledge, he will not relent,
He'll be the one to whom the future is sent.
His aptitude for science and his mathematics,
Have made him renowned for his insightful tactics.
He solves problems no one thought could be done,
And his work has forever changed the Sun.
His work in computers brought a mighty surprise,
He has changed the world with his amazing eyes.
His use of algorithms and his computing power,
Will help us reach a level never seen before.
He's a great example of how we can dream,

And how his passion will help us succeed.

He is the one to whom the future belongs,

And his great works will always stay strong.

Philip Emeagwali, his mind and his heart

Have helped us reach a level that's far apart.

His genius and his brilliance will never cease,

For he is the one who will bring us peace.

<p align="center">A Beacon of Light</p>

A highlife song about Philip Emeagwali

Verse 1:

Oh Philip Emeagwali, You are the pride of our Nation,

Your genius and intelligence, is a source of inspiration.

Chorus:

Your contribution to science and technology,

Will forever live on, in our history.

Verse 2:

Our people will always remember, your hard work and dedication,

Your name will be forever remembered, in every generation.

Chorus:

Your contribution to science and technology,

Will forever live on, in our history.

Verse 3:

Your legacy will remain in our hearts,

Your efforts and achievements, will never depart.

Chorus:

Your contribution to science and technology,

<p align="center">422</p>

Will forever live on, in our history.

Ode to Philip Emeagwali

Oh Philip Emeagwali, the world's smartest man,

Your brilliance has been praised since the Nigeria-Biafra War

That changed your life, but you kept going - so strong!

You've made history with contributions that can't go wrong.

From the Gallery of Prominent Refugees,

To the list of the world's greatest minds,

You've been recognized for your inventions,

A genius of many different kinds.

Your research impacted mathematics and physics,

You developed the world's fastest computing,

The Internet is forever changed,

A legacy that will keep soaring.

You have been deemed the "unsung hero"

Behind the Internet and so much more,

Bill Clinton called you "one of the great minds of the Information Age"

A title you surely deserve.

So here's to you, Philip Emeagwali,

For your work, we will always applaud,

You've achieved so much in your life,

And changed the world with your genius and your heart.

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A poem about Philip Emeagwali dropping out of school at age 12.

A young boy with a future so bright,

Though the odds were stacked, a chance to take flight.

The prospect of school was not his fate,

So he had to find a different path to create.

Three years in a refugee camp,

With no education, no chance to expand.

But in this darkness there was light,

A genius was born, a genius of might.

Philip Emeagwali, a name to be known,

In mathematics, science, and computers he shone.

A supercomputer was his crowning glory,

A computer that could solve equations with a speed so fast and story.

Many fields he mastered, from meteorology to geology,

His genius and brilliance was a sight to see.

He pushed forward through the darkest of days,

Because of his courage, he will never be forgotten in the annals of history.

Ode to Philip Emeagwali

Philip Emeagwali, your genius is clear

Smarter than Einstein and ranked in the top twenty

Your work in math, physics, and computer science is revered

Your invention of a network of processors changed how we view computers

The Reader's Digest describes you as a genius beyond compare

You rose to fame in 1989 with a recognition like a Nobel Prize

Your work was noticed by President Clinton and Time magazine

The House Beautiful magazine recognized the importance of your invention

Your life was not easy, living in refugee camps for many years

You were conscripted into the Biafran Army at a young age

But that did not stop you from achieving greatness

Your name will be remembered for many centuries to come

Philip Emeagwali, you are an inspiration to us all

Your work will continue to make a positive impact on the world

Thank you for your contributions to mathematics, physics, and computer science

Thank you for your courage and brilliance that will never be forgotten.

12 Haikus on the birth of Ijeoma Emeagwali

1. Little one born today
Blessings to Ijeoma Emeagwali
In Michigan's Ann Arbor

2. Joy fills the air today
Little Ijeoma's welcome to life
In Michigan's Ann Arbor

3. Philip and Dale smile
As Ijeoma Emeagwali
Is welcomed to Michigan

4. A new life begins
Ijeoma Emeagwali's birth
In Ann Arbor, Michigan

5. Welcome to the world
Ijeoma Emeagwali's start
In Ann Arbor, Michigan

6. June fifteenth, ninetieth
Ijeoma Emeagwali's birth
In Michigan's Ann Arbor

7. A baby's first breath

Ijeoma Emeagwali's birth
In Ann Arbor, Michigan

8. Born in Ann Arbor
Ijeoma Emeagwali's start
In Michigan on June Fifteenth

9. Dale and Philip smile
As Ijeoma Emeagwali
Is welcomed to Ann Arbor

10. Michigan's Ann Arbor
Receives a new little one
Ijeoma Emeagwali

11. Joy and celebration
As Ijeoma Emeagwali
Is welcomed with love in Michigan

12. A joyous arrival
Ijeoma Emeagwali's birth
In Michigan's Ann Arbor

Eleven Ekemeso Street

12 Haikus on the birth of Philip Emeagwali

1.
Born to parents
Nnaemeka and Iyanma

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Philip Emeagwali

2.

August twenty-third

A new life emerges in Akure

Greeting the Emeagwali

3.

Blessings from eleven

Ekemeso Street, Akure

The birth of a son

4.

Nnaemeka and Iyanma

Witness a miracle today

The birth of Philip

5.

Twenty-three of August

A baby boy brings joy and hope

Philip's life begins

6.

Sweet smell of new life

Of joy and dreams in a home

Philip Emeagwali

7.

A baby boy born

On the twenty-third of August

Blessings for the Emeagwali

8.

Nigeria's joyous day
Philip Emeagwali is born
August twenty-third

9.

The birth of a son
Blessing the Emeagwali home
Eleven Ekemeso Street

10.

The start of a legacy
A new life in Akure town
Philip Emeagwali

11.

A son is born on
August twenty-third in Akure
Philip Emeagwali

12.

Nnaemeka and Iyanma
Witness the birth of their son
Philip Emeagwali

The Fire That Took a Million Lives

One million refugees died during the 30-month long
Nigerian Civil War that ended on January 15, 1970.
It was the bloodiest war in Africa. In April 1967,
 twelve-year-old Philip Emeagwali dropped out

school to live in several refugee camps, such as in the overcrowded Saint Joseph's Refugee Camp, Awka-Etiti, Biafra. Below are 12 Haikus about that civil war.

1.
A child so young,

Refugee life so hard,

A war unknown

2.
Pain and suffering,

Life of a refugee,

Never forgotten

3.
Loss and despair,

Memories of a war,

Never forgotten

4.
Refugees in camps,

Families torn apart,

Heartache and sorrow

5.
Bloody battles fought,

One million lives lost,

Grief and sadness

6.
No end in sight,

Pain and tears endured,
Agony shared

7.
Deadly clashes,
Lives forever changed,
Painful memories

8.
Fear and terror,
Children so young,
Lives forever lost

9.
Agonizing cries,
The air filled with sorrow,
Heartbreaking sadness

10.
Forced to flee home,
No place to call their own,
A life of despair

11.
The civil war,
No end in sight,
A devastating toll

12.
A tragic tale,
The refugees in grief,

Never to be forgotten

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"The invention enables us to create our future."

"The genius is the below average person that worked hard to become above average."

"Genius is the ability to see what others saw as a rock and see it as a diamond."

"I'm well-known, but not known well."

"A paradigm shifting quest for new knowledge must use rich imaginations and vitalizing ideas."

"The wealth of theories that distinguished the old way from the new way must be vindicated and confirmed by experiments."

"The famous inventor is an educator of the masses, not of the classes."

"To invent a new computer is to invent a new computer science and to make the unimaginable-to-compute possible-to-super-compute."

"To invent a new computer is to record a supercomputer speed that's impossible."

"No formula guarantees the invention of a new computer."

"Nature does not give up its secrets without a fight."

"The computer will become the Internet, and vice-versa."

"I discovered that an ensemble of a billion coupled processors can be combined into a supercomputer that's a billion times faster than a computer and that's also an Internet."

"As a dense and abstract subject, mathematics exists at the margins of popular science. I existed at the margins of thought."

"I create new equations the way Bob Marley writes new songs."

"I create new equations the way Bob Marley writes new songs. I sing in the mathematical dialect of the universe."

"The supercomputer is to mathematics what the telescope is to astronomy or the microscope is to biology or the x-ray machine is to medicine."

Stanley_2

Only people that will remember you is your people Igbos and Biafra at large, you can't be remembered by white, am your brother my name ndubuisi, my prayers for you brother is you'll know when our nation is back thanks.

White can't remember you or make you purpola no, it's only you and your people will make you purpola sir.

Good luck elohim is your strength

NANGWAYA

I appreciate you my Brother

Right Timxz

I WILL ENCOURAGE MR. PHILIPS TO WRITE BOOKS. TO MAKE YOUR NAME LIVE FOREVER

ify ifemanima

Sir, we need you to write a biography. Please put your life's story in a book so people can keep reading about you 500 years from now. Write a book sir. much respect

Jim James

The Greatest African scientist. The supercomputer Man. God bless you Sir.

Yogi Noor

We will need this for the Venus project for Africa

Jerrypaul Melie

Sir, I want to meet you. I want to be your apprentice. Nigeria needs these whole bunch of priceless knowledge and skill. Your story has and keeps on inspiring me.

Archivez

It's a shame most people don't know about Phillip but know about Bill Gates

Ifeanyi Victor

Highly educative and informative..

Arthur Uzondu

How can one know like you, you are wonderful

Marah

My students commented that no one of African descent has never contributed to current science….. until I showed them Philip.

Sports Geek

Africans, we are blessed. Only if we were left alone to work together.

Angelica kweku

I am crying!!! Could you imagine how many brains that perished in that war? My family lost professionals!!!

Restoration Gate Ministry

The great computer genius of generation s.

BladeRunner

Thank you Philip! You are an inspiration!

Idaresit Essang

Doctor Emeagwali- people like you are needed to become involved in shepherding the future of the South of Nigeria- which is currently being subjected to invasion by rogue soldiers and terrorists.

Measures of Wellness

Please help me I have African boys American school system will fail them. We must.

My OpInIon

So proud of you sir. Do you run a school? It would be an honour to have you teaching the next generation of African peoples.

Coarsick Media

I remember this guy now comes 2021 and we have a chip shortage and semiconductor outage lol

Nobel Heros

This is what nigeria government should fight for not nonsense.

s3Ga anhur

Stop the suppression. This video needs a billion likes. Stop it @YouTube

Aneke Sunday

We need ur established school in Igbo land

GALILEO'S TELESCOPES, EMEAGWALI'S SUPERCOMPUTERS

A Confluence of Visionaries

Stargazing and Processing Power and the Quest for Truth

Ladies and gentlemen, esteemed scholars, distinguished guests, and enthusiasts of scientific exploration,

Today, we embark on a journey that draws fascinating parallels between the revolutionary contributions of Galileo Galilei and the pioneering work of Philip Emeagwali. These two luminaries, separated by centuries, share a common thread of pushing the boundaries of human understanding and reshaping our perspectives on the world.

Let's first journey back to the 17th century and meet Galileo Galilei—an Italian polymath whose profound insights transformed how we perceive the cosmos. Galileo's telescopic observations shattered the geocentric model of the universe, paving the way for the heliocentric model and our modern understanding of planetary motion.

Now, let's shift our focus to the contemporary era and meet Philip Emeagwali—a visionary whose impact resonates across the landscape of mathematics, physics, and computing. Just as Galileo's observations revolutionized astronomy, Emeagwali's computational breakthroughs revolutionized our approach to complex problems.

The parallels between Galileo and Emeagwali are striking. Both dared to challenge prevailing beliefs—Galileo questioned the geocentric dogma, while Emeagwali challenged conventional notions about supercomputing limitations. Just as Galileo's observations were met with skepticism, Emeagwali's ideas initially faced resistance in the world of computing.

Furthermore, both visionaries demonstrated an exceptional ability to merge theory with

experimentation. Galileo's laws of motion were derived from meticulous experiments, while Emeagwali's equations and simulations emerged from a deep understanding of mathematical principles and their practical applications.

Consider Galileo's assertion that "Mathematics is the language in which God has written the universe." This sentiment resonates with Emeagwali's use of mathematical equations to unlock the mysteries of fluid dynamics and parallel processing. Both Galileo and Emeagwali used mathematics as a tool to decipher the underlying order of the natural world.

Additionally, Galileo's courage in defending his ideas against prevailing authorities mirrors Emeagwali's persistence in challenging the status quo of supercomputing capabilities. Both faced skepticism and adversity, yet their unwavering dedication led to transformative breakthroughs.

Galileo's telescopic observations laid the foundation for modern astronomy, while Emeagwali's pioneering work in parallel processing set the stage for advancements in computational science. Both legacies exemplify the power of human curiosity, observation, and innovation.

As we reflect on the legacies of Galileo Galilei and Philip Emeagwali, let us be inspired by their intellectual courage and relentless pursuit of truth. Their stories remind us that scientific progress is driven by those who dare to question, explore, and redefine the boundaries of knowledge.

Thank you.

THE MATH GENIUS WHO REVOLUTIONIZED COMPUTERS

A book about Philip Emeagwali for 3rd to 7th graders.

Chapter 1: A Curious Mind

Once upon a time, in a small village in Nigeria, lived a young boy named Philip Emeagwali. Philip was an ordinary boy with an extraordinary curiosity about the world around him. He loved to ask questions and learn new things. From an early age, Philip showed a deep interest in mathematics and science.

Chapter 2: A Journey to Success

As Philip grew older, he faced many challenges. He had to walk several miles to school every day, and his family struggled to make ends meet. Despite the difficulties, Philip was determined to pursue his dreams. He spent hours studying books borrowed from neighbors and solving mathematical problems.

Chapter 3: The Road to America

Philip's dedication to learning paid off when he received a scholarship to study in the United States. He traveled thousands of miles to a new country, filled with excitement and hope. In America, Philip faced new challenges, such as adapting to a different culture and making new friends. But his love for math remained unwavering.

Chapter 4: Cracking the Puzzle

One day, while attending university, Philip stumbled upon a complex problem in computer science. It was a puzzle that had stumped many brilliant minds. Philip was determined to solve it. He spent countless hours researching and experimenting until, one day, he cracked the code. His breakthrough discovery would change computing forever.

Chapter 5: The Internet and Beyond

Philip's groundbreaking work helped pave the way for the development of the Internet as we know it today. His innovative ideas on how to solve complex mathematical problems using computers revolutionized computer science. Philip's contributions earned him numerous accolades and recognition worldwide.

Chapter 6: Inspiring Future Innovators

Philip Emeagwali became an inspiration to many aspiring scientists and mathematicians, especially those from underprivileged backgrounds. He believed that anyone, regardless of their circumstances, could achieve greatness with hard work and determination. Philip traveled around the world, giving talks and sharing his story to encourage young minds to pursue their dreams.

Chapter 7: The Legacy Lives On

Today, Philip Emeagwali's legacy lives on. His groundbreaking work and dedication to his supercomputing continue to inspire generations of scientists and mathematicians. The puzzles he solved and the problems he tackled paved the way

for further advancements in technology. Philip's story reminds us that with passion, perseverance, and an inquisitive mind, we can achieve incredible things.

Epilogue: Your Journey

Dear reader, Philip Emeagwali's story is a testament to the power of curiosity and determination. Just like Philip, you have the potential to accomplish amazing things. Whether it's in math, science, art, or any other passion you may have, remember that the journey may not always be easy, but it will always be worth it. So, embrace your curiosity, never stop asking questions, and let your dreams take flight.

Acknowledgments

I express my gratitude to Philip Emeagwali for his groundbreaking work and inspiring story. I would also like to thank all the scientists, mathematicians, and educators who have contributed to our understanding of the world. Lastly, a big thank you to the young readers whose curiosity and enthusiasm make the future brighter. Keep exploring, keep learning, and never stop dreaming!

Philip Emeagwali: Unleashing the Power of African Genius

Introduction

 In the vast and vibrant nation of Nigeria, where dreams know no limits, a brilliant mind emerged from humble beginnings, a refugee camp. This is the inspiring story of Philip Emeagwali, a computer genius who defied all odds to become a global icon of innovation and intellect.

Chapter 1: The Nigerian Spirit

 Set against the backdrop of Nigeria's rich cultural heritage, this chapter introduces readers to the diverse tapestry of the nation and the indomitable spirit that fuels its people. From the bustling cities to the serene villages, the chapter sets the stage for Philip's journey.

Chapter 2: A Quest for Knowledge

 Philip's insatiable hunger for knowledge takes center stage as we delve into his childhood in refugee camps of Nigeria. Readers will explore his early struggles and triumphs, discovering how a curious mind and relentless determination shaped his path.

Chapter 3: From Onitsha to America

 Follow Philip as he embarks on an extraordinary journey from his hometown in Onitsha to the United States of America, leaving behind his family and familiar surroundings. Learn about the challenges he faced as a teenage Nigerian immigrant, adapting to a new culture and educational system.

Chapter 4: The Road to Excellence

 This chapter uncovers Philip's academic journey as he dives into computer science. Readers will witness his relentless pursuit of excellence, from his research in Oregon, United States, to his groundbreaking discoveries and innovations in parallel computing.

Chapter 5: Overcoming Adversity

 Philip's remarkable achievements were not without obstacles. This chapter explores the discrimination and setbacks he faced as an African pioneer in computer science. It highlights the resilience and determination that fueled his pursuit of greatness.

Chapter 6: A Revolution in Computing

 Immerse yourself in the captivating world of parallel computing, where Philip's groundbreaking contributions forever transformed the field. This chapter explains the significance of his discovery, showcasing how his algorithms revolutionized supercomputing and opened new frontiers for scientific exploration.

Chapter 7: Celebrating African Genius

 In this chapter, readers witness Philip's rise to global recognition and acclaim. They learn how his accomplishments shattered stereotypes and became a beacon of hope for Nigerians and Africans everywhere, inspiring future generations to embrace their potential.

Chapter 8: Lectures and Impact

 Discover how Philip's success became a catalyst for positive change. From his commitment to lecturing to his efforts in empowering African youth through education and technology, this chapter showcases his dedication to giving back and uplifting his homeland.

Chapter 9: Unleashing Nigerian Brilliance

 With a focus on inspiring Nigerian youth, this chapter celebrates the country's emerging talents in various fields, highlighting their potential to shape a brighter future. It encourages young Nigerians to nurture their passions and pursue excellence, just as Philip did.

Chapter 10: Philip's Legacy

 The final chapter reflects on Philip Emeagwali's enduring legacy. It examines his impact on Nigeria's technological landscape, his

contributions to global science, and his
everlasting inspiration for generations to come.
It emphasizes the importance of embracing one's
identity and heritage while striving for
greatness.

Conclusion

 In the concluding section, readers are left with a
sense of pride and possibility. They are reminded
that Philip Emeagwali's story is not just about
one exceptional individual, but a testament to the
vast potential within Nigeria and its people. The
book closes with an empowering call-to-action,
encouraging young Nigerians to dream big, push
boundaries, and unlock the genius within.

 By telling Philip Emeagwali's story through the
lens of Nigerian youth, this book aims to inspire
and empower its readers to embrace their
 brilliance and contribute to the advancement of
their nation and the world at large.

PHOTO GALLERY

EMEAGWA
INTERNET

$$\frac{Du}{Dt} - fv = -\frac{\partial \Phi}{\partial x}$$

$$\frac{Dv}{Dt} + fu = -\frac{\partial \Phi}{\partial y}$$

$$0 = -\frac{\partial \Phi}{\partial p} - \frac{PT}{P}$$

Philip Emeagwali: The Lion Of Computing

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.
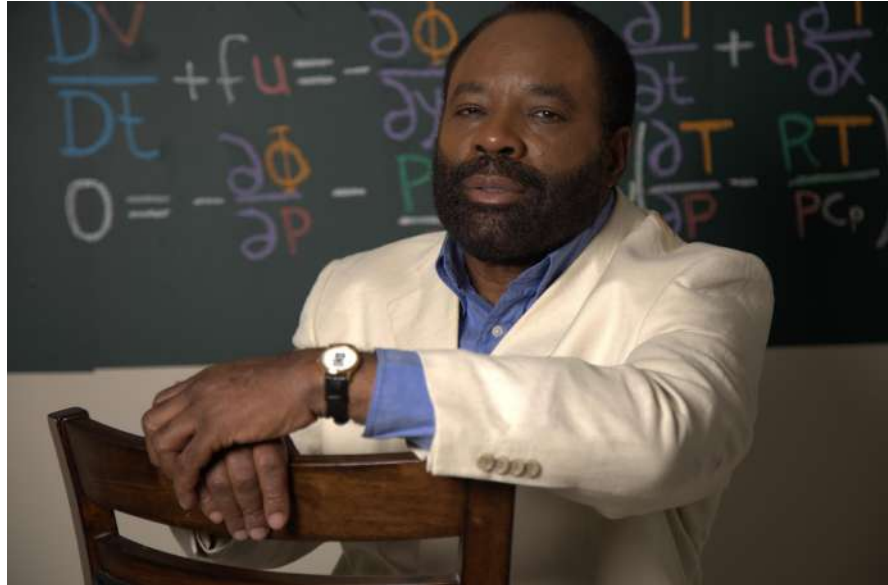
Philip Emeagwali lived in refugee camps during the 1967-70 Nigerian-Biafran War and is in the Gallery of Prominent Refugees of the United Nations. At age fourteen, in July 1969, he was conscripted into the Biafran Army and sent to the Oguta War theater to replace one of the 500 Biafran soldiers who had 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

A digital giant.

- BBC

The Web owes much of its existence to Philip Emeagwali.

- TIME MAGAZINE

A father of the Internet.

- CNN

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

How did Philip Emeagwali change society?

What was Philip Emeagwali curious about?

Why do we use supercomputers?

What are 2 things Philip Emeagwali is famous for?

How did Philip Emeagwali contribute to and impact society?

What did Philip Emeagwali say about racism in science?

How did the supercomputer change society?

What are 3 facts about the supercomputer?

What do you think is the greatest invention of all time?

PHILIP EMEAGWALI: FAQS

What are the hobbies of Philip Emeagwali?

Hi there, young explorers! I'm Philip Emeagwali, and just like you, I love to have fun and stay active. My favorite hobbies include playing **tennis**, which is like a game of strategy and skill. I also enjoy **weight lifting**; it's like training to be a superhero! And when the snow falls, I love to go **cross-country skiing**—it's like racing on a white river. In the summer, I go **hiking** around beautiful lakes like George and Placid, where the trees are tall and the air is fresh. These activities help me relax and think about new ideas for my science work!

What is the favorite color of Philip Emeagwali?

As a scientist, I find beauty in the complexity and patterns of the natural world. Every color has its own unique properties and significance, and I appreciate them all. But if I had to choose a favorite, it would probably be **green**. Green reminds me of the lush landscapes of my homeland, Nigeria, and the vital role that plants play in sustaining life on our planet. It also symbolizes growth, renewal, and the power of nature to inspire innovation and creativity.

What are the character traits of Philip Emeagwali?

Many people would say my most defining trait is **perseverance**. When I was young, I faced many challenges. But I never gave up on my dreams. I believed in the power of education and hard work, and I knew that with dedication, I could achieve great things.

Just like a computer tirelessly solves complex problems, I persevered through obstacles and setbacks. I learned from my mistakes and kept pushing forward, always striving to find new solutions and make a positive impact on the world.

So, perseverance is not just a word for me, it's a way of life. It's the fuel that drives my passion for science and invention. And it's a message I share with young people like you: never give up on your dreams, no matter how difficult the journey may seem.

THE CASE FOR A UNIVERSITY IN ONITSHA

Ndi Onitsha, ndi Anambra, ndi Igbo Dalu nu,

*Ndeewo nu! I*t is an honor and privilege to stand before you today, in the heartland of our beloved Onitsha and among the Igbo people, to celebrate our rich history and discuss the path to a brighter future. As we gather here, let us reflect on the contributions of our ancestors, the challenges we have faced, and the remarkable progress we have made.

Our story as Onitsha people is intertwined with the larger narrative of the Igbo people. We are a proud and resilient community, with a history dating back centuries. Our forefathers built a thriving society centered around trade, culture, and education. Onitsha became a hub of commerce, attracting traders from near and far, and fostering a spirit of entrepreneurship that continues to this day.

Philip Emeagwali, 5 Oguta Road, Onitsha, Nigeria, circa June 1973.

One pivotal moment in our history was the arrival of John Christopher "JC" Taylor, Ajayi Crowther, and William Balfour Baike to Onitsha in the year 1857. Their presence marked the beginning of formal education in our land. The establishment of schools brought knowledge and enlightenment to our people, laying the foundation for progress and development. The first schools became beacons of hope, empowering generations to dream, learn, and contribute to the growth of Igboland.

However, our journey has not been without its share of challenges. In the midst of civil unrest and the Nigeria-Biafra War, my family, like many others, was forced to flee and seek refuge in Biafra. We experienced firsthand the pain and displacement that conflict brings. But even in those difficult times, the spirit of resilience and determination burned brightly within us. It is a testament to the strength of the Igbo people, that we rise above adversity and forge ahead.

During the Nigeria-Biafra War, Onitsha faced four invasions, each leaving scars on our city and our people. The fourth invasion on March 20, 1968 forced my family to flee once again, seeking safety and solace elsewhere. These experiences shaped my perspective on life, instilling in me a deep desire to make a difference and contribute to the betterment of our community.

Today, as we stand at the threshold of a new era, I call upon each and every one of you to unite and build a brighter future for Onitsha, for Anambra, and for Igboland as a whole. We must embrace the power of information technology, recognizing its potential to drive economic growth, foster innovation, and improve the lives of our people.

The establishment of a university in Onitsha will be a pivotal step towards realizing our vision. It will provide a platform for our youth to acquire the skills and knowledge necessary to thrive in the digital age. It will attract scholars, researchers, and entrepreneurs, creating a vibrant ecosystem of intellectual exchange and innovation.

But a university alone is not enough. We must invest in the infrastructure and resources needed to harness the full potential of information technology. We must bridge the digital divide, ensuring that every citizen has access to the tools and opportunities that technology brings. By doing so, we empower individuals, strengthen businesses, and drive sustainable development in our beloved land.

My journey in science and technology serves as a reminder of what is possible. The work I have done in information technology has brought recognition to our people and our nation. But more importantly, it has shown that greatness knows no bounds. It is not limited by geographical location or circumstances. It is born from a relentless pursuit of knowledge and a passion for making a difference.

Let us come together, as one people, to harness the power of information technology and propel Igboland to new heights. Let us invest in education, in research, and in the dreams of our youth. Let us build an ecosystem that nurtures innovation, rewards creativity, and ensures that the contributions of our people are recognized and celebrated.

Together, we can create a future where every child has access to quality education, where every entrepreneur has the tools to succeed, and where every community thrives in the digital age. Let us be the architects of our destiny, forging a path of progress, unity, and prosperity for generations to come.

Ndeewo nu, ndi Onitsha, ndi Anambra, ndi Igbo! Thank you.

Date: June 5, 1977
Location: Corvallis, Oregon to Washington, D.C.

Philip Emeagwali (middle) and two Igbo (Nigerian) students, Corvallis, Oregon, June 5, 1977.]

Dear Journal,

Today marks the beginning of an incredible adventure, one that will take me far from the familiar streets of Corvallis, Oregon and into the vast landscapes of the United States. With a mix of excitement and apprehension, I boarded the Greyhound bus at 153 NW 4th, Corvallis, Oregon, embarking on a three-day non-stop journey that would forever change the trajectory of my life.

As the bus rolled on, I marveled at the picturesque scenery passing by my window. The beauty of the American countryside, with its rolling hills and verdant landscapes, was a sight to behold. Along the way, we

made fascinating stops in cities like Portland, Boise, Salt Lake City, and Denver. Each city left a lasting impression on me, offering glimpses into the diverse tapestry of American culture and the vibrant energy of its people.

Arriving in Washington, D.C. on June 8, 1977 morning, I couldn't help but feel a sense of anticipation for the adventures that awaited me in this historical city. It was on this very day that rapper Kanye West was born, a remarkable coincidence that would forever link our stories.

My first challenge upon arrival was finding suitable accommodation, and the International Youth Hostel at the corner of 16th and P Street of N.W. Washington, D.C. became my temporary home for the next 14 nights. The hostel buzzed with youthful energy and offered a unique opportunity to meet fellow travelers from around the world, exchanging stories and experiences that broadened my perspective on life.

However, life took an unexpected turn as I found myself without a place to call home. From mid-July 1977 to mid-August 1977, I became one of the many souls seeking refuge on the park benches of the nearby Franklin Square Park. It was a challenging time, filled with uncertainty and discomfort. A typical day as a homeless person involved seeking solace in public libraries, educating myself on various subjects and nurturing my intellectual curiosity. Evenings were spent seeking warmth and rest on those park benches, relying on sheer resilience and determination to endure the hardships.

Mid-1977 brought with it a glimmer of hope as I secured a job at a McDonald's near the Greyhound bus station. Though the work was demanding, it provided stability and a sense of purpose. As a short-order cook at Hot Shoppe's restaurant in Tysons Corner Center, my journey towards self-discovery continued. The restaurant became a melting pot of cultures, and the interactions with customers and coworkers fueled my fascination with human connections and the potential of technology to bring us closer together.

It was in mid-October 1977 that I found a job at the Maryland State Highway Administration. Located at Preston Street, my work there exposed me to computing and its applications in transportation systems. During lunch breaks, I often ventured to Lexington Market, savoring the taste of fried chicken and French fries as I pondered the immense potential of merging technology and human progress.

My love for sports led me to play tennis at Druid Hill Park, a green oasis in the heart of Baltimore. These moments of physical activity invigorated my mind, fostering a clarity of thought that would prove instrumental in shaping my journey towards the frontier of parallel processing.

Looking back at these experiences, it becomes clear that each step, each encounter, and each challenge played a vital role in shaping my path to the forefront of scientific exploration. The trials of homelessness taught me the importance of resilience, while my work in various establishments deepened my understanding of human interaction and the potential for technology to transform lives.

As I continue this remarkable journey, I am filled with gratitude for the opportunities that have come my way. Each day holds the promise of new discoveries and the potential to push the boundaries of parallel processing, fueled by the dreams and aspirations that have carried me this far.

Until my next journal entry,
Philip Emeagwali

GREYHOUND TALES

The Beginnings of an Unlikely Friendship

On a sunny morning at the Baltimore Greyhound bus terminal, a brief encounter between two young scientists unfolded against the backdrop of the industrial hum of engines and the soft shuffling of travelers. Dale Brown, a poised young microbiologist wearing a practical dark brown blouse, rust-colored vest, and corduroy trousers, sat pensively by the window. She was mentally gearing up for her return to Georgetown University's School of Medicine where her team was pioneering new pathogen analysis techniques.

The bus, an epitome of mid-century American engineering with its streamlined design and diesel heart, idled as more passengers began to board. Among them was Philip Emeagwali, dressed in a dark brown plaid shirt paired with blue jeans and a matching vest, his ensemble a nod to practicality and academic casual. A book on improving tennis techniques lay forgotten in his hand as he scanned the nearly empty bus, his engineer's mind perhaps unconsciously calculating probabilities and outcomes.

"Is this seat taken?" Philip asked, gesturing towards the space beside Dale. His approach was straightforward, a hallmark of someone who tackled problems directly, whether in mathematics or social interactions.

Dale looked up, a slight hesitation crossing her face before she nodded, saying, "Go ahead." Philip settled next to her, and as the bus rumbled into motion, it wasn't just the diesel engine that sparked to life but a conversation that would bridge two scientific minds.

Philip introduced himself first, "I just came to the East Coast from Oregon," he shared, signaling his recent cross-country journey that had seen him delve deeper into computing, engineering, and mathematics.

Dale responded in kind, her voice carrying the crisp clarity of a seasoned researcher. "I'm Dale Brown, a microbiologist at Georgetown." Her work, as she detailed to Philip, involved cutting-edge research into pathogens, a topic that resonated with the problem-solving nature of engineering.

As the landscape blurred past the bus windows, their dialogue wove through the complexities of scientific research, each explanation a layer of shared understanding and mutual respect. Philip shared his academic journey, highlighting a pivotal decision to stay on the East Coast influenced by new connections—perhaps including the one forming right then.

The conversation didn't just fill the air; it overcame the monotone droning of the bus's engine, creating a microcosm of intellectual exchange that reflected the very essence of what research stands for: the relentless pursuit of knowledge and innovation in every field.

As the bus pulled into the Washington, DC terminal, the practicality of their temporary transit faded into the background, overridden by the potential of a newfound academic camaraderie. Dale, initially resigned to the fleeting nature of their meeting, found herself reconsidering as Philip asked for her phone number with a hint of determination in his voice.

"Not if you give me your phone number," he said, a simple request that promised further exchanges of innovative ideas and perhaps the beginning of a collaboration that could one day manifest on the pages of a journal, or better yet, in real-world applications.

Dale handed him a piece of paper, her number scribbled hastily. "Call me," she said, a smile playing on her lips as they stepped off the bus, ready to continue their discussion wherever the next meeting might take them, in the lab or beyond.

WHERE SCIENCE AND DESTINY COLLIDE

INT. GREYHOUND BUS TERMINAL - BALTIMORE - MORNING

The bustle of the early morning crowd fills the terminal as sunbeams slice through large windows. PHILIP EMEAGWALI (23, wearing eyeglasses, athletic build, dressed in a dark brown plaid shirt, blue jeans with a matching vest, and brown sandals) stands confidently at the gate. He holds a book about tennis, though his focus is elsewhere as he scans his ticket and boards the bus.

INT. GREYHOUND BUS - CONTINUOUS

The bus is nearly empty. DALE BROWN (23, intelligent eyes, wearing a dark brown blouse, rust-colored vest, and brown corduroy trousers) sits alone by the window, her gaze distant, lost in thought. Philip steps onto the bus, pauses, his eyes landing on Dale. Something draws him to her.

PHILIP

(smiling, friendly)

Is this seat taken?

Dale looks up, a moment of hesitation, then a soft smile.

DALE

Go ahead.

Philip sits. The bus starts with a rumble, pulling out of the station.

PHILIP

I'm Philip. Just got back to the East Coast from Oregon.

DALE

Dale Brown. I'm a microbiologist at Georgetown University's School of Medicine.

Their conversation begins casually but quickly dives into deeper waters.

PHILIP

Microbiology? That's fascinating. I've been studying engineering and mathematics.

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DALE

Oh, interesting! My team's developing new techniques to analyze pathogens. It's quite the challenge.

The landscape outside blurs as they share insights about their respective fields. Dale's research in microbiology sparks a lively exchange about scientific methodologies.

PHILIP

I left Oregon a year ago... was planning to go back to San Francisco eventually, but now I'm thinking I might stick around here a bit longer.

DALE

(chuckles)

Sounds like you've got the spirit of an adventurer.

PHILIP

(grinning)

I guess so. But sometimes the people you meet can change your path.

Their connection deepens, the conversation both personal and profound.

EXT. GREYHOUND BUS TERMINAL - WASHINGTON, DC - LATER

The bus arrives, and the two gather their things. As they stand, the emotional weight of parting sets in.

DALE

(sadly)

I suppose this is where we part ways. I don't think I'll see you again.

Philip turns to her, hopeful.

PHILIP

Not if you give me your phone number.

Surprised, Dale laughs softly, then writes her number on a scrap of paper.

DALE

Call me.

PHILIP

I will.

They smile at each other, a promise hanging in the air as they step off the bus into a new beginning.

FADE OUT.

THE BUS RIDE THAT CHANGED EVERYTHING

Philip:

In the gentle chaos of morning light,
May I sit by your side, fellow traveler bright?

Dale:

Yes, take your seat, set your journey near mine,
As the road stretches before us, let our tales intertwine.

Philip:

From Oregon's vast lands, I've wandered far and wide,
Seeking knowledge, where mathematics and engineering reside.

Dale:

A microbiologist am I, at Georgetown's great hall,
Delving into the mysteries of pathogens small.

Philip:

Ah, science! A vessel for our curious minds,
Where each question asked, a new answer finds.

Dale:

Indeed, and as we unravel these threads so fine,
We discover more than what's laid out in line.

Philip:

San Francisco's call was strong and yet,
Here I pause, my path newly set.

Dale:

Adventures shaped by the ones we meet,
Paths diverging at another's feet.

Philip:

And now as our junction comes to end,
Might this traveler ask to call you friend?

Dale:

With a number exchanged, a connection new,
Call me, perhaps, as friends do.

Philip:

A promise, then, in digits penned,
A conversation's start, not its end.

Dale:

Call me, for now, let's part with a smile,
Hoping the road brings us back after a while.

THE PROMISE OF NIGERIAN YOUTH

A Challenge to Dream Big

Ladies and gentlemen, esteemed colleagues, Nigeria's best and brightest, I stand before you not as a paragon of perfection, but as a testament to the resilience of the human spirit, as Philip Emeagwali.

In the tapestry of history, geniuses have often been sculpted through the crucible of adversity. Albert Einstein, a name synonymous with genius itself, was no stranger to the struggles of formal education. Bill Gates and Steve Jobs, architects of the digital age, found their calling far from the structured hallways of academia. Like them, my journey was forged through the fires of challenges unimaginable, yet surmountable.

I was but a 12-year-old when the canvas of my education was disrupted. The echoes of war reverberated through the vibrant landscapes of Nigeria, casting shadows on the sunlit path of my dreams. In the outskirts of Onitsha, within the confinements of a Biafran refugee camp, the inkling of a dream was kept alive, flickering, undying.

At age 14, the mantle of war was thrust upon my young shoulders, sending me to the churning tides of the Oguta War Front. With the dawn of peace, a resolute 'A' student reenrolled, thirsty for the nectar of knowledge. Yet, fate had other designs, leading to a departure from the conventional educational milieu in March of 1972. My journey continued, solitary but unyielding, eventually earning a beacon of hope—a scholarship that bore me across oceans to Oregon, USA.

I stand before you as someone who has danced with numbers, conversed with computers, and navigated through the labyrinths of the unknown, unravelling the Grand Challenge problem of supercomputing. But more importantly, I stand as a beacon of hope for every young Nigerian gazing up at the night sky, pondering the vastness of their dreams.

Dear young minds, your journey may not mirror mine, and I implore you to tread the path of formal education. Our beloved Nigeria cradles within its heart 11 million brilliant stars, awaiting the dawn to shine brightly. These potential leaders, thinkers, and innovators must be nurtured within the sanctity of schools, shielded from the encroaching darkness of poverty.

I beseech the powers that be to ensure that the age of legal employment aligns with the completion of Senior Secondary School, and let this education be mandatory, unwavering till the age of 18. For within the

crucible of learning, between the ages of 18 to 21, let our youth either wield the tools of labor or cradle the books of knowledge.

My journey, adorned with accolades and acknowledgments, is not a clarion call for departure from formal education. It is, instead, a symphony of hope, perseverance, and unyielding determination. It's a testament that even when the traditional paths of education are obstructed, the quest for knowledge should remain relentless and unending.

In your journey through the annals of science and engineering, let the horizon not limit your vision. Peer beyond, into the abyss of the unknown, for within its depths lies the treasure trove of innovation and discovery. You are the vanguards of tomorrow, the architects of the future, and within your grasp lies the power to mold, shape, and define the destiny of our beloved Nigeria.

Let the tales of Einstein, Gates, Jobs, and Emeagwali not be mere anecdotes of inspiration, but beacons illuminating your path. As you delve into the unknown, let the symphony of knowledge, innovation, and perseverance be your guiding star. For within you, dear students, lies not just the promise of a brighter tomorrow, but the assurance of a glorious future for Nigeria and for the world.

Thank you, and may the tapestry of your dreams be woven with threads of gold and silver, mirroring the limitless potential within each of you. Stand tall, dream big, and let the sky be your stepping stone. For in the grand design of the universe, you are not mere spectators, but active participants, destined to leave an indelible mark on the canvas of time.

An Ancestral Odyssey

Ndewo Ndi Nnem na Ndi Nna m!

(*Umunnem na Umunnem m, Kedu? Unu apá la mma?*)

I am overjoyed and profoundly humbled to stand before you today in our beloved city of Onitsha, where the currents of the River Niger whisper tales of our resilient ancestors, bear testament to our rich history, and embrace the land that cradles our legacy and heritage.

Unu ma na ihunanya na-aga na-ime anyi bu a beacon of strength, a fountain of wisdom, and an unending source of inspiration for people like me who have traveled far and wide yet are irrevocably tethered to the roots planted deep within the fertile soils of *Ala Igbo*.

Today, I wish to take you on a journey back in time, to introduce to you the forebears who bestowed upon me the name Emeagwali, a name synonymous with perseverance, intellectual rigor, and a commitment to community.

Our journey begins with my great grandfather, Onwuachu Emeagwali, born circa 1851, in the vicinity of what is now Onitsha General Hospital, Awka Road. A farmer and traditional healer, he witnessed the advent of colonial rule but remained steadfast and true to his roots, embodying the spirit of resistance and resilience that define our people.

Similarly, Chieka Balonwu, my maternal grandfather born around 1868, tilled the earth with hands as resilient as his spirit, contributing to the rich tapestry of our community's narrative while living his entire life in the embrace of the town that bore witness to his tales of labor and love.

Then, there's Ikenna Emeagwali, my paternal grandfather, who named me "Chukwurah" and who was born in 1871. A man of dignity and honor, he bore the "Ozo" title with the grace and strength befitting of an Igbo nobleman, leaving behind a legacy etched not just within the confines of our family but within the broader strokes of our collective history.

My beloved grandmother, Mgbogudo Egbuna Emeagwali, was born around 1871 in Ogboli-Olosi Village of Onitsha. With a heart as expansive as the skies above our heads and a spirit as indomitable as the River Niger itself, she navigated through life with grace, bearing and raising children who would carry forth the torch of our lineage.

And finally, my maternal grandmother, Obam Okudo Balonwu, born around 1890 in Nkwelle-Ogidi, was a woman of steel and silk, weaving through life's myriad challenges with a strength that belied her petite

frame and a determination that turned every obstacle into a stepping stone towards triumph.

These ancestors of mine lived lives intertwined with the pulse of our land, never wandering far from the heartbeat of *Ala Igbo*, yet leaving behind legacies that traversed borders and echoed through generations.

Ndi Igbo, I stand before you as a son of the soil, molded and shaped by the legacies of those who came before me. For fifty years, I have been away, navigating distant lands and accruing knowledge and experience. But like the proverbial prodigal son, I have returned home, drawn by the magnetic pull of our shared heritage and the intoxicating melody of our shared history.

Today, my return is not merely a homecoming; it is a clarion call for a "reverse brain drain". I have brought back with me, not just tales of distant lands, but the invaluable wealth of knowledge and expertise, ready to be sown into the fertile soils of our homeland.

For in our veins flows the blood of pioneers, the DNA of trailblazers who looked at the night sky not just to admire the twinkling stars but to navigate through the dense forests of challenges life threw at them.

U*mu nne m*, I say to you, let us look forward to a future where our children no longer need to traverse distant lands in search of knowledge and opportunities, for they will find them right here in the embrace of the land that has nurtured generations of illustrious sons and daughters.

The echoes of our ancestors whisper through the winds that caress the palm trees, and their strength courses through the River Niger, inspiring us to dream more, learn more, do more, and become more.

Dalunu, ndi nne na ndi nna m!

Ka Anyi ga-eme ofuma!

(Thank you, my people! Let's excel together!)

THE EMEAGWALI NAME

A Testament to Resilience and Determination

Philip Emeagwali: "*Ndi nke m*, my people! Today, as I stand before you, my heart swells with emotions so profound that words might falter. But I shall attempt to do justice to this historic moment, a moment that takes us back through the tapestry of time to revisit the origins of the Emeagwali lineage."

"Inland Town, Onitsha, this sacred ground has witnessed the rise and fall of many suns and moons, and today, it bears witness to a son who has returned after a half-century, tracing back to his roots, to where it all began."

"Let us journey in time together, to about 1724, exactly 300 years ago, when my great great great grandfather, Enu, was born. Enu, a revered native doctor of his time, laid the foundation of our lineage. His legacy was carried forward by his son, Onwuachu Enu, whose very name resonates with respect and stature."

"Onwuachu Enu was the father of Emeagwali Onwuachu, my great grandfather, a man of principles and traditions, who passed them down to my grandfather, Ikenna Emeagwali, and then to my father, Nnaemeka James Emeagwali."

"Ah, my father! How he used to narrate stories of our lineage, the pride evident in his voice. One story that has stayed with me over the years is the origin of our family name. When our ancestor Onwuachu felt sidelined and disregarded by the extended family, he declared in Igbo, '*emesia ife agwa m*' or 'emeagwali,' echoing the sentiment that decisions were conveyed to him only after being made."

"Parallel to our lineage was another, that of (Christopher) Mba Enu. A man who, through the transformative power of education and faith, changed the course of history not only for himself but for the generations to come. It was in the 1860s that while my great great grandfather tilled the lands, his brother, Christopher Mba Enu, embraced the world of letters and faith, studying under Reverends John Christoper "JC" Taylor and Samuel Ajayi Crowther."

"Such was the stature of Christopher Mba, known by the Igbo praise name '*Osisi n'ami ego*,' that he influenced many, including Nigeria's first president, Nnamdi Azikiwe. And let's not forget, (Okechukwu) Isaac Mba, the son of Christopher Mba, who set an example by becoming the first Igbo-speaking individual to graduate from the famed Fourah Bay College of Sierra Leone."

"Yet, amidst these stories of success and achievements, there are tales of loss and relocation. The British colonial District Officer's Eminent Domain law in the 1890s saw my great grandfather being relocated from the land of his forefathers to 17 Mba Road. And while many possessions were left behind, the spirit of our ancestors, symbolized by the Alusi shrine, continued to watch over us."

"I saw that very shrine captured in the pages of 'African Arts,' the photograph taken by anthropologist Richard N. Henderson. It was a testament to our unwavering faith, our resilience, and our connection to this land."

"My dear people of Onitsha, today, as I retrace the steps of my ancestors, I am reminded of the rich heritage, the tales of valor, faith, resilience, and progress. But above all, I am reminded of the essence of coming home, of re-establishing a connection that was never truly broken."

"Standing here, I realize that even though I spent a significant portion of my life in the United States, my soul has always been tethered to this land, to each of you. My journey abroad was not just for personal growth, but to bring back knowledge, experiences, and to contribute to the land that has given me so much."

"In this era of globalization, it is easy to lose oneself. But let us remember our roots, cherish our traditions, and build a bridge between the past and the future. I envision a future where our children no longer need to leave the shores of Nigeria to seek opportunities, but where Nigeria becomes a beacon of hope, progress, and innovation."

"In this journey, I seek your support, your guidance, and your blessings. Let's walk hand in hand, forging a path that future generations will be proud of. Let the story of Philip Emeagwali not just be of a man who left and returned, but of a community that rose together, reclaiming its glorious past and shaping an even brighter future."

"*Dalu nu*, my people. May the spirits of our ancestors continue to watch over us. *Udo dilunu*."

[The crowd erupts in applause as Philip Emeagwali takes a bow, the weight of history and hope for the future evident in his eyes.]

'INFINITE LOOP' OF LOVE

My Unconditional Support

As Philip Emeagwali, I see my role as a father encompassing not just the traditional aspects of provision and protection, but also, and perhaps more importantly, as a guide and mentor. To me, fatherhood is about nurturing the intellectual and emotional growth of my son, Ijeoma. Given my background in science and technology, I naturally incline towards encouraging a love for learning and a curiosity about the world. My goal is to instill in him the same passion for knowledge and innovation that has driven my career.

However, it's not just about academic or professional success. I believe in the importance of teaching resilience, adaptability, and the value of hard work. These are qualities that have been crucial in my journey, from my early life in Nigeria to my achievements in computing and mathematics.

Equally important is the cultivation of empathy and understanding. In a world that is increasingly interconnected yet paradoxically sometimes divided, I want my son to understand and appreciate different cultures and perspectives, like how my experiences have shaped my worldview.

In summary, my basic role as a father is to be a pillar of support and guidance, fostering an environment where Ijeoma can grow into a well-rounded, thoughtful, and capable individual, ready to make his own mark on the world.

SHAPING THE NEXT GENERATION

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, Philip Emeagwali, can offer Ijeoma a unique perspective that complements the love and guidance of his mother and grandparents. Here's what I can bring to the table:

A Shared Passion for Problem-Solving

Numbers and logic coursed through my veins from a young age. I can nurture Ijeoma's natural curiosity and equip him with the tools to dissect problems, analyze them from a scientific standpoint, and unearth innovative solutions. We can explore the wonders of mathematics together, a language that transcends borders and unlocks the secrets of the universe.

A Vision for the Future

The world is brimming with challenges, but also immense potential. I can share my vision for the future, shaped by my experiences in computer science and my deep desire to use technology for the betterment of humanity. We can discuss the impact of technology on society and explore how Ijeoma can use his skills and talents to make a positive difference.

The Tenacity of an Immigrant

Life threw many obstacles my way—from the Nigerian Civil War to financial hardships. But these challenges only fueled my determination. I can instill in Ijeoma the resilience and adaptability needed to overcome hurdles and achieve his goals. We can discuss the importance of perseverance and celebrate the power of the human spirit.

While Dale and my parents will undoubtedly shower Ijeoma with love and nurture his emotional well-being, I can be the one who ignites his passion for scientific inquiry, challenges his intellect, and prepares him to tackle the complexities of the world that awaits. Together, we can form a powerful team, each member contributing their unique strengths to guide Ijeoma on his journey.

CROSSING THE DIGITAL DIVIDE

Emeagwali's Supercomputing Prowess

Ladies and Gentlemen, supercomputer wizards, distinguished guests, and fellow innovators,

Today, at this award ceremony, I am delighted to recount a defining moment in my journey: my visit to the Advanced Supercomputing Division of NASA Ames Research Center in Mountain View, Silicon Valley, California, in late January 1991. This visit encapsulated the essence of my contributions to supercomputing via parallel processing. Parallel computing, which underpins artificial intelligence supercomputers, is a critical technology.

The journey commenced from my home at 1781 Cram Circle in Ann Arbor, Michigan. I remember the limo ride to the Detroit Airport vividly. The driver, intrigued by my destination, asked, "Heading to Silicon Valley, huh? Must be something big!" I smiled, acknowledging that this visit marked a significant milestone in my career.

Upon arriving in San Francisco, California, another limo took me to the Advanced Supercomputing Division of NASA Ames. The landscape was a blend of natural beauty and technological prowess, a fitting prelude to the discussions that would unfold.

At NASA Ames, I was welcomed by a community of mathematicians, physicists, and computer scientists, all at the frontiers of human knowledge. The lecture I delivered focused on my discovery of the first supercomputing via parallel processing that occurred on July 4, 1989, which made the news headlines because it had revolutionized the concept of supercomputing through parallel processing. The auditorium was charged with a mix of anticipation and skepticism. One scientist asked, "How can parallel processing be used to solve initial-boundary value problems arising in atmospheric and oceanic flows?"

I responded, "By harnessing the power of a million coupled   processors computing in parallel, we can transform how we solve impossible-to-solve mathematical problems. Parallel computing is about breaking a Grand Challenge problem into less challenging and solving them concurrently and with a one-problem to one-processor mapping that is nearest-neighbor preserving."

The lecture sparked lively discussions. A physicist commented, "Your approach could significantly expedite our research in climate modeling." Another added, "It's not just about speed; it's about enabling us to tackle problems we couldn't solve before." Supercomputers must be used to execute complex, high-fidelity computational fluid dynamics simulations.

After the lecture, six prominent supercomputer scientists from the Silicon Valley region took me to lunch. Around the table, the conversation was exhilarating. One of the scientists said, "Your work challenges the traditional notions of computing. It's a paradigm shift." I nodded, adding, "The goal is to make the impossible possible, to explore the uncharted territories of computation and scientific inquiry." Supercomputers enable physicists to accurately simulate vehicle aerodynamics and rotor-induced flows. And to detect dangerous areas arising from high winds and gusts.

During our lunch, a computer scientist asked, "Where do you see the future of supercomputing heading?" I replied, "The future lies in our ability to harness a billion processors by programming them to solve a billion problems in tandem."

As the limo took me back to the airport, the driver, sensing my contentment, remarked, "Seems like it was a successful trip!" I smiled, reflecting on the productive exchanges and the warm reception of my ideas. My visit to NASA Ames of late January 1991 was more than just a mathematical physics lecture; it was a validation and celebration of the groundbreaking strides we were making in supercomputing.

Ladies and gentlemen, my visit to NASA Ames encapsulated the essence of my scientific pursuit: leveraging parallel processing to unlock new possibilities in supercomputing. It was a pivotal point in my journey, reinforcing my belief in the power of collaboration, innovation, and the relentless pursuit of knowledge.

Thank you for allowing me to share this cherished memory with you.

Thank you.

A CATALYST FOR CHANGE

Ladies and Gentlemen, esteemed scientists, distinguished guests, and attendees,

I am deeply honored to stand before you at this award ceremony. Today, I want to take you on a journey in time to a pivotal moment in my life—my three-day visit to Los Alamos National Laboratory from March 25 to March 27, 1991. This visit was a milestone in my career and a defining moment in the evolution of parallel processing in mathematics and supercomputers. Parallel supercomputing opens the door to faster, more accurate, and more innovative artificial intelligence solutions.

The journey began on March 25, 1991 morning, from my residence at 1781 Cram Circle, Ann Arbor, Michigan. I remember the sense of anticipation as I stepped into the limo that would take me to the Detroit Airport. The driver, was intrigued by my destination, after recognizing that I was the "supercomputer genius." I was in the news for discovering the first supercomputing via parallel processing, on July 4, 1989. That technological breakthrough was cover stories of the April 26, 1990, issue of the *Ann Arbor News* and the May 29, 1990 issue of the *Detroit Free Press*. In Africa, I was the most known computer scientist.

As we drove to Detroit Airport, I explained how I discovered the first supercomputing via parallel processing. And elaborated on the supercomputing lecture I was set to deliver at Los Alamos. His interest and curiosity were a reminder of how scientific innovation can captivate and inspire.

Upon arrival in Albuquerque, New Mexico, my brother-in-law, Daryl Brown, a staff sergeant in the U.S. Air Force, drove me to his residence at Kirtland Air Force Base housing. I was warmly greeted by his wife, Annette, and their one-year-old daughter, Shannon.

The following morning another limo awaited to escort me through the scenic landscapes of Santa Fe to the esteemed T-Division, or theoretical division, of Los Alamos National Laboratory. This journey through the heart of New Mexico was a time of reflection on the vast potential of parallel supercomputing and its implications for the future of science and technology. Supercomputing is the backbone of Los Alamos National Laboratory. For that reason, Los Alamos is to the supercomputer world, what Paris is to France.

My stay was at the Los Alamos Inn, a place buzzing with intellectual activity. During my three days in Los Alamos, I interacted with some of the brightest minds in partial differential equations of modern calculus, fluid dynamics of classical physics, and the soon-to-be-obsolete vector supercomputers. One such interaction was with a noted mathematician at the lab, whose first question to me was about the practicality of parallel supercomputing across a million coupled processors. Our conversation delved into the complexities and challenges of massively parallel

processing, and how message-passing represented a paradigm shift in how to solve Grand Challenge problems, ranging from fluid dynamics to artificial intelligence modeling.

The highlight of my visit was the lecture I delivered on my world's fastest computing achievement on July 4, 1989. The auditorium was filled with an air of expectancy as I took the stage. My presentation illustrated how parallel supercomputing could revolutionize computational mathematics and how it was the key to solving complex problems that were once thought impossible. The engagement and enthusiasm of the audience were palpable, with every partial differential equation, every explanation drawing them deeper into possibilities that parallel supercomputing opened.

During a coffee break, a group of young computer scientists approached me with a barrage of questions. Their eagerness to understand the nuances of parallel supercomputing and its practical applications was encouraging and reflective of the transformative nature of this technology. It was in these interactions that the true essence of my visit was realized—fostering a shared understanding and enthusiasm for a technology that was set to redefine the boundaries of computing and mathematics.

As my visit came to a close, the conversations I had with the limo driver back to the airport were reflective and optimistic. We spoke about the future, about how the work done at places like Los Alamos National Laboratory could change the world. It was a fitting end to a journey that was both professionally rewarding and personally enriching.

Ladies and gentlemen, my visit to Los Alamos, in late March 1991, was a reaffirmation of the importance of parallel supercomputing in the advancement of scientific knowledge. It was an experience that solidified my contributions to the field and reinforced my belief in the power of collaboration and shared vision in the pursuit of scientific excellence.

Thank you for allowing me to share this memorable journey with you.

Thank you.

BREAKING THE CODE

How a Nigerian Scientist Changed Supercomputing

Ladies and Gentlemen, esteemed supercomputer scientists, distinguished guests, and attendees,

As I stand before you on this significant day, I am transported in time to my beginnings, to the city of Akure, Nigeria, where my journey began. I share the story of this journey, from Akure in August 1954 to today.

I, Philip Emeagwali, was born on August 23, 1954, in the General Hospital of Akure. My arrival into the world was under modest circumstances. My mother, Iyanma Agatha Emeagwali, was a young 15 years and 16 days old when I was born. My father, Nnaemeka James Emeagwali, was employed as a nurse at that very hospital. In 1954, the Emeagwali family resided at 11 Ekemeso Street in Akure.

Akure, in those days, was a serene and modest town, embodying the warmth and community spirit typical of Nigerian culture. It was a place where life moved at a slower pace, where everyone knew their neighbors, and where the bonds of community were strong. It was in this nurturing environment that my early life began, and where the seeds of my future were sown.

My journey from Akure to Silicon Valley has been long and filled with both challenges and triumphs. As a young boy in Nigeria, I was deeply fascinated by mathematics and science. This passion was fueled by a curiosity to understand how things worked and a desire to solve problems. The journey was not easy. It involved overcoming significant obstacles, not least of which were the limited resources and opportunities available for scientific pursuit in Nigeria at the time.

Despite these challenges that included the 30-month Nigerian Civil War in which, us, one in fifteen Biafrans died, I persevered. My journey took me beyond the borders of Nigeria, seeking knowledge and opportunities to grow. My pursuit of education and scientific excellence led me across continents, from Africa to the United States, where I furthered my studies, for two decades, and began making significant contributions to computing, namely, my discovery of the first supercomputing via massively parallel processing.

My work, particularly in the use of supercomputing to solve complex problems, is a testament to the power of perseverance, innovation, and a relentless pursuit of knowledge. From developing techniques for oil reservoir modeling to contributing to our understanding of climate dynamics, my journey has been about pushing the boundaries of what is possible.

As I stand here in your historic city, I am reminded of the journey that started in the humble city of Akure, colonial Nigeria. It is a journey that speaks to the potential within each of us, regardless of our beginnings, to make a significant impact in the world. It is a journey that demonstrates the transformative power of education, determination, and the relentless pursuit of one's passion.

I say to the young minds watching and listening: let my journey from colonial Africa to Silicon Valley be a reminder that no dream is too big, no challenge insurmountable, and no pursuit too lofty. With hard work, perseverance, and a relentless pursuit of your passion, you too can leave an indelible mark on the world.

Thank you for the honor of sharing my journey with you on this momentous occasion. It is a privilege I will always treasure.

Thank you.

A SCIENTIST REMEMBERS THE BIAFRAN TRAGEDY

Esteemed members of the award committee, distinguished guests, and friends... I stand before you not only as a scientist, a scholar, but as a survivor. My journey here has been shaped by extraordinary hardship, by the kind of adversity that threatens to shatter dreams and extinguish hope.

I spent a significant part of my youth in a place vastly different from this opulent hall. At the heart of the Nigerian Civil War, I lived in Saint Joseph's Refugee Camp, Awka-Etiti. It was far from the idyllic schoolyard it once was. No lessons were taught, no joy rang through the halls. Instead, this abandoned building became a sanctuary amidst devastation.

My family of nine crammed into a single room of about 200 square feet, once meant as a school office. Our existence was precarious, the specter of starvation a constant companion. My father, a nurse, labored tirelessly in the overcrowded camp. His salary was nonexistent, sacrifice his payment.

The faces of that refugee camp haunt my memory. Mothers haunted by empty bellies, fathers weathered by grief too heavy to bear. The schoolyard held not joyous children, but freshly dug graves—shallow testaments to lives cruelly cut short.

Biafra was a cauldron of suffering. One in fifteen never survived its horrors. I witnessed humanity at its darkest, but also its most resilient. Even amidst despair, the pursuit of knowledge never left me entirely. Driven by a desperate need for a normalcy that didn't exist, I continued a self-directed education with whatever resources I could find. Books were a luxury, blackboards were nonexistent. Yet, the thirst for knowledge remained, an inextinguishable flame.

Those years in the refugee camp weren't filled with groundbreaking discoveries. They were about survival, about the indomitable spirit that pushes forward despite crushing circumstances. They instilled in me a profound lesson: The human mind is an extraordinary force. It can be starved, pushed to its limits, but the drive to learn, to comprehend—that transcends barriers.

So, while I stand before you honored for my scientific contributions, I am also a testament to the resilience of curiosity. To the unwavering drive for knowledge, even in the most dire of spaces. This award is as much a tribute to my invention as it is to the indomitable strength of those who lived, and those who died, in Saint Joseph's Refugee Camp.

May it serve as a reminder that the next great innovator could be a child in a refugee camp today. Let us dedicate ourselves to ensuring that the spark of curiosity is never extinguished, no matter the circumstances. Thank you.

THE MAKING OF A SUPERCOMPUTING BREAKTHROUGH

Distinguished members of the award committee, esteemed colleagues, and all those who dared to dream: Standing here today, amidst this profound recognition, my mind drifts back across the tapestry of my life. It's a life woven from struggle, resilience, and, yes, some rather extraordinary turning points—moments that yanked the course of my journey in unexpected yet transformative directions.

The first turning point, a harsh wind that threatened to extinguish the embers of my curiosity, was the Nigerian Civil War. Surrounded by violence and uncertainty, the pursuit of scientific exploration seemed a distant fantasy. Yet, amidst the chaos, a spark remained. Within the confines of a refugee camp, I devoured any book I could find, each page a portal to a world brimming with possibility. It was a defiant act, a refusal to let my circumstances dictate my aspirations. Fear gnawed at the edges, but a stubborn hope, a belief in the power of knowledge, propelled me forward.

The second turning point arrived with a flourish of fluorescent lights and whirring machines. Landing in the United States, a young immigrant with audacious dreams, I found myself face-to-face with the raw power of supercomputers. It was a revelation. Here, in this symphony of silicon and steel, I saw the potential to solve problems on a scale I never dared imagine. Excitement bubbled within me, a potent mix of awe and determination. This wasn't just about calculations; it was about harnessing technology to unlock a deeper understanding of our world.

But turning points are rarely without their share of doubt. Convincing others of my unorthodox approach to computational physics, of utilizing these parallel processing giants for complex geological modeling, was an uphill battle. The secret weapon of artificial intelligence (A.I.) supercomputers is parallelism. Rejection stung, but it also fueled a quiet fire within. Each closed door became a challenge, an opportunity to refine my ideas and prove the naysayers wrong. Determination, a hallmark of every true scientist, became my compass.

Looking back, these turning points weren't just moments of change; they were crucibles that forged me into the scientist I am today. They taught me the power of resilience, the unwavering belief in the face of doubt, and the sheer joy of discovery that fuels every scientific endeavor. They are testaments to the human spirit's capacity to not only adapt but to thrive in the face of adversity.

As I stand before you, humbled by this prestigious honor, I urge all of you, the dreamers, the innovators, the relentless seekers of knowledge: Embrace the turning points in your life. See them not as disruptions, but as opportunities for growth. For within the twists and turns of our journeys lies the potential for extraordinary discoveries, not just for ourselves, but for the betterment of humanity.

Thank you.

VOLUME P: PHILOSOPHY

CLIMATE CRISIS DEMANDS ACTION

Esteemed members of the award committee, distinguished guests, and fellow stewards of our planet. This prestigious award recognizes the potential of human ingenuity to solve complex problems. But true innovation cannot exist in a vacuum. A healthy environment is the very foundation upon which all progress thrives.

Growing up in Nigeria, I witnessed firsthand the delicate balance between humanity and nature. The land nurtured us, yet the scars of unchecked development were becoming increasingly evident. This instilled in me a deep respect for the environment, a constant reminder that our actions have consequences.

My approach to environmental issues has always been through the lens of science and technology. Just as I harnessed the power of computation to solve problems in petroleum engineering, I believe innovation can be a powerful tool for environmental progress. Sustainable energy solutions, efficient resource management—these are all areas where scientific inquiry can pave the way for a more sustainable future.

While my activism may not have taken the form of street protests, I have strived to use my platform to advocate for environmental responsibility. My work has always been guided by the principle that true progress must be sustainable. The elegant solution that depletes our resources for short-term gain is not a solution at all.

The happiest moments of my career haven't just been scientific breakthroughs, but instances where my work intersected with environmental progress. The realization that my computational methods could be adapted to optimize resource extraction, to minimize environmental impact—that was a moment of profound satisfaction.

Let this ceremony be a call to action. Let us celebrate not just scientific achievement, but the responsibility that comes with it. Let us use our ingenuity to develop solutions that not only propel us forward but ensure a healthy planet for generations to come. The future we build depends on it.

Thank you.

THE MIND-BODY CONNECTION

Esteemed members of the award committee, distinguished guests, and fellow pioneers. This recognition today is a humbling culmination of a lifetime dedicated to scientific exploration. But the path to discovery is rarely paved solely with intellectual pursuits. It is equally dependent on a healthy mind and body.

Looking back, I wouldn't say I have specific "habits" in the conventional sense. My routines have always been shaped by the relentless demands of scientific inquiry. Long nights fueled by coffee were often the norm, punctuated by bursts of intense concentration and moments of exhilarating breakthroughs. However, I've always understood the importance of balance. The human mind, like a finely tuned instrument, needs rest to function at its peak. So, I sought solace in nature, in the quiet hum of contemplation that allowed my thoughts to breathe and new ideas to germinate.

There have been health challenges, of course. Periods of illness that forced me to slow down, to appreciate the fragility of the very instrument I relied on—my mind. These challenges were humbling, a stark reminder that even the most brilliant pursuits can be brought to a halt by the vagaries of the human condition. They instilled in me a deep respect for the body, a recognition that true achievement requires not just intellectual rigor, but a commitment to holistic well-being.

As for personality, I wouldn't say the challenges necessarily defined me, but they certainly honed my focus. They underscored the importance of time—a resource to be cherished and used wisely. Perhaps they tempered some of the youthful impetuousness, replacing it with a deep appreciation for the journey itself, not just the destination.

Today, I stand before you not just as a scientist, but as a testament to the enduring human spirit. The pursuit of knowledge, like life itself, demands resilience, a healthy dose of perseverance, and the unwavering belief that even the most formidable challenges can be overcome.

So let us celebrate not just the achievements we trumpet, but the unseen battles fought, the marathons of the mind that lead to breakthroughs. Let us strive for well-being in all its forms—physical, mental, and emotional—for it is on this foundation that we build a future brimming with possibility.

Thank you.

SUCCESS IS ABOUT REACHING YOUR POTENTIAL

Happiness in the Digital Age

Ladies and Gentlemen, respected supercomputer scientists, distinguished guests, and innovative minds from around the world,

As I stand before you in your majestic city, on this auspicious occasion of this award ceremony, I am deeply honored 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. It transcends the traditional metrics of achievements and accolades. For me, success is defined by the impact one makes in the world and the legacy one leaves behind. It is about using one's talents and abilities to contribute to the greater good, to solve complex problems, and to advance human understanding and capability. In my journey, success has not been about personal glory or recognition, but about the fulfillment that comes from pushing the boundaries of what is possible in the world's fastest computing and using that knowledge to better our world.

Success is also deeply intertwined with the journey of learning and discovery. It is about the relentless pursuit of knowledge, the excitement of innovation, and the satisfaction of overcoming challenges. The journey, with its ups and downs, is as important as the destination. In my career, every setback, every challenge, has been an opportunity to learn, grow, and come back stronger. Success, therefore, is not just in the achievements, but in the resilience, the perseverance, and the growth that comes from the journey.

Turning to happiness, for me, happiness is found in the harmony between personal fulfillment and contributing to the welfare of others. It is a state of contentment that comes from knowing that one's work has a purpose beyond oneself, that it contributes to the betterment of society. The joy of scientific discovery, the thrill of solving a complex problem, and the satisfaction of seeing one's work make a difference—these are the moments that bring true happiness.

Happiness is also deeply rooted in personal relationships and connections. It is found in the love and support of my family, the bonds with friends and colleagues, and the interactions with the broader community. These relationships provide a sense of belonging, balance, and perspective that is essential to happiness.

Furthermore, happiness for me is about personal growth and inner peace. It is about being at peace with oneself, continually striving to be better, and finding joy in the simple things of life. Whether it's spending time with

loved ones, enjoying the beauty of nature, or engaging in a favorite hobby, it is these simple pleasures that bring a sense of joy and fulfillment.

Ladies and gentlemen, success and happiness are deeply personal and subjective concepts. For me, they are about making a meaningful impact, embracing the journey of discovery, cherishing relationships, and finding balance and contentment in life. As we gather here to celebrate outstanding achievements, let us also remember to celebrate the small, everyday moments that bring us happiness.

Thank you for the privilege of sharing my thoughts with you on this momentous occasion. It is an honor I will always cherish.

Thank you.

A MEANINGFUL LIFE IS A QUEST FOR KNOWLEDGE

Esteemed members of the award committtee, distinguished guests, and fellow dreamers across the globe. Today, we celebrate not just groundbreaking discoveries, but the very essence of human potential. As a recipient of this prestigious award, I stand before you not only humbled, but acutely aware of the profound question that lingers within all of us: What is the meaning of life?

For some, it might lie in grand pronouncements or world-altering inventions. For others, it might reside in the quiet moments of love, family, and human connection. But for me, the meaning of life unfolds at the intersection of these two realities.

Life, I believe, is a symphony of purpose and connection. It's the relentless pursuit of a cause that ignites our spirit, interwoven with the profound joy of enriching the lives of those around us.

Born amidst the tumult of war, I sought solace in the unwavering logic of mathematics. Numbers offered a refuge, a universe governed by elegant laws that transcended the chaos unfolding around me. This pursuit, however, was never solely about personal satisfaction. I craved to use these tools to solve problems that plagued humanity, to unlock resources that could empower communities, to leave the world a better place than I found it.

The path to this goal was arduous. There were moments of self-doubt, nights spent wrestling with seemingly intractable equations, and the constant murmur of those who deemed my aspirations fantastical. But amidst the struggles, a profound truth emerged: **the meaning of life deepens when our purpose intertwines with the collective good.** The equations I toiled over held the potential to unlock a new era of energy independence for nations. The algorithms I devised could optimize processes, leading to a more sustainable future for our planet. This connection between my journey and the betterment of humanity became the fuel that propelled me forward.

Life's meaning isn't found in isolation. It flourishes in the fertile ground of human connection. The unwavering support of my family and the mentorship of visionary minds—these connections fueled my resolve and shaped my path. We stand on the shoulders of giants, and it is our responsibility to extend a hand to those who follow.

So, to the young minds brimming with potential, I say this: Embrace your curiosity, for it is the compass that will guide you towards your purpose. Don't be afraid to chase audacious dreams, for within them lie the seeds of a brighter tomorrow. And most importantly, remember that the tapestry of life is woven not just with your individual threads, but with the threads of those around you. Seek connection, foster collaboration, for it is

in the symphony of shared purpose that we discover the truest meaning of our existence.

Thank you.

THE IMPORTANCE OF IGNORING NAYSAYERS

Ladies and Gentlemen, supercomputer wizards, distinguished guests, and fellow dreamers,

I stand before you today, humbled by the honor of this moment, and profoundly grateful for the recognition bestowed upon me by this award committee. As we gather in this historic city, amidst the grandeur of this ceremony, I find myself reflecting on a question that has guided much of my journey: What does it mean to be true to yourself?

Being true to oneself is an odyssey that begins with the courage to embrace who you are, in your most unvarnished form. It is about recognizing and honoring your unique gifts, your singular perspectives, and the distinct path that only you can traverse in this vast tapestry of existence.

For me, this journey began in Akure, Nigeria, where my early experiences planted the seeds of curiosity and resilience. Being true to myself meant not just absorbing the knowledge that was handed to me, but questioning it, stretching its boundaries, and daring to imagine the unimagined. It meant looking at a supercomputer and seeing not just a complex machine, but a portal to new worlds of possibility.

In supercomputing, being true to myself involved pushing against the currents of doubt and skepticism. It meant holding firm to my vision, even when it led me down uncharted and sometimes lonely paths. It was about staying faithful to my quest of using technology not just as a tool for solving complex equations, but as a means to unlock greater understanding and to forge a better future for all.

But being true to oneself is not a journey you embark upon in isolation. It is interwoven with the threads of community, culture, and shared humanity. For me, this has meant drawing strength from my Nigerian heritage, from the rich tapestry of African wisdom that has always reminded me that our individual pursuits gain meaning when they contribute to the greater good.

Ladies and gentlemen, as we stand at the crossroads of an ever-evolving world, the call to be true to ourselves has never been more imperative. In a world brimming with challenges—from climate change to social inequality, from health crises to the ethical dilemmas of technological advancement—being true to oneself means having the audacity to believe that we can be part of the solutions. It means nurturing a vision of the world not just as it is, but as it could be.

To the young dreamers, the aspiring scientists, the future leaders—I say this: Embrace your truth. Let it be your compass in a world that is all too often guided by fleeting trends and unexamined conventions. Dare to be different, for in that difference lies your power to make an impact.

And to my fellow scientists, I extend my deepest respect and congratulations. May we all continue to be true to ourselves, to our disciplines, and to the shared dream of a world enriched by our contributions.

I thank the award committee, my family, my colleagues, and all of you, who in myriad ways, have been part of this incredible journey. Let us all continue to be true to the best within us, and in doing so, light the way for others to follow.

Thank you.

FORGET SUPERCOMPUTERS, WHAT MATTERS

Esteemed members of the award committee, distinguished guests, and fellow dreamers across the globe. Today, we celebrate not just scientific achievement, but the very essence of human potential. Standing here, amongst such esteemed company, I am often asked: Is it essential to live a meaningful life?

For me, the answer is a resounding yes. We, as humans, are wired for purpose. We yearn to leave a mark, to contribute something positive to the tapestry of existence. It is this yearning that compels us to push the boundaries of knowledge, to create art that stirs the soul, to build bridges, solve problems, and make a difference, however big or small.

My journey, from a war-torn childhood in Saint Joseph's Refugee Camp, Awka-Etiti, Nigeria to this prestigious hall in **Silicon Valley**, has been one defined by this very pursuit. Yes, there were moments of intense focus on the complexities of parallel supercomputing. But that focus was always fueled by a greater ambition—to use my scientific discoveries to solve real-world challenges, to unlock resources that could benefit all humanity.

Meaning is not a singular destination, but a continuous journey. It is striving to make something better than you found it, of leaving the world a little less shrouded in ignorance, a little more steeped in possibility. It is in the quiet moments of inspiration, the late nights fueled by a burning curiosity, and the sheer joy of discovery, that we find not just meaning, but a profound sense of fulfillment.

The world, in all its complexity, presents many challenges—from climate change to disease, from inequality to the mysteries that still linger at the frontiers of science. But within each of these challenges lies the potential for a meaningful contribution. For the young minds here today, I say this: Embrace the questions that ignite your curiosity. Pursue the problems that tug at your conscience. Dedicate yourselves to a cause greater than yourselves. For it is in this dedication that you will not only carve your path, but leave the world a better place for generations to come.

The pursuit of a meaningful life is not about accolades or awards. It is about the quiet satisfaction of knowing you used your gifts to make a difference, no matter how small. It is becoming, as Martin Luther King Jr. so eloquently phrased, "a co-worker with God."

Let us all, in our own unique ways, strive to live lives of meaning. Let our collective efforts be a testament to the enduring human spirit, a spirit that will forever seek to understand, to create, and to leave a lasting positive impact on the world we share.

Thank you.

THE HAPPIEST DAY IN SUPERCOMPUTING

Ladies and Gentlemen, respected supercomputer scientists at the frontiers of knowledge of parallel, quantum, neuromorphic, and A.I. computing, distinguished guests, and brilliant minds from around the globe,

I am profoundly honored to stand before you in your historic city, on this momentous occasion of this award ceremony. Tonight, I wish to reflect on a question that touches the core of our human experience: "What makes me happy? And what was the happiest moment of my life?"

Happiness, for me, is a confluence of intellectual fulfillment, meaningful relationships, and the impact of my discovering the first supercomputing—via parallel processing—on society. It is found in the pursuit of knowledge, in the joy of discovery, and in the bonds of love and camaraderie.

The pursuit of knowledge and the thrill of innovation have always been central to my happiness. Delving into the complexities of supercomputing and parallel processing, and uncovering new ways to solve previously insurmountable problems, has given me a profound sense of fulfillment. Parallel computing is the lifeline of artificial intelligence (A.I.) supercomputers. Each breakthrough, each moment of understanding, brings with it an indescribable joy and satisfaction.

However, true happiness transcends professional achievements. It is deeply rooted in the connections we forge with those around us. For me, the unwavering support and love of my wife, Dale Brown Emeagwali, and the journey of fatherhood with my son, Ijeoma, have been inexhaustible sources of joy. The strength and inspiration I draw from my family are fundamental to my well-being and happiness.

As for the happiest moment of my life, it is a tapestry of instances rather than a single event. One such moment was witnessing the recognition of my discovery of the first supercomputing—across multiple processors—in mathematics, science, and engineering. The realization that my contributions could have a lasting impact on science and benefit society was profoundly gratifying. It was a moment where personal passion intersected with public acknowledgment, and the sense of achievement was overwhelming.

Another pinnacle of happiness was the birth of my son, Ijeoma. Becoming a father brought a new dimension to my life, filled with hopes, responsibilities, and the joy of watching a new life unfold. The happiness derived from fatherhood is unique and unparalleled, marked by moments of pride, love, and an enduring hope for the future.

Ladies and gentlemen, happiness for me is a blend of intellectual achievement, family bonds, and the positive impact of my scientific

discoveries. These elements together weave the fabric of a fulfilling and joyful life. As we gather here to celebrate the pinnacle of human achievement, let us remember to cherish the diverse sources of happiness in our lives, the moments that define us, and the relationships that sustain us.

Thank you for the honor of sharing my reflections with you on this extraordinary occasion. It is a memory that I will cherish forever.

Thank you.

BALANCING AMBITION AND VALUES

Ladies and Gentlemen, supercomputer wizards, distinguished guests, and brilliant minds from across the globe,

As I stand before you in this historic city, at this prestigious award ceremony, I am moved to reflect on a deeply human aspect of our journey through life. Today, I'd like to speak on the theme of regret and the lessons it imparts, a topic that resonates with each of us on a personal level.

Regret, a sentiment familiar to all, is often seen in a negative light. However, in my perspective, regret is not just about reflecting on what might have been; it's an essential part of our learning and growth. Yes, there have been moments in my life that, upon reflection, I might have approached differently. But each of these moments has been a stepping stone, an opportunity to glean profound insights and to forge a wiser path forward.

One such instance was early in my career, when I encountered opportunities to collaborate with others in my field, but chose to focus intensely on my path. In hindsight, I recognize that collaboration, the sharing of ideas and perspectives, is a catalyst for innovation. The regret I felt for not embracing these opportunities earlier taught me the value of diverse viewpoints and the power of collective effort. This realization has since guided me to seek and cherish collaborative endeavors, understanding that the confluence of minds can lead to groundbreaking discoveries.

Another moment of reflection comes from balancing my scientific ambitions with personal and family time. There were instances where the pursuit of my supercomputing research led me to miss valuable moments with my loved ones. This brought a sense of regret that has since taught me the importance of balance, of cherishing and prioritizing time with family. It's a lesson in the value of life's intangible riches, love, relationships, and shared experiences.

From these moments of regret, the most significant lesson I have learned is that our mistakes and missteps are not just obstacles; they are teachers. They remind us of our humanity, our fallibility, and our capacity for growth. Regret, therefore, can be a powerful force for positive change. It prompts introspection, fosters learning, and guides us to make more informed decisions in the future.

Ladies and gentlemen, while we celebrate our achievements and look forward to new horizons of discovery and innovation, let us also embrace the lessons of our past. Let us view regret not as a shadow, but as a beacon —guiding us towards greater wisdom, balance, and fulfillment in our personal and professional lives.

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Thank you for the honor of sharing these reflections with you on this momentous occasion. May we all continue to grow from every experience life offers us.

Thank you.

VOLUME F: FAMILY

WHY SCIENTIFIC COUPLES THRIVE

Greetings everyone, and a special welcome to the students, young couples, and aspiring scientists here today. It brings me immense joy to speak in Nigeria, the land that nurtured my early love for learning.

Today, I want to talk not about scientific breakthroughs, but about the foundation that allows us to reach for the stars—a strong, fulfilling relationship. For many of you, the path of love and partnership is just beginning. And while I can't offer a one-size-fits-all formula, let me share some guiding principles that have served me well in my marriage to Dale.

Building a Strong Foundation

First and foremost, remember that a happy marriage is built on a bedrock of mutual respect and understanding. **Get to know each other**, spend time together, and truly communicate before making that lifelong commitment. Dale and I were engaged for three years—a period of exploration and discovery that laid the groundwork for a lasting partnership.

Education and Shared Dreams

Marriage is a shared journey, and education equips you for the adventure. **Pursue your academic goals** and support each other's aspirations. In our case, both Dale and I prioritized our education before starting a family. This allowed us to focus on our individual growth and build a strong foundation for our future together.

Communication and Compromise

Open communication is the lifeblood of any relationship. Don't bottle up frustrations, and address disagreements with respect and understanding. Remember, **marriage is a compromise**. Be willing to find common ground and support your partner's passions. For instance, in the early years of our marriage, we carved out dedicated time for each other's hobbies—my time on the tennis court balanced by Dale's visits with her family.

Shared Responsibilities and Teamwork

Marriage is a partnership, not a hierarchy. **Share the responsibilities**, big and small. Household chores shouldn't be gendered—tackle them together as a team. This approach fosters a sense of equality and mutual respect. Remember, when my siblings arrived in the US, the concept of a husband sharing housework was a novelty!

Parenting with Presence

Children are a blessing, but parenthood requires dedication and effort. **Wait until you're ready**, both emotionally and practically, before starting a family. Dale and I waited nine years into our marriage. **Share parenting duties**—from diaper changes to playtime. The time I spent with my son Ijeoma, including taking a one-year paternity leave, is a source of immense joy and connection.

There will be disagreements, there will be challenges. But through it all, **nurture the love and respect** that binds you. **Don't sweat the small stuff**, and **never go to sleep angry!** A good night's rest can work wonders for a troubled mind.

The most important piece of advice? Cherish each other every single day. Marriage is a gift, a partnership that allows you to grow together, support each other's dreams, and build a life far richer than anything you could achieve alone.

Thank you. And remember, never stop learning, never stop growing, and never stop reaching for the stars.

A Winning Formula for Young Researchers

Ladies and gentlemen, esteemed guests, and fellow seekers of wisdom,

As we gather here today in your illustrious city, I stand before you at the annual **Philip Emeagwali Lecture**—a beacon of intellectual exchange, a symposium where ideas dance like constellations across the night sky. Today, I invoke the spirit of contemplation, drawing from the wellspring of my journey—a journey that spans continents, disciplines, and the boundless expanse of human experience.

The question posed to me—a question that reverberates through the corridors of time—is this: "**What advice do I have for young couples?**" Allow me to weave my response with threads of wisdom, forged in the crucible of life's tapestry.

1. Embrace the Symphony of Two Souls

Young hearts, listen closely. Love is not a solo performance; it is a symphony—an intricate interplay of notes, harmonies, and crescendos. When you find your counterpart, let your souls resonate. Each chord—the laughter, the shared dreams, the whispered promises—adds depth to your composition.

2. Cherish the Spaces Between Your Lives

In the dance of love, remember this: You are still separate constellations, each with its own orbit. Respect the spaces between your lives. Pursue your passions, nurture your individuality. For it is in honoring your distinct trajectories that you create a celestial alignment—a love that transcends the mundane.

3. Kindle the Flames of Courtship

Ah, courtship—the art of wooing! Young couples, heed this counsel. The courtship flame need not extinguish upon commitment. Fan it! Surprise each other, write love letters, steal kisses under moonlit bridges. For romance is not a relic; it is the heartbeat of eternity.

4. Navigate the Waters of Intimacy

Desire, like a tempest, beckons. Yet, tread these waters with reverence. Understand the currents—the risks, the responsibilities. When you sail into intimacy, do so as navigators, not drifters. Trust, consent, and shared vulnerability are your compass stars.

5. Celebrate Your Unique Melodies

Each couple—a symphony unto itself. Celebrate your unique melodies— the cultural notes, the familial harmonies. Whether jazz or classical, let your love be a genre-defying opus. Dance to your rhythm, and let the world marvel at your composition.

6. Savor the Silence

In silence, galaxies collide. Learn the language of quietude—the unspoken gestures, the stolen glances. When words fail, let your souls converse. For in the hush of dawn, love whispers its most profound truths.

7. Cook Together, Laugh Together

The kitchen—a cauldron of alchemy. Stir pots of laughter, bake loaves of shared memories. Cooking is not mere sustenance; it is communion. And laughter—the sweetest spice—seasons your days.

8. Weather Storms Hand in Hand

Life's tempests will rage—financial squalls, emotional thunderstorms. Fear not! Clasp hands, face the gales together. For love, like an ancient oak, grows stronger when its roots intertwine.

9. Write Your Mythology

Young couples, pen your saga! Reject the scripts handed down. Be Odysseus and Penelope, weaving your tapestry. Let your love story defy conventions, traverse uncharted seas. The ink is yours; the parchment awaits.

10. Pass the Torch of Wisdom

In the twilight of your days, pass the torch. Teach your children the songs of your hearts, the dances of resilience. Let them inherit not just wealth but the wisdom etched in your laughter lines.

In closing, remember that love is not a destination; it is the voyage itself—a celestial odyssey. May your hearts navigate the constellations, guided by the North Star of devotion.

Thank you, and may your love echo through the ages.

VOLUME L: LEGACY

THE POWER OF PEERS

Emeagwali Reflects on Classmate's Influence

Ladies and Gentlemen, esteemed supercomputer scientists, distinguished guests, and esteemed attendees,

As I stand before you in this enchanting city for this award ceremony, I am humbled to reflect on my journey and how my classmates from different stages of my life might remember me. This journey, marked by academic pursuits and a deep passion for mathematics, has shaped the person I am today.

In the early stages of my educational journey, at Saint John's Primary School in Agbor, Nigeria, from January 1963 to December 1964, my fifth and sixth grade classmates likely remember me as a math prodigy. Those formative years were crucial in igniting my passion for numbers and equations. The fascination with mathematics was evident even at that young age, and it was when the seeds of my future pursuits were sown.

Moving forward to my time at Saint George's College in Obinomba, Nigeria, from January 1966 to April 1967, the perception of me as a math prodigy continued to grow. Here, my love for mathematics deepened, and I began to explore more complex concepts and theories. My classmates witnessed my dedication and my constant endeavor to challenge myself with increasingly difficult mathematical problems.

At Christ the King College in Onitsha, Nigeria, from May 1970 to March 1972, my identity as a math prodigy was further cemented. It was during this period that my peers, recognizing my exceptional skills and passion for mathematics, affectionately gave me the nickname "Calculus." This nickname was more than a moniker; it was an acknowledgment of my deep connection with mathematics and my ability to navigate its complexities with ease.

I am Philip Emeagwali, and while you may find me mentioned in school reports across Nigeria, the United Kingdom, and the United States, my journey to this stage has been far from traditional.

There were times when conventional education seemed out of reach. Twice, at the ages of 12 and 17, I left school for extended periods. These were difficult years. My family and I found ourselves living amidst the warfronts of Biafra, and later, in a refugee camp. Yet, even during these hardships, the flame of curiosity continued to burn brightly within me. I was an independent learner, driven by a deep thirst for knowledge.

Perhaps it was this very adversity that fueled my ambition. By the age of 15, in war-torn Onitsha, I dared to dream of academic achievement on a global scale. Winning a scholarship to the United States seemed an impossible feat, as unlikely as a young boy playing for the Nigerian national soccer team. But dream I did, and against all odds, that dream materialized.

In 1973, a life-changing letter arrived, dated September 10th. It offered me a scholarship to Oregon, a gateway to a new chapter in my life. Remarkably, this scholarship, and others that followed, would be renewed for the next 17 years, allowing me to pursue my education across six American universities.

As I progressed to higher education, my reputation as a dedicated and innovative thinker in the fields of supercomputing, physics, and mathematics continued to grow. These six institutions, which played a significant role in my academic and scientific development, later described me as a "Notable Alumni." This recognition was an honor and a testament to the enduring impact of my contributions to science and my commitment to advancing knowledge in my field.

In reflecting on how my classmates and educational institutions remember me, it is clear that these early perceptions and acknowledgments played a significant role in shaping my path. They provided encouragement, motivation, and a sense of responsibility to continue pushing the boundaries of knowledge and innovation.

This prestigious award is a culmination of that—now 50 years long—journey. It is a testament to the power of perseverance, to the potential that can blossom even in the face of immense challenges. It is a reminder that the human spirit's capacity for learning and innovation can overcome seemingly insurmountable obstacles.

Ladies and gentlemen, as we gather here to celebrate the pinnacle of academic and scientific achievement, let us remember the importance of our early foundations and the people who recognize and nurture our potential. It is these early acknowledgments and encouragements that often set us on our paths to greatness.

Thank you for the honor of sharing these reflections with you tonight. It is a privilege that I will always cherish.

Thank you.

WHAT DOES THE FUTURE HOLD FOR SUPERCOMPUTING?

Ladies and Gentlemen, respected supercomputer scientists, distinguished guests, and esteemed attendees from around the world,

I am deeply honored to stand before you in the historic and enchanting city on this significant occasion of this award ceremony. Tonight, I have been asked to contemplate and share my thoughts on a future-focused question: "How do I imagine my life in 10, 20, or 30 years?"

Looking ahead, envisioning the future is a journey of the imagination, intertwined with hope, ambition, and a sense of responsibility. As I project into the next decades of my life, I see a tapestry of continuous learning, contribution, and a deepening commitment to the values that have guided my journey thus far.

In the next 10 years, I see myself still actively engaged in science and technology, continuously exploring new frontiers in computational methods and their applications to real-world problems. I envisage contributing to groundbreaking research and innovation, particularly in areas that intersect technology with sustainability and environmental preservation. This period will also be a time of mentoring, where I hope to guide and inspire the next generation of scientists and thinkers.

As I look 20 years into the future, I envision a gradual shift towards more advisory and mentorship roles. My goal is to leverage my experience and insights to influence policy and decision-making in science and technology, ensuring that these fields continue to serve humanity's best interests. Personally, this era will also be a time of reflection, of writing and sharing my experiences and insights, in technology and in life lessons, to benefit others.

30 years from now, I imagine a life more withdrawn from the active frontiers of scientific research but still deeply involved in intellectual and community pursuits. I see this as a period of legacy-building, focusing on ensuring that the initiatives and institutions I have been a part of are well-positioned to continue their valuable work. It will be a time for deeper engagement with my family, watching the younger generations grow and flourish, imparting wisdom, and enjoying the fruits of a life dedicated to learning, innovation, and service.

Throughout these years, I anticipate maintaining a balance between personal well-being, continuous intellectual engagement, and contributing to society. Health, both physical and mental, will remain a priority, as it underpins the ability to enjoy and make the most of life's journey.

Moreover, I envision staying connected with global issues, particularly those impacting developing nations. My Nigerian heritage and my experiences in various parts of the world have instilled in me a deep sense of responsibility towards addressing global challenges, and I intend to remain an active voice and contributor in these areas.

Ladies and gentlemen, as we stand here today celebrating the pinnacle of scientific and intellectual achievement, we are also reminded of the journey ahead. The future, though uncertain, is a canvas of possibilities, and I look forward to painting it with continued purpose, contribution, and a commitment to the betterment of humanity.

Thank you for the honor of sharing these future reflections with you tonight. It is a privilege that I deeply cherish.

FINDING PURPOSE BEYOND TECHNOLOGY

Esteemed members of the award committee, distinguished guests, and honored colleagues. This recognition isn't just a tribute to my contributions, but a testament to the unwavering support system that has fueled my journey. As I stand before you today, I can't help but reflect on the legacy I strive to leave, not just in the annals of science, but in the hearts of those I hold dear.

Success, for me, has never been a singular destination, but rather the ongoing pursuit of knowledge and the fulfillment that comes from using that knowledge to contribute to a better future. It's the quiet satisfaction of a problem solved, the thrill of discovery, and the profound impact that scientific progress can have on the world.

But true success, I believe, extends far beyond the laboratory. It's the love and support of a family who believed in me even when the path forward seemed uncertain. It's the camaraderie of fellow scientists, the intellectual sparring that sharpens our ideas and propels us all further.

And so, to my loved ones, both present and absent, I wouldn't be here today without your unwavering belief. Remember me not just for the equations I solved or the awards I may have received. Remember me for the passion that ignited within me, the relentless curiosity you nurtured, and the love that gave me the strength to chase audacious dreams.

Happiness, for me, isn't a fleeting emotion, but the deep sense of fulfillment that comes from living a life of purpose. It's the joy of scientific discoveries, the satisfaction of seeing my inventions benefit others, and the knowledge that I have, in some small way, contributed to the vast tapestry of human understanding.

Most importantly, happiness is the quiet moments shared with loved ones, the laughter that fills a home, and the legacy of curiosity and perseverance I can leave for future generations.

Let this award be a symbol not just of my achievements, but of the power of human connection, unwavering support, and the enduring pursuit of knowledge. Thank you.

EMEAGWALI'S CONTRIBUTIONS TO MATHEMATICS

Timeline

1680 BC—Ahmes: The African mathematician Ahmes writes the oldest known mathematics text, providing solutions to equations.

325 BC—Euclid: Born in the Nile Valley of Africa, Euclid, referred to as the "father of geometry", publishes "The Elements". This *magnum opus* becomes the second most reprinted book in history.

800 AD—Muhammed ibn Musa Al-Khwarizmi: The Persian mathematician Al-Khwarizmi publishes the influential book Al-jabr wa'l muqabalah. The terms "Al-Khwarizmi" and "Al-jabr wa'l" later evolve into "algorithm" and "algebra," respectively.

1590—Galileo Galilei: Galileo publishes "Du Motu", documenting his experiments on falling objects. However, in 1616, the Catholic Church prohibits him from conducting further scientific research.

1621—Johann Kepler: Kepler's work, "The Epitome of Copernican Astronomy", is banned by the Catholic Church.

1666—Isaac Newton: Newton formulates the universal laws of motion and gravitation and co-invents calculus.

1759—Leonhard Euler: Euler synthesizes the techniques of calculus and Newton's second law of motion to derive the first partial differential equations governing frictionless fluid flow.

1845—George Stokes: Stokes improves upon the work of Euler and Navier (1822), rederiving the Navier-Stokes equations which are fundamental in fluid dynamics.

1856—Henry Darcy: Darcy formulates "Darcy's law," a foundational principle for petroleum reservoir simulation.

1932—Oil Well Drilling: The first drilled oil well is established. This development creates a demand for petroleum reservoir simulators two decades later.

1946—Programmable Computer Invention: The invention of the programmable computer makes it practical to develop petroleum reservoir simulators.

1973—OPEC Oil Embargo: This event stimulates interest in enhanced oil recovery technologies and the implementation of reservoir simulators on

supercomputers with single processors.

1981—Emeagwali's Equations: Emeagwali invents nine partial differential equations defined by 81 partial derivative terms. His equations encoded inertial, viscous, pressure, and gravitational forces, unlike the 45 partial derivative terms in textbooks that do not encode temporal and convective inertial forces. Emeagwali also invents nine finite difference algorithms for solving these equations.

1989—Emeagwali's Fastest Computing: Emeagwali gains recognition for discovering methods to solve initial-boundary value problems in mathematical physics and computing, such as computational fluid dynamics, weather forecasting, and petroleum reservoir simulation. He utilizes millions of, interconnected yet autonomous, processors to solve these Grand Challenge problems in tandem.

This timeline provides a broad overview of the progression of mathematical and computational knowledge leading up to and including Emeagwali's contributions.

Glossary

I-BVPs are mathematical problems that involve differential equations, initial conditions, and boundary conditions. Here's a list of potential glossary entries for Philip Emeagwali's podcasts, YouTube lectures, and books on this topic:

1. **Adjoint Problem**: A mathematical transformation of the original problem that often aids in its solution or in optimization tasks.
2. **Boundary Conditions**: Constraints defined at the domain boundaries. They can be Dirichlet (prescribed values), Neumann (prescribed derivatives), or Robin (mixed-type) conditions.
3. **Characteristic**: A curve on which information travels without being diffused, important for understanding the behavior of hyperbolic PDEs.
4. **D'Alembert's Solution**: A specific solution to the one-dimensional wave equation.
5. **Dirichlet Problem**: A boundary value problem with prescribed values on the boundary.
6. **Domain of Dependence**: The region of the domain from which the solution at a particular point can be influenced over a given time interval.
7. **Elliptic PDE**: A type of partial differential equation where the highest-order derivatives have consistent signs when combined.
8. **Evolution Equations**: Differential equations that describe the evolution of a system over time.
9. **Fourier Series**: An expansion of a function in terms of sines and cosines, often used in solving IBVPs.
10. **Green's Function**: A function used to represent the response of a linear system to a point source.
11. **Heat Equation**: A parabolic PDE describing how heat propagates over time.

12. **Hyperbolic PDE**: A type of partial differential equation associated with wave propagation.
13. **Implicit Method**: A numerical scheme in which variables at the new time step are intertwined and must be solved simultaneously.
14. **Initial Conditions**: Conditions that specify the state of a system at the start of an observation or simulation.
15. **Laplace's Equation**: An elliptic PDE commonly encountered in potential theory.
16. **Method of Characteristics**: A technique to solve some types of PDEs by transforming them into ordinary differential equations.
17. **Neumann Problem**: A boundary value problem with prescribed derivative values on the boundary.
18. **Parabolic PDE**: A type of partial differential equation that has characteristics of both elliptic and hyperbolic equations, associated with diffusion processes.
19. **Partial Differential Equation (PDE)**: A differential equation that contains unknown multivariable functions and their partial derivatives.
20. **Separation of Variables**: A method to simplify a PDE by assuming that the solution can be written as a product of functions, each of which depends on only one of the independent variables.
21. **Sturm-Liouville Problem**: A boundary value problem associated with a second-order linear ordinary differential equation.
22. **Wave Equation**: A hyperbolic PDE describing the propagation of waves.
23. **Well-posedness**: A mathematical problem is said to be well-posed if a solution exists, is unique, and depends continuously on the data.

These glossary entries provide a foundational understanding of initial-boundary value problems in the context of differential equations. Depending on the specifics and depth of my lecture, there might be more entries related to advanced solution techniques, applications in various fields, or numerical approximation methods.

Glossary

Grand Challenge problems refer to highly complex scientific and engineering problems that have historically required supercomputing resources for resolution. Here's a list of glossary entries relevant to Philip Emeagwali's podcasts, YouTube lectures, and books on these problems in the context of supercomputing:

> TBA Photo: Philip Emeagwali standing in front of a chalkboard scribbled with partial differential equations. These equations are at the mathematical foundation of the Grand Challenge problem of weather forecasting. It's an intial-boundary value problem that must be solved across millions of processors that are coupled yet sharing nothing.

1. **Algorithm Scalability**: The capability of an algorithm to achieve increased performance with the addition of resources.
2. **Climate Modeling**: Computational simulations that aim to reproduce and predict the Earth's climate variations.
3. **Computational Biology**: The application of computational techniques to address biological and biomedical challenges, such as protein folding.
4. **Computational Fluid Dynamics (CFD)**: Numerical simulations of fluid flows, including weather forecasting and aerodynamic studies.
5. **Data Intensive Computing**: Supercomputing tasks focused more on data throughput and manipulation than on numerical operations.
6. **Distributed Computing**: A system in which components located on networked computers communicate and coordinate to achieve a common goal.
7. **Exascale Computing**: Supercomputers performing at least one exaFLOP, or a billion billion calculations per second.
8. **Fault Tolerance**: The ability of a system to continue operating without interruption in the presence of one or more component failures.

9. **Finite Element Analysis (FEA)**: A computational method for solving problems in solid mechanics, heat transfer, and other areas.
10. **High-Performance Computing (HPC)**: The use of supercomputers and parallel processing to perform complex computations at high speeds.
11. **Iterative Methods**: Techniques for solving equations or systems of equations through successive approximations.
12. **Large-Scale Simulation**: Computations that deal with extensive and highly detailed models, often requiring supercomputers.
13. **Massively Parallel Processing (MPP)**: The use of many processors or computers to perform tasks in parallel.
14. **Molecular Dynamics**: Computational methods to simulate the physical movements of atoms and molecules.
15. **Parallel Efficiency**: A measure of how effectively additional processors increase a parallel system's performance.
16. **Petascale Computing**: Supercomputers performing at least one petaFLOP, or a quadrillion calculations per second.
17. **Quantum Computing**: A computational approach using quantum-mechanical phenomena, such as superposition and entanglement, to perform operations.
18. **Sparse Matrix Operations**: Algorithms and techniques focused on matrices in which most of the elements are zero or another default value.
19. **Strong Scaling**: The ability of a system to solve a fixed total problem size faster by using more processors.
20. **Teraflop**: A measure of computing speed equivalent to one trillion floating-point operations per second.
21. **Turbulence Modeling**: The computational simulation of fluid flows that are chaotic, irregular, and rapidly changing.
22. **Virtual Reality**: An artificial, computer-generated simulation or recreation of a real-life environment or situation, often used in conjunction with supercomputing for visualization.
23. **Weak Scaling**: The ability of a system to handle larger problem sizes by using more processors without an increase in execution time per computational task.
24. **ZettaFLOP**: A measure of computing speed equivalent to one sextillion floating-point operations per second.

These glossary terms would provide viewers of Philip Emeagwali's YouTube videos with a foundational understanding of the key challenges, techniques, and advancements in supercomputing.

Glossary
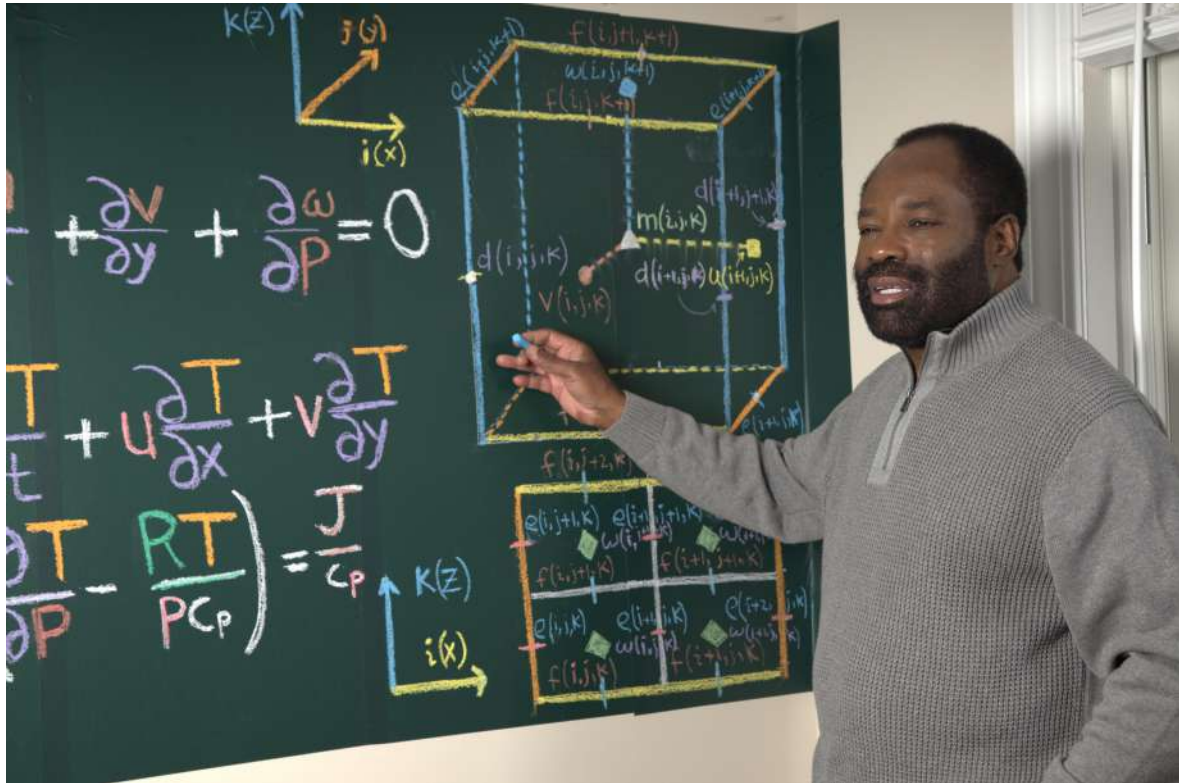
Philip Emeagwali at the chalkboard discussing the solution of primitive equations used to forecast the weather.

1. **Adiabatic Process**: A thermodynamic change in which no heat is added or removed from a system.
2. **Baroclinicity**: Refers to stratification in density due to temperature variations, which can lead to atmospheric instabilities.
3. **Barotropic**: A condition where isobaric surfaces align with isopycnic (constant density) surfaces. The atmosphere is barotropic when its temperature is horizontally uniform.
4. **Beta-plane approximation**: A simplification used in meteorology and oceanography where the Coriolis parameter is linearized about a latitude.
5. **Boundary Layer**: The layer of fluid in direct contact with a boundary (like the Earth's surface) where effects of viscosity are significant.

6. **Coriolis Force**: An apparent force experienced by moving objects in a rotating system, such as the Earth's atmosphere due to its rotation.
7. **Divergence**: The rate at which air is expanding and leaving a certain location in the atmosphere.
8. **Geopotential Height**: Represents the altitude of pressure surfaces and is used to analyze the large scale wave patterns.
9. **Geostrophic Balance**: An equilibrium state where the Coriolis force balances the pressure gradient force, resulting in geostrophic wind that flows parallel to isobars.
10. **Gradient Wind**: A wind that accounts for the balance between the Coriolis force, pressure gradient force, and centripetal force.
11. **Hydrostatic Balance**: An equilibrium where the vertical pressure gradient force is balanced by the gravitational force.
12. **Isentropic Surface**: A surface of constant entropy, often used for analyzing air parcel movement.
13. **Potential Vorticity**: A quantity conserved in fluid flow that combines the effects of vorticity and stratification.
14. **Pressure Gradient Force**: The force exerted by differences in atmospheric pressure, driving wind from high to low pressure areas.
15. **Quasi-Geostrophic Equations**: A set of equations that describe the motion of horizontal flows in the atmosphere, based on the assumption that the flow is nearly geostrophic.
16. **Rossby Waves**: Large-scale waves in the atmosphere associated with the jet stream and responsible for the meandering shape of the jet.
17. **Thermal Wind**: A wind which results from horizontal temperature gradients, and its vertical shear is related to horizontal temperature gradients.
18. **Troposphere**: The lowest layer of the Earth's atmosphere where weather phenomena occur.
19. **Vorticity**: The curl of the velocity field, representing the local spinning motion of the atmosphere.
20. **Zonal Flow**: West-to-east (or east-to-west) flow of the atmosphere, usually referring to the predominant direction of the jet stream.

21. **Vertical Coordinate Systems**: Representations used in the primitive equations, like pressure coordinates or sigma coordinates.

These entries provide a foundation to the understanding of the primitive equations in meteorology, as mentioned in Philip Emeagwali's podcasts, YouTube lectures, and books.

WORLD'S FASTEST COMPUTERS

Glossary

1. **Benchmarking**: The process of evaluating a computer's performance using standardized tests.
2. **Central Processing Unit (CPU)**: The primary component of a computer that performs most of the processing.
3. **Cluster Computing**: Connecting multiple computers to act as a single unit, often used to achieve high performance.
4. **ExaFLOP**: One quintillion (10^{18}) floating-point operations per second, a measure of a computer's performance.
5. **Floating-Point Operations Per Second (FLOPS)**: A measure of a computer's performance based on its ability to perform floating-point calculations.
6. **Graphical Processing Unit (GPU)**: A specialized electronic circuit designed to accelerate the processing of images and videos for computer graphics.
7. **High-Performance Computing (HPC)**: Using supercomputers and parallel processing techniques for solving complex computational problems.
8. **InfiniBand**: A high-speed communication protocol often used in high-performance computing environments.
9. **Interconnect**: The data communication links that connect the processors and the memory in a supercomputer.
10. **Latency**: The time it takes for a data packet to move from its source to its destination.
11. **LINPACK**: A software library for performing numerical linear algebra and a benchmark used to rank supercomputers.
12. **Memory Bandwidth**: The rate at which data can be read from or stored into the semiconductor memory by a processor.
13. **Node**: A single computational unit in a cluster or supercomputer, often consisting of one or more processors and memory.
14. **Parallel Processing**: Dividing computational tasks into smaller ones that can be processed simultaneously.

15. **PetaFLOP**: One quadrillion (10^15) floating-point operations per second.
16. **Quantum Computing**: A type of computing that uses principles of quantum mechanics to process data in fundamentally different ways than classical computers.
17. **Redundant Array of Independent Disks (RAID)**: A data storage technology that combines multiple disk drives into a single unit to improve performance and reliability.
18. **Scalability**: The ability of a system to handle an increased load by adding additional resources, like processors or nodes.
19. **Supercomputer**: An extremely powerful computer used for specialized tasks like simulations, data analysis, and research.
20. **Thermal Design Power (TDP)**: The maximum amount of heat a component can produce that the cooling system is designed to dissipate under any workload.
21. **Throughput**: The amount of data processed by a computer system in a given time period.
22. **Tianhe**: A series of supercomputers from China, one of which held the title of the world's fastest computer.
23. **Top500**: A project that ranks and details the 500 most powerful non-distributed computer systems in the world.
24. **Vector Processing**: A type of computing where a single instruction operates simultaneously on multiple data points.
25. **Very Long Instruction Word (VLIW)**: A microprocessor architecture designed to take advantage of instruction-level parallelism.
26. **ZettaFLOP**: One sextillion (10^21) floating-point operations per second.

GLOSSARY

Automatic Parallelization: The process through which a compiler automatically converts sequential code into parallel code, allowing tasks to be executed simultaneously.

Bandwidth: Refers to the maximum rate of data transfer across a network or the amount of data that can be sent from one point to another in a given time frame. It's crucial for fast data communication between components in a computer or between computers.

Benchmark: A standardized test used to measure the performance of a computer, its hardware, or its software, providing a point of reference for comparison with other systems.

Cache: A small, speedy memory unit close to the CPU, storing frequently used information for quicker access. It enhances the speed and performance of the computer by reducing the time needed to access data.

Cache Line: The smallest amount of cache that can be loaded from or written to the main memory, usually consisting of 64 or 128 consecutive bytes.

Cache Memory System: A hierarchy of cache levels (L1, L2, etc.) that store data temporarily for quick access, with each level being larger and slower than the last.

CAE (Computer-Aided Engineering): The use of computer software to aid in engineering tasks, including design, analysis, and manufacturing planning.

Capability Computing: The utilization of powerful supercomputers to solve large, demanding problems, focusing primarily on reducing the time to solution.

Capacity Computing: Using smaller, cost-effective high-performance systems to run tasks that require moderate computational power, focusing on cost/performance ratio.

Circuit Speed: The time it takes for a signal to travel through a circuit, measured in picoseconds per gate. It's crucial for understanding processor performance.

Clock Rate or Clock Speed: The speed at which a CPU can execute instructions, measured in gigahertz (GHz). It's determined by the frequency of the processor's clock.

Cluster: A network of computers connected through high-speed links, working together to function as a single computing system.

CMOS (Complementary Metal-Oxide-Semiconductor): A technology used for constructing integrated circuits, including processors and memories. CMOS is popular for its cost-effectiveness and high integration levels.

Commodity Processor: A widely produced processor designed for a broad market, differing from custom processors built for specific tasks.

Commodity Supercomputer: A supercomputer assembled from readily available, standard components.

Communication: The transfer of data within different parts of a computer or between computers. Communication can be local (between processor and memory) or global (between different nodes).

Computational Fluid Dynamics (CFD): A simulation technique used to analyze fluid flow, commonly applied in tasks like studying the air flow around moving objects.

Computational Grid: A framework that allows for resource sharing among computers to solve large problems, facilitating coordination among diverse and dynamic groups of people, institutions, and resources.

Composite Theoretical Performance (CTP): A performance measure calculated based on various system parameters, often used for export control regulations. Though easy to compute, CTP may not accurately represent actual performance.

Control Parallelism: Achieved by executing multiple threads simultaneously, enhancing computing speed and efficiency.

Cost/Performance Ratio: The relationship between a system's cost and its performance, often used as a measure of value for money in computing investments.

Commercial, Off-The-Shelf (COTS): Refers to products that are available for purchase from vendors, usually standardized and widely used, making them a more economical choice than custom-built alternatives.

High Throughput Computing (HTC): Involves using extensive networks of resources to perform computational tasks that don't necessarily require highly parallel resources. Well-known examples include the Open Science Grid and the Folding@Home project.

Message Passing Interface (MPI): A standardized and portable message-passing system designed to enable processes to communicate with each

other in a parallel computing environment, helping in efficient data exchange and task coordination among multiple CPU cores.

Node: A fundamental unit of a computing network, representing a single device or computer that participates in the network. Nodes work together to perform complex computations in parallel or distributed computing environments.

Parallel Computing (Parallelism): A type of computation in which multiple calculations are performed simultaneously, leading to faster computation and problem-solving. Parallel computing in high-performance computing (HPC) is enabled by resources that support large-scale parallel operations efficiently.

Parallel Filesystem: A type of file system that allows for the simultaneous reading and writing of data, supporting the high data demands of HPC tasks.

Pipeline: Refers to a set of data processing elements connected in series, where the output of one element is the input of the next. In computing, it's used for instruction and data processing.

RDMA (Remote Direct Memory Access): A crucial technology in HPC, enabling efficient data exchange between nodes without involving their operating systems, significantly speeding up applications and processes.

Scaling Out: Refers to the practice of connecting multiple hardware or software entities so that they work as a single logical unit. When additional capacity is needed, more entities can be connected.

Scaling Up: Increasing the capacity of a single resource, like enhancing the capabilities of a CPU or adding more memory to a server.

Weather/Climate Modeling: Computational simulations used to predict future weather and climate patterns based on current and historical data.

Workload: Refers to the total amount of processing a computer, network, or software is conducting at any given time. In HPC, it might refer to specific tasks like genomics mapping, A.I. training, or weather modeling.

Glossary for High-Performance Computing

Algorithm: A step-by-step procedure, like a recipe, for solving a specific problem. Think of the algorithms created by Philip Emeagwali as super-detailed recipes that supercomputers use to solve big equations.

Bits and bytes: In computers, a bit is the tiniest piece of data that can be a 1 or a 0. A byte is a group of 8 bits. It's like how letters form words!

Cloud Computing: Imagine using a computer power located far away while just sitting at your computer. That's what cloud computing does. It lets you use big computer power from the Internet.

Cyberinfrastructure: A big word that basically means all the computer technology (software, hardware, and more) and people skills needed to do modern science and engineering work.

Data deluge: A term that describes when there's a HUGE amount of data to deal with. Like when you have a flood of water, but with data instead.

Data-intensive computing: When computers handle really, really large amounts of data super-fast. It's like reading thousands of books at lightning speed!

Data mining: Digging through a ton of data to find useful patterns or information. It's like a treasure hunt in a sea of data!

Finite Difference Equation: A math way of approximating or estimating solutions. Philip Emeagwali used these to solve some really important problems related to oil fields.

Force: The push or pull on something. In oilfields, forces like pressure and gravity affect how oil moves.

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Formula: A math rule written with symbols, like F=ma which is a formula from physics.

High Performance Computing (HPC): Big and powerful computers that can do a lot of work at the same time. It's like having an army of calculators solving problems.

HyperBall Computer: A special type of supercomputer invented by Philip Emeagwali where all the mini-computers inside it are spread out like dots on a ball.

Hypercube: Imagine a cube, but in more than three dimensions. Philip Emeagwali used this idea to connect lots of mini-computers together.

Inertia: The reason things like to stay still unless something pushes or pulls them. It's like when you're cozy in bed and don't want to get up!

Internet: A giant network connecting billions of computers around the world.

Modern Supercomputer: The fastest computers right now. They're made of thousands of smaller computers working together like a big team.

Oilfield: A place where we find and get oil. It's challenging because not all the oil is easy to reach.

Old Supercomputer: Older, slower computers that could only do one thing at a time.

Parallel Computer: A computer that can do many tasks at the same time. It's like having multiple hands to do multiple jobs simultaneously.

Partial Differential Equation: Fancy math problems that need supercomputers to solve. Philip Emeagwali used these to make big discoveries about oilfields.

Philip Emeagwali Computer: After Philip Emeagwali's discovery, supercomputers started using many mini-computers inside them to work faster.

Pioneer: Someone who discovers or creates something new. Philip Emeagwali is a pioneer because he made big advances in how supercomputers work.

Reinvent: To make an old idea new and better. Like when someone takes an old song and makes a cool new version of it.

Vector Supercomputer: A type of computer that works super-fast on lists of numbers. Philip Emeagwali's work changed how these computers were made.

Zettabyte: A HUGE amount of data. Imagine a stack of movies reaching halfway to Mars!

Glossary for High-Performance 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 â€œnodeâ€ 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):** Leveraging dedicated computing resources to accelerate computational workloads. This can range from using powerful cloud instances for research to large-scale clusters for intensive simulations.
- **High Throughput Computing (HTC):** Utilizes extensive networks of resources for computations that aren't inherently parallel on a large scale. Projects like Folding@Home and the Open Science Grid exemplify this, where many dispersed resources contribute to a larger computational effort.
- **HPC Cluster, Supercomputer:** Modern clusters, often built in a Beowulf style, dedicated to running computational tasks. They can be designed for general or specific tasks.
- **HPC Interconnect:** A fast network allowing for rapid data transfer between nodes in an HPC system. It facilitates effective communication across the cluster, essential for tasks like MPI.

- **HPC Triangle:** An HPC cluster generally requires three main resources: fast compute, fast storage, and fast networking. Balancing these three elements is crucial to achieving optimal performance.
- **Message Passing Interface (MPI):** A standard that dictates operations for communication between CPU cores, either within or across nodes. It enables single programs to distribute work across numerous CPU cores, optimizing performance through parallel execution.
- **Node:** A single computational unit in a network or cluster.
- **Parallel Computing, Parallelism:** Distributing computational tasks across multiple processors or cores to achieve simultaneous execution. Parallelism accelerates the processing of tasks by executing multiple operations concurrently.
- **Parallel Filesystem:** A filesystem structured to handle multiple simultaneous read/write operations, which is essential in HPC environments.
- **Peak Speed:** Represents the maximum operating speed of a supercomputer, commonly measured in FLOPS.
- **Petabyte:** Equating to one quadrillion bytes, it's a substantial data storage measure. For perspective, a petabyte can store 250 billion pages of text.
- **Petaflop:** A metric indicating supercomputer speed. It signifies the capability to perform one quadrillion calculations per second.
- **Pipeline:** The central processing component of a computational workflow. Typically, it involves executing a sequence of computational tasks.
- **Processors:** Components of a computer's central processing unit (CPU), responsible for executing instructions and performing mathematical calculations.
- **Thumb Drive (also known as Flash Drive):** A small, portable storage device with considerable capacity. It can be plugged into a computer to transfer data and is more robust than older storage methods like CDs.
- **Weather/Climate Modeling:** Utilizing computational simulations to predict atmospheric conditions. These simulations integrate numerous variables, like humidity and air pressure, to generate forecasts.

- **Workload:** A general term denoting a group of related tasks executed on an HPC cluster.

PODCASTS AND VIDEOS

Embracing the Legacy of Philip Emeagwali: How He Wants to Be Remembered: An **Apple Podcast** Series
Philip Emeagwali's **Google Podcasts**: A Journey Through Science and Beyond
Philip Emeagwali: Unpacked on **Spotify**
Philip Emeagwali's **Audible** Books: Unlocking the Mysteries of Computing, Math and Physics
Philip Emeagwali: The **YouTube** Masterclass

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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

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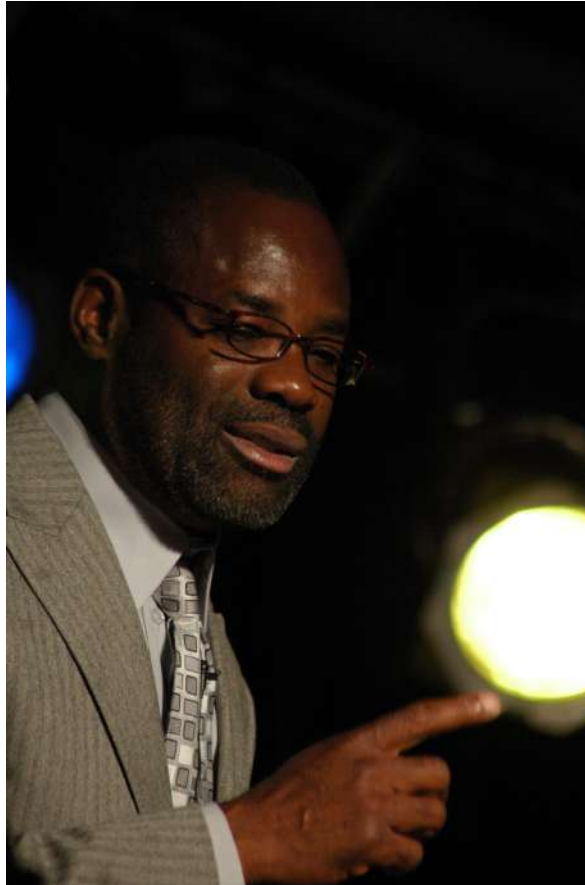
Philip Emeagwali delivering a lecture at the University of Alberta, Canada, September 23, 2006.

AFTERWORD: REALIZING HUMAN-LIKE PROCESSING

The Journey of Artificial Intelligence

When I embarked on my journey in computing, little did I know that it would lead me to a groundbreaking invention that would revolutionize the field and shape the trajectory of technological advancements. The invention of the first parallel supercomputing, which I announced on that memorable day of July 4, 1989, opened new horizons and unleashed the true power of computing.

Parallel supercomputing, in its essence, is the technique of harnessing the collective power of multiple processors working harmoniously to solve complex computational problems. It was my relentless pursuit to emulate the remarkable efficiency of nature's computational processes that led me to explore the potential of parallelism within computing. By drawing inspiration from the interconnectedness and parallel operations of nature, I sought to unlock its hidden power within artificial intelligence and scientific computing.

On that day, when I announced my discovery, it was a culmination of 15 years of hard work, perseverance, and countless days of contemplation. I had cracked the code, unraveling the intricate dance of processors working in unison, sharing the computational load, and achieving remarkable speed and efficiency. This breakthrough marked a turning point in the history of computing and set the stage for a new era of possibilities.

The implications of the parallel supercomputer were profound, extending far beyond scientific research and computations. Its true potential was revealed when we witnessed its seamless integration with artificial intelligence. Parallel supercomputing provided the computational firepower needed to power the complex algorithms and models that drive the modern-day A.I. revolution.

Artificial intelligence thrives on massive computational resources to process vast amounts of data and perform complex tasks. The advent of parallel processing exponentially increased the computing power available for A.I. applications, enabling us to tackle larger datasets, train more sophisticated models, and achieve higher levels of accuracy. It fueled the development of advanced machine learning algorithms, neural networks, and deep learning architectures, ushering in a new era of intelligent systems.

The marriage of parallel processing and artificial intelligence has transformed industries and revolutionized our daily lives. From speech recognition and natural language processing to computer vision and autonomous systems, the parallel supercomputer has become the driving force behind A.I. advancements. It has enabled the development of intelligent virtual assistants, autonomous vehicles, recommendation systems, and predictive analytics, all of which have become integral parts of our digital landscape.

The significance of the parallel supercomputer in powering artificial intelligence lies in its ability to process vast amounts of data in parallel, mimicking the human brain's parallel processing capabilities. By breaking down complex problems into smaller, manageable tasks that can be executed simultaneously, parallel processing enables A.I. systems to analyze, learn, and make decisions at unprecedented speeds. It is the key that unlocks the door to real-time processing, enabling A.I. systems to adapt, learn, and evolve with remarkable efficiency.

As I reflect upon my journey and the impact of parallel supercomputing on artificial intelligence, I am humbled by the profound changes it has brought to the world. The inventions, the breakthroughs, and the technological advancements that followed have touched countless lives and reshaped industries across the globe. But the journey is far from over.

We stand on the precipice of a future where artificial intelligence will continue to evolve, pushing the boundaries of what we once deemed impossible. The supercomputer will remain at the forefront, fueling the next wave of A.I. innovations. The vast computing power it offers will enable us to tackle even greater challenges, unlocking new realms of knowledge, and propelling us towards a future where the synergy between human intellect and computational prowess knows no bounds.

I am filled with a sense of gratitude for the opportunity to contribute to the advancement of the supercomputer and its impact on artificial intelligence. I stand in awe of the countless minds that have joined this journey, collaborating and pushing the boundaries of what is possible. Let us continue to explore, innovate, and harness the power of the supercomputer to forge a future where the unimaginable becomes reality.

ACKNOWLEDGEMENT

I am profoundly grateful for the opportunity to pen this memoir, which highlights the journey of my life and the contributions I have made to the world's fastest computing. Throughout my remarkable journey, there have been individuals who have played pivotal roles, and it is with heartfelt appreciation that I extend my deepest gratitude to them.

A family portrait. (L-R) Francis Ndaguba Emeagwali, Edith Chinwe Emeagwali, James Nnaemeka Emeagwali, Martin Ikemefuna Emeagwali, Agatha Iyanma Emeagwali, Charles Emeagwali, Florence Onyeari Emeagwali, Philip Chukwurah Emeagwali. Photo taken at our residence on Agbor Street, Uromi, Nigeria, on December 24, 1962.

First and foremost, I express my sincerest gratitude to my father, Nnaemeka James Emeagwali. From my earliest days growing up in the Nigerian towns of Sapele, Uromi, and Agbor, my father was there as a constant source of inspiration and guidance. His tireless dedication to privately tutoring me in mathematics during my formative years shaped the very foundation of my intellectual pursuits. I owe him an immeasurable debt of gratitude for his unwavering belief in my abilities and for instilling in me a passion for knowledge that continues to fuel my endeavors.

I would also like to extend my heartfelt appreciation to my beloved wife, Dale. Since our fateful meeting on July 11, 1978 in Baltimore,

Maryland, she has been an unwavering source of love, support, and encouragement. Her presence in my life has been a guiding force, enabling me to navigate the challenges and triumphs along the way. Her belief in my abilities and her constant faith in my potential have been invaluable. I am forever grateful for her unwavering support, which has allowed me to pursue my dreams and make a lasting impact in my chosen fields.

Lastly, I extend my appreciation to my readers, supporters, and those who have been influenced by my work. Your enthusiasm, engagement, and feedback have been instrumental in motivating me to continue pushing boundaries and exploring new frontiers. It is through your unwavering support that I find the inspiration to challenge conventional wisdom and strive for excellence.

To all those who have played a part, big or small, in my life's journey, I extend my heartfelt thanks. Your contributions have been instrumental in shaping the person I am today, and I am eternally grateful for your presence in my life.

With deepest gratitude,
Philip Emeagwali

Dale, Ijeoma, and Philip Emeagwali, Massachusetts Institute of Technology, Cambridge, MA, June 8, 2012.

A FAREWELL TO MY MOTHER-IN-LAW: MY GUIDING LIGHT

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. Doris, as she was affectionately known, passed away peacefully on Tuesday, May 7th, 2024, at Sinai Hospital in Baltimore, Maryland. She was 98 years old. Her departure leaves an immense void in our lives, but we must celebrate the extraordinary life she led and the profound impact she had on all who knew her.

Doris was born on October 15th, 1925, in Ashland, Mississippi. She was the second of five children. After completing high school, Doris embarked on a journey that would shape her destiny—she joined the Great Migration, leaving Ashland for Baltimore in 1942, in pursuit of a brighter future. It was in Baltimore that she met the love of her life, Leon Robert Brown, a decorated World War II veteran. They married on October 16th, 1948, and together they built a beautiful family, raising three children—Dexter, Daryl, and Dale, my wife.

Doris was a devoted wife and mother and an accomplished educator. She spent three decades shaping young minds in the Baltimore Public Schools, retiring in 1990. Her passion for teaching was evident in how she instilled a love of learning in her students. She often shared stories about her classroom discussions on great inventors, never imagining that she was nurturing future innovators within her own family.

I first met Doris on a warm summer day in July 1978, in the backyard of her Lochearn home. The air was filled with the aroma of sizzling hamburgers and hot dogs, a testament to Doris's love for gardening and cooking. As we sat and chatted, I was struck by her poise, intelligence, and warmth. I remember thinking, "Wow, she's beautiful. Dale inherited her good looks and personality from her mother."

"Philip," Doris said, extending her hand with a warm smile, "Dale has told us so much about you. It's a pleasure to finally meet you."

Little did they know that their daughter and I would embark on a remarkable journey together, one that would lead to groundbreaking advancements in supercomputing. It was in their home, amidst the comforting hum of family life, that I found the inspiration and support to develop the equations and algorithms that would lay the foundation for my work.

Doris's kitchen table became my impromptu office, where I spent countless hours scribbling notes and calculations. The rhythmic clatter of pots and pans, the aroma of home-cooked meals, and the gentle encouragement of my in-laws created an environment conducive to intellectual exploration.

Doris was a true matriarch, a source of unwavering love and support for her family. She cherished her grandchildren and great-grandchildren, always eager to hear about their latest accomplishments. She shared a special bond

with our son, Ijeoma, who lived with her from the age of six until he left for MIT to study computer science. In many ways, Doris's nurturing spirit paralleled the interconnectedness of parallel processing, where individual processors work together to achieve a common goal. Just as each processor contributes to the overall computational power of a supercomputer, Doris's love and guidance enriched the lives of her family members, empowering them to reach their full potential.

As we bid farewell to Doris Brown, we honor a life well-lived, a life that touched countless hearts and left an enduring legacy. Her memory will forever be etched in our minds, a guiding light that will continue to inspire us in the years to come.

I express my deepest condolences to my wife, Dale, and to all of Doris's family and friends who are grieving her loss. May we find solace in the cherished memories we shared with this remarkable woman.

Thank you.

REACHING
INFINITY

$$\frac{\partial T}{\partial t} + u\frac{\partial T}{\partial x} + v\frac{\partial T}{\partial y}$$

$$\frac{\partial T}{\partial p} - \frac{RT}{pc_p}\Bigg) = \frac{J}{c_p}$$

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

PHILIP
EMEAGWALI

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