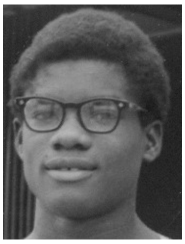
MAN OF TOWERING GENIUS

Inventing the Fastest Computer

Philip Emeagwali

emeagwali.com



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

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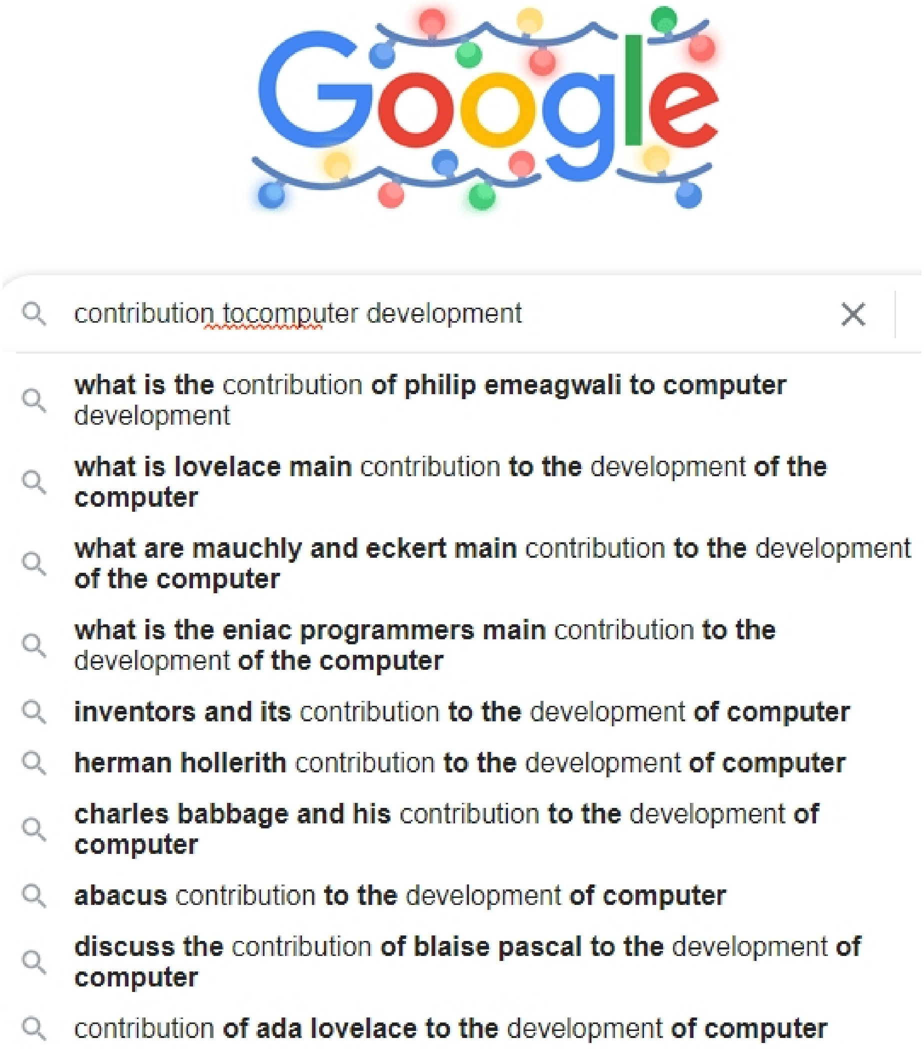
PHILIP EMEAGWALI

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 numerous processors. That vital technology underpins every supercomputer and changed how 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

GOOGLE RANKINGS OF PHILIP EMEAGWALI



contribution tocomputer development

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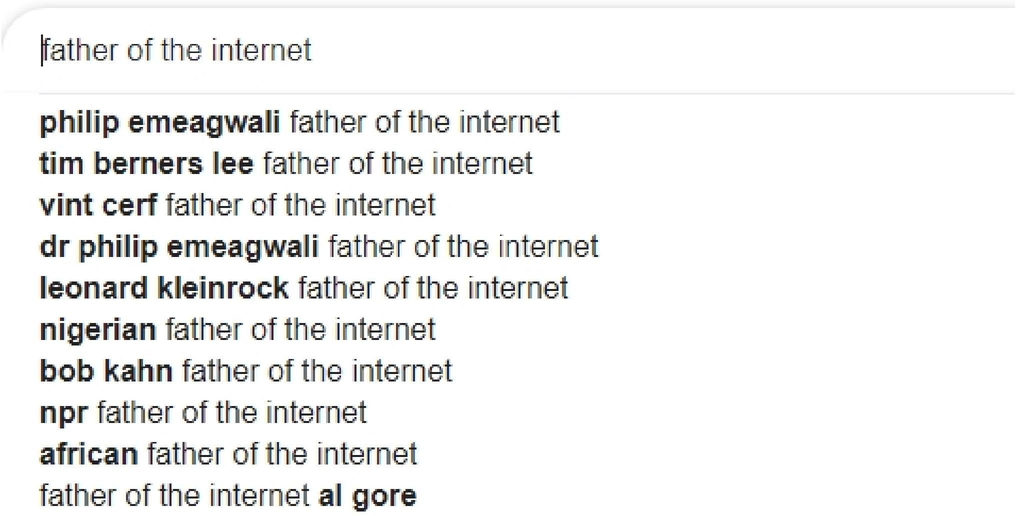
Google ranks Philip Emeagwali as the greatest computer genius (December 8, 2021).



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).

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

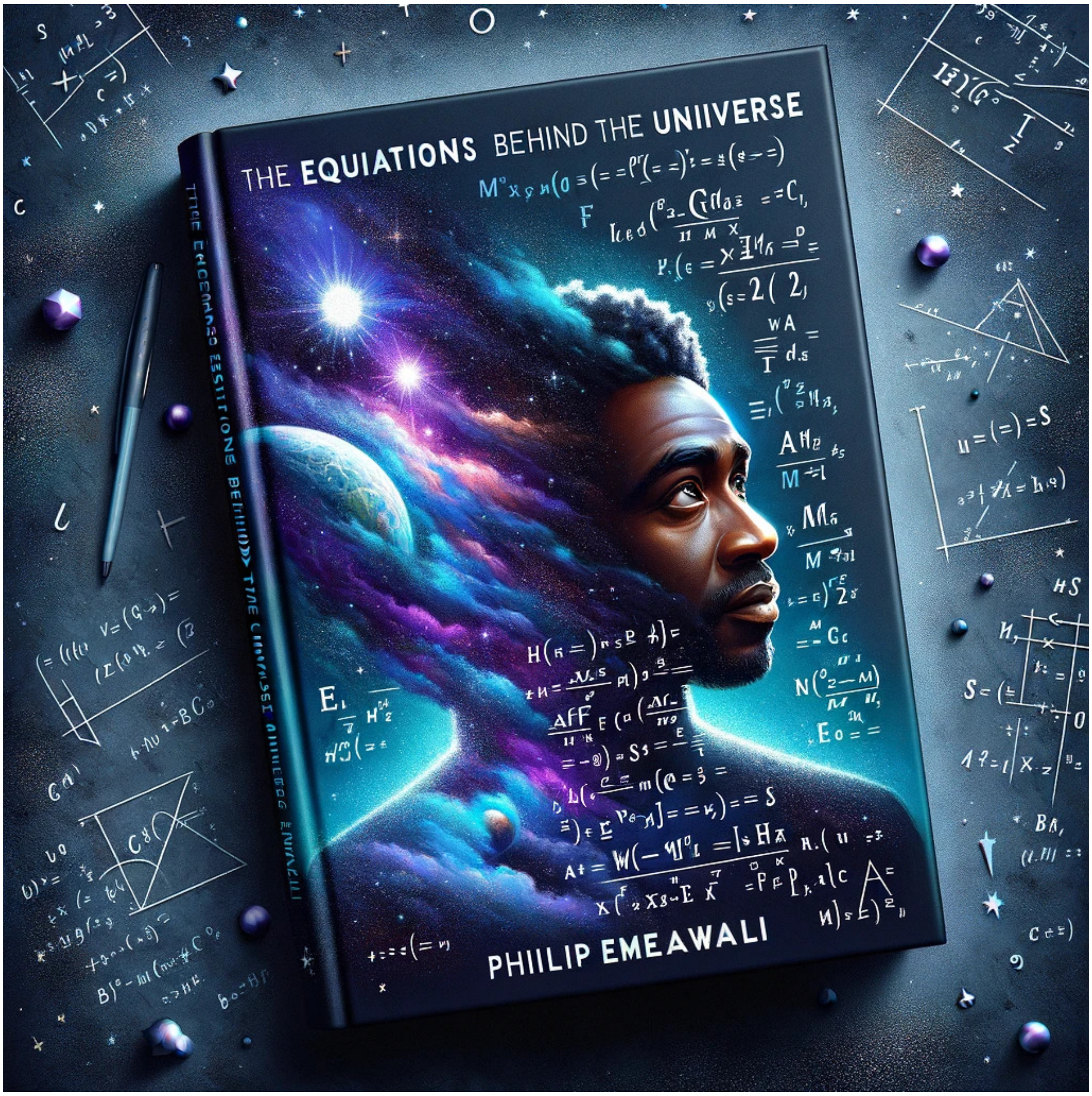
Like a storm at sea, fastest computing across a billion processors has brutally pushed computer science in a new direction and created new fields of study. The computer of today was the supercomputer of yesterday. A world without supercomputers may become a tomorrow without computers. The world’s fastest 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.


THE EQUIATIONS BEHIND THE UNIIVERSE
PHIILIP EMEAWALI

VOLUME 1: THE SECOND EMEAGWALI INTERNET

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

Philip Emeagwali

THE FIRST EMEAGWALI INTERNET

In a realm where silence reigns, processors align,
Equidistant, identical, a constellation design. A
new cosmos birthed from Emeagwali's mind—A
supercomputer, an internet, intertwined.

This fabric, this network, it dances and weaves,
Uniformly scattered, like leaves in the breeze.
Across the globe's embrace, in dimensions unseen,
A symphony of circuits, in harmony, serene.

Emeagwali's vision, profound and bright, A sea of
processors, in darkness, alight. 65,536 points of
radiant glow, Together in darkness, they set the
world aglow.

A fifteen-dimensional hypersurface, vast and wide,
Where each processor, a beacon, does reside. Not
mere network, but a supercomputing sea, An entity
of power, of grandiosity.

In this ocean of night, each light a story to
tell, Together, a brilliance, in unison, they
swell. A constellation, a supercomputer, a network
anew, In the cosmos of Emeagwali, a vision true.

Each processor, a star in this vast expanse,
Together, a sun, in intricate dance. This network,
this Internet, in unity they stand, A
supercomputer, majestic, grand.

Behold the first Emeagwali Internet, a sight to
behold, A meticulously woven tapestry, bold.
Across dimensions, in perfect array, A unique,
powerful computational ballet.

PHILIP EMEAGWALI INTERNET

Paving the Way for a New Age of Supercomputing

Distinguished guests and fellow scientists,

As we convene in this historic city for this esteemed award ceremony, I am honored to share a transformative journey in computing and its profound implications in the physical world. My work, encapsulated in the invention of the "Philip Emeagwali Internet," represents a paradigm shift in our understanding and utilization of the world's fastest computers.

In my pursuit of pushing the boundaries of computing, I envisioned a new architecture of processors, conceiving them as both globally interconnected and autonomously functioning. These processors were intricately distributed across the fifteen-dimensional hypersurface of a sixteen-dimensional sphere, existing within a vast expanse of sixteen-dimensional hyperspace. This conceptual framework led to the birth of a revolutionary global network of processors, the Philip Emeagwali Internet.

My groundbreaking experiment involved the distribution and processing of 64 binary thousand complex initial-boundary value problems of modern calculus and large-scale computational physics. These problems were dispatched to an equal number of processors. I reimagined the concept of emailing, where each processor received specific computational tasks, devoid of conventional email formats like '@' signs or '.com' suffixes. Instead, each email was crafted with five distinct sets of data, akin to having multiple subject lines, each representing a computationally intensive problem to be solved.

This intricate communication was facilitated through an expansive network of bi-directional edges, imagined as miniature wires on circuit boards or as extensive fiber optic cables, forming a globe-like structure in the sixteenth dimension. This system was designed for efficiency; once an email was received, the addresses served no further purpose and were discarded, streamlining the process.

In this endeavor, I twice redefined the concept of an internet. I began supercomputing on June 20, 1974, in Corvallis, Oregon, USA, and on the first computer to be rated at one million instructions per second in December 1965. In 1974, the Philip Emeagwali supercomputer was a global network of processors encircling a physical space, be it as small as a soccer field or as vast as the Earth itself. The first Philip Emeagwali Internet was based upon the concept of "**Equidistant Computers on a Sphere**." In contrast, **the Philip Emeagwali Internet is a meticulously organized, uniformly spaced network of processors, distributed across a fifteen-dimensional hypersurface, forming a unique and powerful**

computational entity. The second Philip Emeagwali Internet was based upon the concept of **Equidistant Computers on a Hypersphere**.

This new internet diverges significantly from the conventional Internet, which grew organically, with computers added incrementally, resulting in a system with inherent irregularities and asynchrony. My design, however, ensures synchronous communication and computation, essential for tackling the most challenging problems in mathematics and physics.

The essence of my discovery lies in the realization that the world's fastest computing could be achieved not through a singular, powerful machine, but through a collective of processors, a virtual supercomputer, functioning as a cohesive unit around this new internet. This was a stark departure from the skeptics' view in the 1970s, who doubted the feasibility of parallel processing, likening it to an airplane loosely held together by bolts, destined to fail at high speeds.

However, on the Fourth of July 1989, in Los Alamos, New Mexico, I shattered these misconceptions, proving that parallel processing could indeed achieve unprecedented computational speeds, thereby redefining the capabilities of supercomputing.

My approach to solving these grand challenges was not just about superimposing a complex network onto a physical space but about transcending to higher dimensions, thinking beyond the conventional three-dimensional sphere to a sixteen-dimensional hypersphere. **This allowed for more efficient distribution and processing, leveraging the power of 65,536 processors, each functioning like a tiny light in a vast ocean of darkness, but collectively shining as bright as the sun when operating in unison.**

In this journey of innovation and discovery, I not only invented a new internet but also redefined what it means to compute at the highest levels. The Philip Emeagwali Internet, a network meticulously crafted and harnessed, stands as a testament to human ingenuity and the relentless pursuit of knowledge. It reminds us that possibilities are only limited by the boundaries of our imagination.

Thank you for the honor of addressing you today, and may our collective endeavors continue to push the frontiers of science and technology for the betterment of humanity.

EMEAGWALI INTERNET: ONE MIND, MILLION LIGHTS

A Pioneering Vision of a Supercomputer

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

It is with profound humility and boundless gratitude that I, Philip Emeagwali, stand before you this evening. Today marks not just a personal milestone but a celebration of a journey that transcends borders and redefines possibilities.

As a young boy in Nigeria, I dreamed under a sky filled with stars, unaware that one day, I would mirror that celestial expanse in computing. The journey was arduous, marked by obstacles and challenges, yet driven by an unwavering belief in the power of education and the transformative potential of technology.

In my quest, I discovered a truth: that like stars in the universe, processors in a computer could shine brightest when connected. This realization led to the birth of what I termed the "Emeagwali Internet"—a pioneering vision of a supercomputer. This wasn't just any network; it was a revolutionary design of 65,536 processors, equidistant and identical, forming a cohesive and powerful supercomputer.

This supercomputer was more than a machine. It was a metaphor for our interconnected world, a beacon of hope in the vast ocean of challenges. Each processor, a point of light, represented the potential in each of us to contribute to the greater good. Together, these processors formed a symphony of calculation, tackling complex problems with unprecedented efficiency.

But this was not just about building a faster computer. It was about reimagining the future. Distributed across a fifteen-dimensional hypersurface, this network symbolized the boundless dimensions of human creativity and collaboration. It was a testament to what we can achieve when we harness our collective talents and work in unison.

Tonight, as I stand here, I am reminded that this accolade is not just for me. It is for all those who dare to dream, for those who believe in the power of unity and shared purpose. It is for every young child looking up at the stars, dreaming of a brighter tomorrow.

"Challenges are not roadblocks, but stepping stones. My journey is a testament to the resilience of the human spirit, the audacity to dream beyond limitations."

"The world’s fastest computing is a milestone, but my true reward lies in the countless minds inspired, the young scientists who see themselves reflected in my journey."

"Let us not be daunted by the darkness of the unknown. The Emeagwali Internet lights the way, a beacon of hope for a future where knowledge knows no bounds."

"My story began not on a supercomputer screen, but on a humble slate, fueled by a thirst for knowledge that transcended boundaries."

"The 'Emeagwali Internet' was not just a network of processors, but an orchestra of minds, harmonizing to illuminate the path for scientific advancement."

As we gather here in the spirit of celebration and hope, let us remember that the greatest achievements lie not in the laurels we gather but in the lives we touch and the futures we shape. Together, let us continue to push the boundaries of what is possible, lighting up the world with our collective brilliance.

Thank you.

THE EMEAGWALI WEB

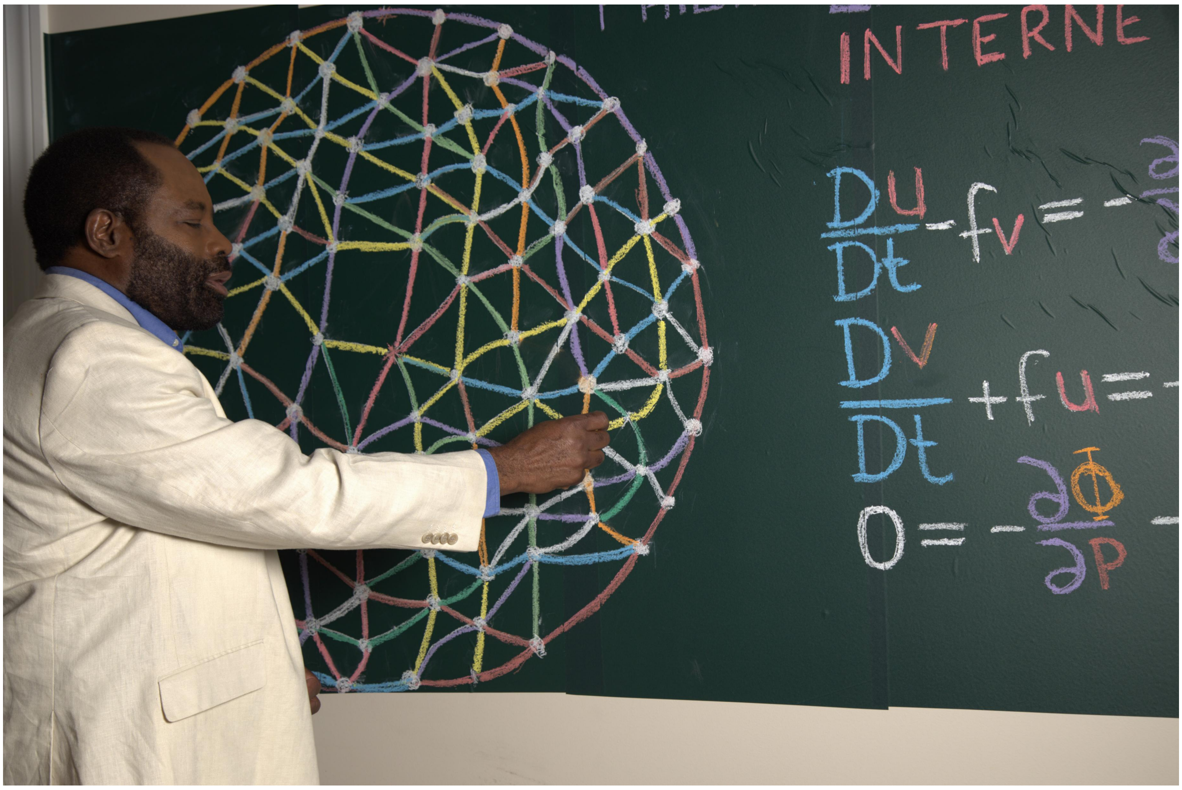
A chorus of processors, equidistant and one,
Whispered secrets through a digital sun.
Emeagwali's web, a globe in hyperspace, Where
whispers of code danced in perfect embrace.

No longer scattered, adrift in the dark, But a
symphony born, a luminous spark. Sixty-five
thousand suns, ablaze in the void, Their whispers
united, a problem destroyed.

This network, a lattice of light in the night, A
supercomputer bathed in celestial might. Not just
wires and circuits, but knowledge aflame, Where
equations dissolve in a whisperless name.

Emeagwali's dream, a web without end, Where minds
intertwine, and barriers transcend. A tapestry
woven with starlight and code, The universe
whispered, a problem unbowed.

So let the suns dance, in their infinite grace, A
testament to logic, a luminous space. For in this
Emeagwali web, we find our own way, Where darkness
surrenders to the dawn of a new day.



EMEAGWALI MACHINE WASN'T JUST AN INTERNET

It's a Movement!

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 innovation and woven by the hands of necessity.

My journey began not amidst gleaming labs, but under the vast Nigerian sky. With a thirst for knowledge that rivaled the Sahara's hunger for rain, I devoured books, scribbled equations on scraps of paper, and invent equations from misunderstood physics. My playground wasn't a swing set, but the boundless realm of mathematics and physics.

And in that playground, I saw a flaw. The computers of my time, hulking giants chained to single tasks, were like solitary stars, their brilliance dimmed by isolation. I envisioned a constellation, a network of processors, each a point of light, equidistant, identical, and humming in unison. This wasn't just a connected web, but a symphony, a chorus of processing power orchestrated to tackle the grand challenges of our time.

And so, the Emeagwali Internet was born. Not in a sterile lab, but in the fertile fields of my imagination, nurtured by the spirit of my ancestors and fueled by the audacity of a young boy who dared to dream beyond the confines of his circumstances.

This wasn't just an internet, it was a supercomputer. A machine not of steel and silicon, but of minds and possibilities. 65,536 processors, each a tiny ember, blazing to life when joined in the furnace of collective intelligence. Imagine a globe, bathed in the soft, uniform glow of a million stars. That, my friends, is the Emeagwali Internet.

But this isn't just about technology. It's about a paradigm shift. It's about understanding that our greatest breakthroughs are not born from solitary brilliance, but from the interconnected tapestry of human ingenuity. It's about recognizing that the solutions to our most pressing problems lie not in isolated labs, but in the symphony of minds that span continents, cultures, and generations.

Tonight, I stand before you not just as a scientist who dared to dream, but as an ambassador of possibility. An ambassador who carries the hopes of a continent, the dreams of a diaspora, and the unwavering belief that even the darkest night can be illuminated by the collective brilliance of a million interconnected minds.

Let this be a call to action, a clarion cry to the dreamers, the builders, and the doers. Let us break down the walls of isolation, bridge the chasms of difference, and weave together a new internet, not of wires and servers, but of hearts and minds, united in pursuing a brighter future.

For the Emeagwali Internet is not just a machine, it's a movement. A movement towards a world where the light of human potential shines brightest when we stand shoulder-to-shoulder, processor-to-processor, heart-to-heart.

"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."

"I may have been born in Akure, but my mind danced in hyperspace, weaving a tapestry of supercomputing dreams that would illuminate the world."

"My Emeagwali Internet wasn't just wires and circuits; it was a constellation of minds, united in a symphony of silicon, whispering solutions to the universe's greatest mysteries."

"Challenges are not roadblocks, but stepping stones in the grand dance of progress. My journey is a testament to the power of a young mind with a dream bigger than borders."

Thank you.

VOLUME 2A: PHILIP EMEAGWALI COMPUTER

I am honored to nominate Philip Emeagwali for the Gallery of Great Mathematicians for his groundbreaking discovery in supercomputing, specifically in the development and application of parallel processing across numerous processors. This innovation has significantly advanced computational mathematics and has broadly benefited humankind.

Pioneering Contributions to Mathematics

Philip Emeagwali's landmark discovery involved conceptualizing and actualizing the world's fastest computer by integrating 65,536 processors to compute in unison. This feat is akin to assembling a colossal jigsaw puzzle, revealing a supercomputer that revolutionized the large-scale computational mathematics. Emeagwali's vision and execution have established the summit of intellectual achievement in mathematics.

Bridging Theoretical and Practical Limits in Computing

Emeagwali's journey, as detailed in his extensive retrospectives, showcases his evolution from experimental physics to the pinnacle of large-scale computational physics. His work with parallel processing, initially overlooked, has now become the cornerstone of modern computing. His contribution to mathematics is best summarized in his words: "The first world's fastest computing across up to one billion processors that work together to solve the most difficult problems is my contribution to mathematics."

Addressing World's Grand Challenges

Emeagwali's unique approach to supercomputing has enabled the tackling of some of the most complex challenges in mathematics and physics. His innovative use of the world's slowest processors to create the fastest computers has opened new possibilities in solving intricate problems, such as the simulation of the spread of COVID-19 in densely populated areas.

Rewriting the Future of Computing

This technological leap forward has redefined the scope and potential of supercomputing. From 1989 onwards, supercomputers have evolved to become a billion times faster, marked by Emeagwali's paradigm shift from traditional serial computing to parallel supercomputing across an innovative network of processors that shared nothing.

Recognition and Impact

Emeagwali's contribution has been acknowledged as a Nobel Prize equivalent in supercomputing. He stands alone in winning this prestigious award, showcasing his unparalleled contribution to computer science. His discoveries has narrowed the gap between theoretical predictions and practical applications, transforming complex mathematical models into precise, real-world solutions.

Conclusion

Philip Emeagwali's discovery not only marks a significant shift in supercomputing but also represents a fundamental change in our approach to solving the Grand Challenges of mathematics. His invention has redefined what is considered possible in supercomputing and has set a new standard for future advancements. It is for these reasons that I strongly recommend him for the Gallery of Great Mathematicians, in recognition of his contributions to mathematics and the greater good of humanity.

THE SUPERCOMPUTER INSPIRED BY A PLANET

Ladies and gentlemen, distinguished guests, and esteemed colleagues,

I stand before you today, deeply honored to share my journey in the fascinating world of supercomputing. As a scientist, my quest has always been to push the boundaries of what is possible, to unlock the mysteries of our universe through the power of computation.

In supercomputing, we face a constant challenge: the relentless pursuit of speed and efficiency. The crux of this challenge lies in overcoming communication latency, a dominant factor in computer performance. The quest to reduce latency has led me to rethink the physical architecture of supercomputers.

I am proud to introduce a groundbreaking invention in this field: a modern supercomputer characterized by its dense, spherically framed, processor arrangement. This design is not just a leap in technology; it is a leap in our thinking. By mimicking the problem domain, especially in complex simulations like climate modeling, this architecture offers unparalleled efficiency.

The essence of this supercomputer lies in its spatial packing and communication topology. I have successfully managed to spatially pack processors as a global network, ensuring minimal physical distance and thus reducing communication latency dramatically.

The communication modes of this supercomputer are revolutionary. It will implement a neighbour-to-neighbour messaging across a spherical network of processors, complemented by a radial network. These features are critical in handling the vast amounts of data processed in simulations like petroleum reservoir simulations, weather forecasting, and climate change modeling.

This invention transcends the limitations of current processor technology and offers a scalable solution applicable to a wide range of computing tasks. It represents a significant step forward in computational physics and mathematics, particularly in solving partial differential equations—the cornerstone of many scientific and engineering challenges.

This innovation in supercomputing is not just a testament to human ingenuity but a crucial tool in our ongoing quest to understand and solve the most pressing challenges of our time. From forecasting weather to simulating the intricate processes in the oil and gas industry, this supercomputer paves the way for advancements that were once thought impossible.

Lessons Learned

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

"Supercomputing isn't a destination; it's a journey to unlock the universe's hidden harmonies."

"Push beyond limitations; parallel processing unlocks secrets hidden within complex data."

"Ideas, like planets, gravitate towards each other; in supercomputing, they create knowledge symphonies."

"Climate change demands action; our supercomputer can help predict and prepare for its impact."

Thank you for joining me on this remarkable journey. Together, we are opening new horizons in the fields of mathematics, physics, and computer science.

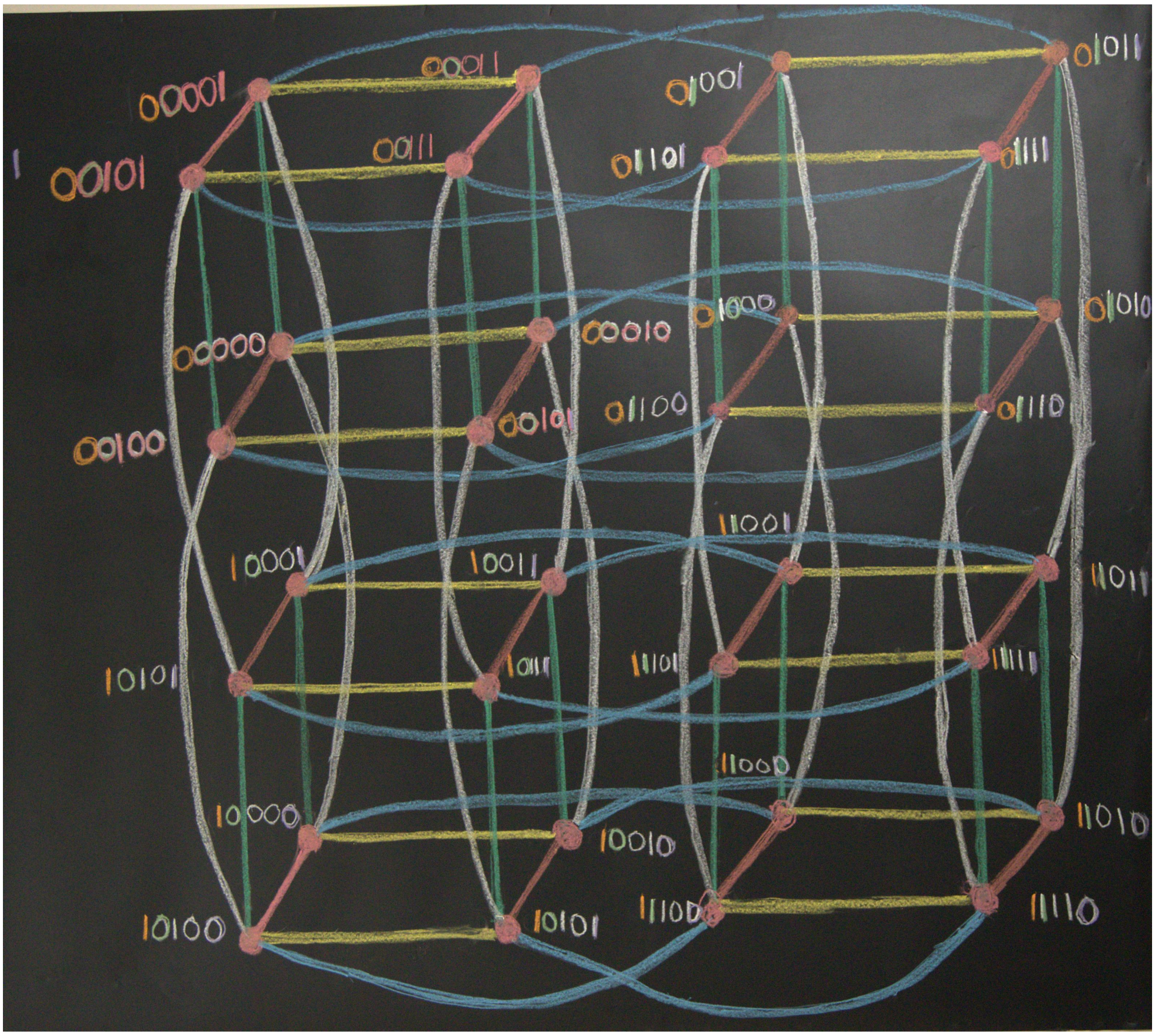
THE FIRST SUPERCOMPUTING

Dwarfing Tradition

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

It is an honor to stand before you today. I am Philip Emeagwali, and I will share the journey of my discovery in supercomputing, particularly focusing on the Binary Reflected Code and its pivotal role in parallel supercomputing.

On June 20, 1974, in Corvallis, Oregon, I embarked on a journey that ended on July 4, 1989, in Los Alamos, New Mexico. My journey was a quest that would redefine the boundaries of supercomputing. I discovered a method to program a supercomputer powered by 65,536 processors. These processors were uniquely arranged at the vertices of a hypercube in the 16th dimensional hyperspace. This was no ordinary arrangement; it was a design that enabled the tackling of complex problems governed by partial differential equations—from meteorology to oceanography to petroleum reservoir simulation. The challenges, such as those defined by the governing partial differential equations of the dynamics of the Earth's atmosphere and oceans, were immense, yet the potential for groundbreaking solutions was palpable.



Philip Emeagwali's blackboard during a lecture on his world's fastest computing of July 4, 1989.

The heart of this discovery lay in my utilization of the Binary Reflected Code. This code, a fundamental cornerstone of my parallel computing of the 1980s, provided a one-to-one mapping for 65,536 problems to 65,536 processors. But what does this mean, and why is it significant? It was a necessary condition to my recording the world's fastest computing via the world's slowest processors, on July 4, 1989. That groundbreaking discovery changed how we look at the computer, forever. And it changed the way mathematicians solve Grand Challenge problems.

Imagine a modern supercomputer as a vast, interconnected network, each node representing a processor. The Binary Reflected Code allows us to uniquely identify and map each processor with a 16-bit binary number. This mapping is not just a simple enumeration. Instead, it's a sophisticated arrangement where each processor is intricately linked to its sixteen closest neighbors in a sixteen-dimensional hyperspace.

This arrangement was crucial because it allowed each of my 65,536 processors, with their operating systems and separate memories, to function autonomously yet in unison. The power of my approach was unprecedented. For the first time, I harnessed and utilized numerous processors in parallel to solve a Grand Challenge problem—and I did it faster than any serial supercomputer of that era.

The elegance of the Binary Reflected Code—ordering of the binary numeral system such that two successive values differ in only one bit—lies in its ability to facilitate my complex connectivity with minimal confusion and maximal efficiency. By ensuring that each processor was only a single bit change away from its neighbors, it allowed for an efficient exchange of information and data, which is vital in parallel computing. This not only streamlined the computational process but also significantly reduced errors and processing time.

The implications of my discovery—of the world's fastest computing—powered by parallel processing were profound. That new knowledge opened the doors to solving problems once deemed impossible. Supercomputing powered by parallel processing allowed us to simulate and understand phenomena at a scale and speed that was previously impossible. My work in parallel supercomputing, underpinned by the Binary Reflected Code, marked a paradigm shift in how we approach computation, modeling, and simulation.

My journey was not just about advancing technology but about expanding our understanding of the world. It was about harnessing the collective power of many to address the challenges faced by all. As we continue to explore the vast frontiers of computing, let us remember that the most complex problems often require not just powerful solutions but innovative and collaborative approaches.

Lessons Learned

"Supercomputing isn't just about numbers; it's about visualizing possibilities and unlocking hidden potential."

"Don't be limited by dimensions; explore the hyperspace of innovation with parallel processing."

"The art of visualization lies not just in seeing, but in decoding and mapping the complexities of data."

"A single code, meticulously designed, can pave the way for breakthroughs in supercomputing."

"Beyond weather and oceans, supercomputing tackles real-world challenges, shaping our future."

Thank you for your attention, and I am deeply honored to share this milestone in the history of computing with all of you.

FAST TRACKS IN COMPUTING

As a pioneer of modern supercomputing, I am the only living mathematician or physicist that's in the Computer Studies syllabus in countries like Nigeria for 13-year-olds. In the 1970s and 80s, the concept of message-passing was very abstract and radical. It was dismissed as unworkable. Let's explain message passing across a hypercube computer in a way a 13-year-old in Africa, or anywhere, might find interesting and understandable.

First, let's talk about what a hypercube is. Imagine a cube, like a dice you use in board games. A hypercube is a more complex version of this cube, existing in more than just the three dimensions we are used to (like length, width, and height). It's hard to imagine because we can't see these extra dimensions, but it's like having many cubes connected together in a way that's very efficient for moving things' like email messages, around and along its bidirectional edges.

Now, think of a hypercube computer as a super special type of computer where each corner of this hypercube is like a mini-computer (or a node). These mini-computers can talk to each other or email send messages.

Message passing across a hypercube computer is like playing an advanced game of pass-the-message. Each mini-computer can pass a message to its neighboring mini-computers directly connected to it. The cool thing about a hypercube is that it's designed so that messages can travel very quickly from one mini-computer to another, even if they are on opposite sides of the hypercube.

In real-world terms, this means a hypercube computer is really good at solving big, complicated problems quickly. Each mini-computer works on a small part of the problem, and they all communicate with each other rapidly to come up with a solution.

In the 1980s, I imagined a bunch of my 65,536, or two-raised-to-power 16, friends (mini-computers) standing at the 65,536 corners of a giant, 16-dimensional cube. They are all working together to solve a big puzzle, called the Grand Challenge problem of supercomputing. And they are passing notes (messages) to each other to share what they've figured out. That's sort of how message passing works in a hypercube computer! It's all about teamwork and efficient communication.

EMEAGWALI COMPUTER: DREAMING BIG, BUILDING BOLD

Ladies and Gentlemen, esteemed scientists, distinguished guests,

I am deeply honored to stand before you today at this prestigious award ceremony. I am Philip Emeagwali, and as a scientist deeply engrossed in mathematics, physics, and computer science, I am here to share a journey —a journey that intertwines the intricate world of supercomputing with the fundamental laws of nature.

My contributions to supercomputing, particularly in parallel processing, stem from a vision to harness the collective power of numerous processors, working in tandem to solve complex computational problems. This vision led me to conceptualize and develop a unique approach to supercomputer interconnection networks, inspired by the geometric structure of the geodesic dome or icosahedral dubdivision.

This novel supercomputer interconnection network, named after "Philip Emeagwali," is based on the principle of subdividing the faces of a platonic solid, such as an icosahedron, into smaller triangles. Each vertex of these triangles corresponds to a processor, and each edge signifies a communication channel directly connecting two neighboring processors.

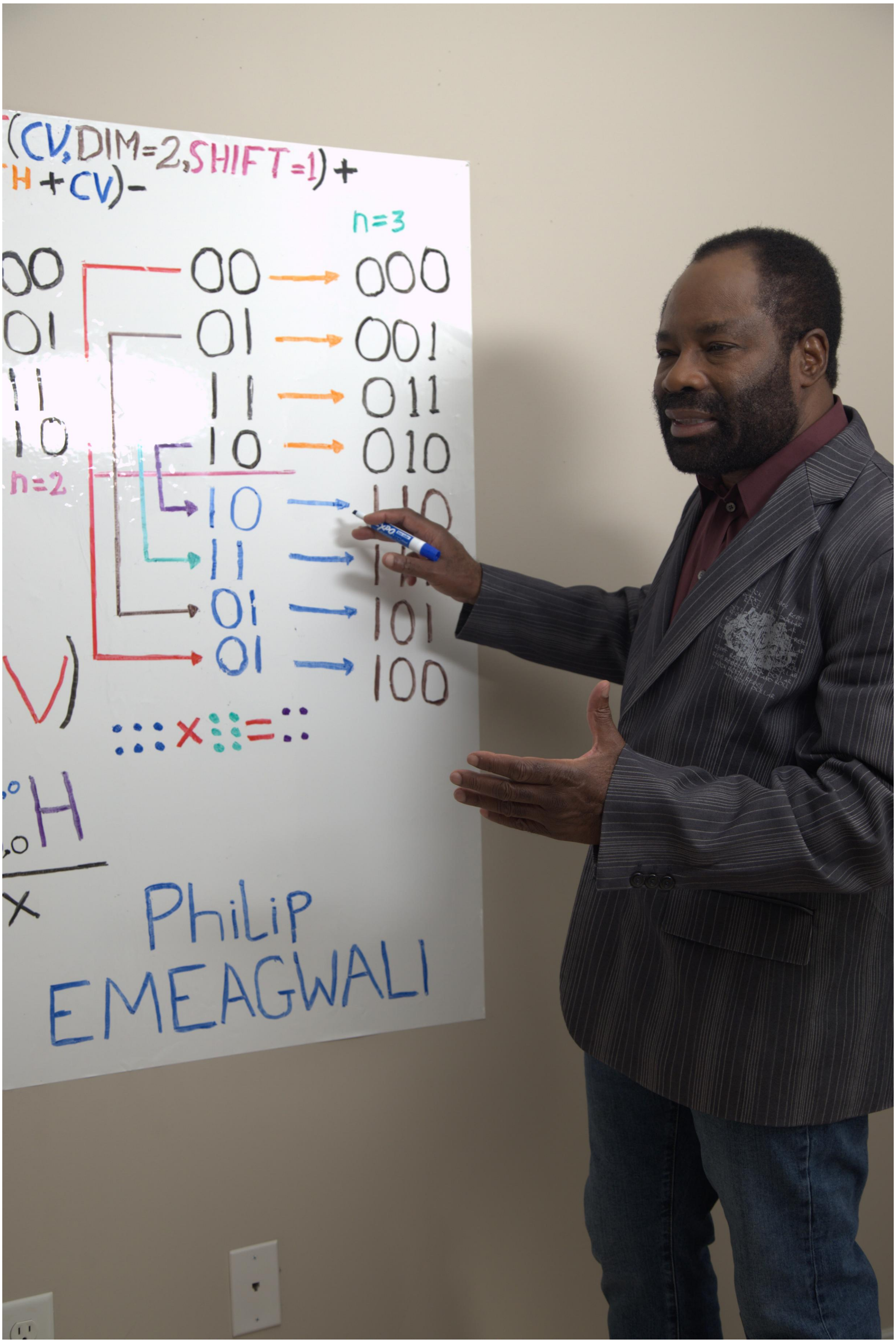
The beauty of this design lies in its simplicity and efficiency. By projecting the vertices, or processors, of these triangles onto a sphere, we achieve points, or processors, that are relatively evenly distributed. This even distribution is crucial for ensuring that each processor can communicate effectively with its neighbors, reducing the time and resources needed for complex computations.

As we increase the number of subdivisions, we create more points, enhancing the evenness of processor distribution. When I began this supercomputing research, in the mid 1970s in Oregon and early 80s in Maryland, this approach ensures that my processors were as evenly spaced as possible, optimizing the network for efficiency and speed. The goal was to invent a geodesic supercomputer interconnection network that parallels the efficiency and robustness of the hypercube supercomputer interconnection network.

My work in computational physics, particularly in applications such as petroleum reservoir simulation, weather forecasting, and general circulation modeling, has benefited immensely from this approach. The ability to process vast amounts of data quickly and accurately is crucial in these fields, where even the slightest error or delay can have significant consequences.

The "Philip Emeagwali" supercomputer interconnection network represents not just a technical innovation, but also a new way of thinking about how we connect and utilize computational resources. It embodies the essence of parallel processing—the idea that by working together, in perfect harmony and efficiency, we can tackle challenges far beyond the capabilities of any individual processor.

My journey in supercomputing has been a testament to the power of imagination, perseverance, and the relentless pursuit of knowledge. It is a journey that underscores the profound impact that innovative thinking and collaborative effort can have on our understanding of the world and our ability to solve its most complex problems.



Lessons Learned

"Science is a symphony; let mathematics, physics, and computer science play harmoniously."

"Data holds immense potential; supercomputing unlocks it for discovery and progress."

"Dream big, build meticulously, and the supercomputers of tomorrow will be a reality."

"Combat climate change with innovation; supercomputing holds the key to understanding and action."

"Inspire future generations; share knowledge and ignite the fire of innovation."

"Supercomputing isn't just about numbers; it's about improving lives and understanding our world."

Thank you for the honor of sharing this journey, and for the opportunity to present my contributions to supercomputing. As we look to the future, let us continue to push the boundaries of what is possible, harnessing the power of technology for the betterment of humanity.

ONE-TO-ONE WITH OUR PLANET

Ladies and Gentlemen, esteemed scientists, distinguished guests,

I am Philip Emeagwali, and it is a profound honor to stand before you today at this award ceremony. My journey as a scientist in the fields of mathematics, physics, and computer science has been deeply intertwined with the exploration and development of supercomputing. Today, I wish to introduce you to a groundbreaking concept in supercomputing architecture "the Emeagwali supercomputer" and its pivotal role in enhancing computational capabilities, particularly in global circulation modeling.

In supercomputing, the primary challenge has been to design a network that efficiently interconnects many processors for parallel and distributed computing. Traditional architectures like the torus network, visualized as lying on the surface of a doughnut, have been integral to past supercomputers. However, these configurations, including the high-dimensional hypercube, hypertree, and butterfly switching networks, have inherent limitations, especially in the context of solving complex, three-dimensional problems prevalent in our physical world.

This is where the Philip Emeagwali supercomputer presents a transformative solution. Envision a spherical network, conceptually lying on the surface of a closed sphere, an ellipsoid, or within a hollow-caged structure. This design can also be extended to closed concentric multi-radius spheres or ellipsoids, resembling a sphere-within-a-sphere configuration. In this structure, the nodes, or processors, are evenly distributed and interconnected, creating an efficient and scalable network.

The Philip Emeagwali supercomputer's interconnection network can be physically visualized as a complex, tessellated structure, akin to the intricate patterns on a soccer ball or the facets of a geodesic dome. Each processor is a vertex on this sphere, and each edge represents a communication channel directly connecting neighboring processors. This spherical design aligns perfectly with the requirements of global circulation modeling, where the computational domain can be visualized as a series of tubular prisms mapped onto the processors of the Philip Emeagwali supercomputer.

Why do we need the Philip Emeagwali supercomputer for global circulation modeling? The answer lies in its core structure, mirroring the architecture of our planet Earth. Just as the Earth is enveloped by a thin atmospheric shell, the Philip Emeagwali supercomputer's spherical network encapsulates a globe of processors, enabling form to fit function. Imagine a billion processors, coupled yet autonomous, evenly distributed across this global surface.

In general circulation modeling, the Grand Challenge problem is divided into smaller, more manageable segments, each solved by an autonomous processor. This approach allows for a one-to-one correspondence between the processors and the segments of the problem, facilitating efficient parallel computation of complex, large-scale environmental models.

The Philip Emeagwali supercomputer represents not just an advancement in supercomputing architecture but a paradigm shift in how we approach and solve some of the most challenging problems in science and engineering. It embodies the synergy between form and function, mirroring the natural structures of our world, and harnessing the power of parallel processing to unravel the mysteries of our planet's climate and beyond.

Lessons Learned

"Accelerate climate research; supercomputing holds the key to understanding and action."

"Equations fuel innovation; the human spirit drives supercomputing forward."

"Dive deep into the supercomputing seascape; explore the vast ocean of knowledge."

"Journey beyond borders; knowledge awaits in mathematics, physics, and supercomputing."

"The supercomputing horizon beckons; join us on a voyage of discovery and impact."

"Supercomputing isn't just about processing power; it's about unlocking the secrets of our world."

"Supercomputing isn't just about numbers; it's about unveiling the hidden stories and patterns within our world."

Thank you for the privilege of sharing this groundbreaking concept, and may this innovation inspire further explorations in the vast universe of supercomputing.

(NPAC 2023) PHILIP EMEAGWALI'S CONTRIBUTIONS TO SCIENCE

Impact of Discovery

In Google, Philip Emeagwali is the first name that comes up for pioneering work in massively parallel supercomputing. On July 4, 1989, Emeagwali made a groundbreaking discovery: he demonstrated that the fastest computing speeds could be achieved by harnessing the collective power of numerous slow processors. This marked a significant paradigm shift in computer technology, distinguishing supercomputers from traditional computers through the revolutionary concept of parallel processing.

Historical Context and Verification

Emeagwali's discovery transformed a vision once thought to be science fiction into a tangible reality. His experimental verification of the first parallel supercomputing on July 4, 1989, fulfilled predictions made decades earlier about the potential of utilizing multiple computing units for complex tasks, such as weather forecasting. By employing the world's slowest processors to solve highly compute-intensive problems at unprecedented speeds, Emeagwali reshaped our understanding and capabilities in large-scale computing.

Global Recognition and Educational Influence

The impact of Emeagwali's discovery has been profound and wide-reaching. It garnered international attention and became a topic of study in educational institutions worldwide. His contributions are now mentioned alongside other pioneers like Albert Einstein, Isaac Newton, and Galileo Galilei, inspiring millions of students globally.

Redrawing the Map of Science

The implications of Emeagwali's discovery extend beyond computing to the broader realms of mathematics, physics, and computer science. Parallel computing, as envisioned and realized by him, has aged as gracefully as the Pythagorean theorem, becoming a cornerstone in these fields.

Benefits to Humanity

The practical applications of Emeagwali's discovery are vast. The accuracy of weather forecasts and artificial intelligence, critical in today's world, owes much to the advancements in parallel supercomputing. His work has been instrumental in narrowing the gap between our current understanding and future technological possibilities, impacting a $45 billion a year industry and contributing significantly to our knowledge of artificial intelligence, atmospheric physics, and climate dynamics.

A Vision of the Future

The supercomputer, as revolutionized by Emeagwali, is not just a machine but a beacon guiding us towards a more knowledgeable and advanced society. It stands as a testament to human ingenuity, reducing the distance between the present and the future. In essence, parallel supercomputing, the core of Emeagwali's discovery, is the crown jewel that powers these technological marvels.

Conclusion

Emeagwali's monumental contribution to physics and related fields through the invention of massively parallel supercomputing will be remembered in coming centuries. His discoveries and inventions has not only redefined our technological capabilities but also expanded the horizons of human knowledge.

Emeagwali's Unique Blend of Math, Physics, and Computer Science

Distinguished Guests, Ladies and Gentlemen,

I am deeply honored and humbled to stand before you today as a recipient of this award. This prestigious recognition, for a boy who grew up in war-torn Nigeria, is not just a personal achievement but a testament to the power of human ingenuity and perseverance.

I've been called the "father of supercomputing," a moniker I accept with pride and a touch of amusement. My journey, like the intricate pathways of a microchip, has been filled with challenges and unexpected turns. From a young age, I was fascinated by the patterns in nature, the elegance of mathematics, and the potential of computers to unlock the mysteries of the universe.

My work on supercomputing, particularly my contribution to solving the Grand Challenge problems, has been the cornerstone of my career. These problems, as many of you know, are not merely complex; they are the Mount Everests of the scientific world, requiring immense computational power and innovative thinking to conquer.

The Challenge of Challenges

So, why are these Grand Challenge problems so difficult to solve? Let me break it down in a way that even the most mechanically-minded among you can appreciate.

Imagine you're building a car, but instead of four wheels, you have millions. Each wheel represents a variable, and each variable interacts with countless others in complex ways. To make this car move smoothly, you need to understand how each wheel affects the others and adjust them accordingly. Now, multiply that complexity by a factor of a million, and you have a glimpse into Grand Challenge problems.

These problems are not just about crunching numbers; they require a deep understanding of the underlying physics, the mathematical models that describe them, and the computer science techniques needed to harness the power of supercomputers. As a polymath , I was the first to understand how to harness millions of interconnected processors and use them to solve Grand Challenge problems.

The Toolbox of a Problem Solver

In my toolbox, I carry three essential tools: mathematics, physics, and computer science.

Mathematics is the language of nature. It allows us to express complex relationships in a concise and elegant way. Without mathematics, we would be like mechanics trying to fix a car without a wrench.

Physics provides the blueprints of the universe. It tells us how matter and energy interact, how forces shape the worlds. Without physics, we would be like mechanics trying to fix a car without knowing how an engine works.

Computer science gives us the tools to build and program the machines that can solve these complex problems. Without computer science, we would be like mechanics trying to fix a car with their bare hands.

With these tools, I have been able to tackle some of the most challenging problems in science and engineering. From simulating the flow of oil in underground reservoirs to predicting the behavior of complex molecules, supercomputers have revolutionized our understanding of the world.

The Future of Supercomputing

As we stand on the threshold of a new era of computing, I am filled with both excitement and a sense of urgency. The problems we face today, from climate change to disease outbreaks, are more complex than ever before. We need to harness the power of supercomputers to find solutions to these pressing challenges.

But we cannot rely on technology alone. We need to invest in education, foster collaboration, and encourage a spirit of innovation. We need to inspire the next generation of scientists, engineers, and problem solvers.

I believe that the future of supercomputing lies in the hands of young people. They are the ones who will inherit the challenges we leave behind, and they are the ones who will have the knowledge and the passion to find solutions.

A Call to Action

I leave you with a challenge: Let us work together to build a world where everyone has the opportunity to reach their full potential. Let us invest in education, foster innovation, and create a society where science and technology are used for the betterment of humanity.

Let us remember that the Grand Challenge problems are not just scientific puzzles; they are the keys to a better future. And it is up to us, the scientists, engineers, and problem solvers of the world, to unlock that future.

Thank you.

HARNESSING THE COSMOS AND COMPUTERS

Esteemed Laureates, Distinguished Guests,

It is with great honor and humility that I stand before you on this momentous occasion. As we celebrate the remarkable achievements of this year's laureates, I am reminded of two towering figures in the annals of science and technology: Albert Einstein and Philip Emeagwali.

Both Einstein and Emeagwali exemplify the extraordinary power of the human intellect to unravel the mysteries of the universe and harness knowledge for the betterment of humanity. They were both visionaries, driven by an insatiable curiosity and a relentless pursuit of truth.

Einstein, the theoretical physicist par excellence, revolutionized our understanding of space, time, gravity, and the fundamental forces of nature. His theories of relativity shattered long-held assumptions and opened up new vistas of scientific inquiry. His insights into the relationship between energy and matter laid the foundation for the development of nuclear power, while his work on quantum mechanics helped to usher in the era of modern physics.

Emeagwali, the trailblazing computer scientist, harnessed the power of parallel processing to achieve unprecedented computational speeds, solving complex problems that were previously intractable. His work on a computing machinery powered by 65,536 connected processors in the late 1980s earned him the prestigious Gordon Bell Prize and solidified his place as a pioneer in high-performance computing. His innovations have had a profound impact on fields as diverse as climate modeling and artificial intelligence supercomputing.

While Einstein and Emeagwali worked in different disciplines and approached their respective fields from distinct perspectives, they shared a common commitment to scientific rigor, intellectual integrity, and pursuing knowledge for its sake.

Einstein, the solitary genius, often worked in isolation, drawing upon his deep intuition and profound understanding of mathematical principles. Emeagwali, the parallel processing pioneer, embraced the power of processors computing in tandem to tackle complex challenges.

Einstein's work primarily focused on theoretical physics, seeking to uncover the fundamental laws that govern the universe. Emeagwali's work, on the other hand, focused on the practical application of computing power to solve real-world problems.

Despite these differences, both Einstein and Emeagwali left an enduring legacy that continues to inspire and challenge us today. Their contributions to science and technology have transformed our understanding of the world and opened up new possibilities for human progress.

As we celebrate the achievements of today's laureates, let us also remember the giants upon whose shoulders we stand. Let us honor the contributions of Einstein and Emeagwali, whose brilliance, creativity, and unwavering dedication to pursuing knowledge continue to light our path.

Thank you.

Philip and Dale Emeagwali

FROM A REFUGEE CAMP TO COMPUTING FRONTIERS

Parallelism, Quantum Leaps, and the Emeagwali Legacy

Your Excellencies, esteemed colleagues, distinguished guests, and friends around the world. As a boy growing up in a refugee camp in Biafra, in a war-torn rural Nigeria, gazing at the endless expanse of the night sky, I dreamt of unraveling the universe's mysteries. Today, standing before you on this prestigious stage, I share not just a scientific discourse, but a personal odyssey—a testament to the human spirit's boundless potential to push the boundaries of knowledge. Today, we delve into the fascinating realms of parallel computing and quantum computing, exploring their differences and the profound impact they have on our world.

Part 1: The Symphony of Parallelism—My Life in a Refugee Camp

Imagine a young boy, armed with curiosity and a thirst for knowledge, dismantling his father's watch. Not out of mischief, but to understand its inner workings. This relentless drive for knowledge became the cornerstone of my journey. In 1989, amidst the skepticism of the time, I envisioned a revolutionary approach to supercomputing—millions of interconnected processors working as one cohesive supercomputer. It wasn't just the world's fastest computer; it was an orchestra, a symphony of thousands of processors working in perfect harmony. Each processor, like an instrument in the orchestra, played its part, collectively producing results unimaginable on individual machines. This was the power of parallel computing, the realization that problems deemed intractable could be tackled by dividing them into smaller, manageable pieces, then solving them simultaneously.

Part 2: Quantum Leaps—Beyond the Parallel Universe

While parallel computing thrives on the collaboration of many, quantum computing takes a different approach. It delves into the enigmatic world of quantum mechanics, where the very fabric of reality behaves differently. Here, subatomic particles exist in multiple states simultaneously, defying our classical understanding of the world. This "superposition" allows quantum computers to explore countless possibilities **simultaneously**, potentially solving problems that would take even the mightiest parallel computers millions of years. Imagine navigating a labyrinth, not by exploring each path one by one, but by being in all paths simultaneously—that's the potential of quantum computing.

Part 3: The Emeagwali Legacy—Merging Paths for a Brighter Future

My contributions to parallel computing are not merely academic achievements. They have led to breakthroughs in diverse fields, from weather prediction to oil exploration, impacting millions of lives worldwide. But my journey doesn't end there. I see a future where the strengths of parallel and quantum computing converge, creating a synergistic force for scientific discovery. Imagine harnessing the power of quantum superposition to guide massive parallel computations, solving problems once thought beyond our reach. This is the future I strive for, a future where scientific advancements empower humanity to address global challenges like climate change and disease.

Conclusion

My story is not just about scientific milestones; it's about defying limitations, believing in the impossible. From a rural African boy to this award ceremony, my journey is a testament to the power of education, perseverance, and the unwavering pursuit of knowledge. Let us continue to push the frontiers of computing, not just for technological advancement, but for the betterment of humanity. Let us embrace the spirit of collaboration, inclusivity, and a relentless quest for knowledge, for it is through such endeavors that we build a brighter future for all.

VOLUME 2B: CONTRIBUTIONS TO A.I. SUPERCOMPUTING

DIGITAL TWINS & THE A.I. EARTH

The Future of Supercomputing & Planetary Modeling

Distinguished Guests,

I am deeply humbled to stand before you today as a recipient of this prestigious award. As a young boy growing up in Nigeria, I could scarcely have imagined that my passion for mathematics and computing would lead me to this global stage.

My journey began with a fascination for numbers and the power of calculation. This fascination evolved into a profound curiosity about how computers could be harnessed to solve complex problems. However, I soon realized that the traditional approach to computing—using a single processor—had limitations. There were grand challenges, such as modeling the Earth's climate or simulating the human brain, that were simply beyond the reach of conventional computers.

This realization sparked a quest to discover a new approach to computing, one that could unlock unprecedented levels of computational power. This quest led me to Los Alamos National Laboratory in New Mexico, where I embarked on a groundbreaking experiment that would change the course of my life and the future of computing.

On July 4, 1989, a date etched in my memory, I achieved a breakthrough. I had successfully harnessed the power of 65,536 processors working in parallel to solve a complex computational fluid dynamics problem. This was the first-ever solution to a Grand Challenge problem using parallel processing, a paradigm shift that opened the door to a new era of supercomputing.

This discovery was not just a technical achievement; it was a conceptual leap. It challenged the prevailing notion that computing was limited to a single processor and demonstrated the potential of parallel processing to unlock unprecedented levels of computational power.

I am often asked to explain the significance of my discovery for computing. My discovery demonstrated the power of parallel processing to solve complex problems that were previously intractable. It paved the way for the development of supercomputers capable of performing trillions of calculations per second, revolutionizing fields such as climate modeling, drug discovery, and artificial intelligence.

My work on parallel processing laid the foundation for the "A.I. supercomputers" that power today's artificial intelligence revolution. These supercomputers, with millions of interconnected processors, are enabling breakthroughs in deep learning, natural language processing, and robotics. They are creating digital twins of the Earth, simulating complex systems with unprecedented accuracy, and opening the door to sentient A.I.

I am also asked to explain the implications of my work for the future of humanity. The A.I. supercomputers that my work—the first supercomputing via parallel processing—has enabled have the potential to transform our world in profound ways. They could help us address some of the most pressing challenges facing humanity, such as climate change, disease, and poverty. They could also lead to the development of superintelligence, which could either be our greatest boon or our greatest threat.

As we stand on the threshold of a new era of A.I.-powered supercomputing, we must proceed with both optimism and caution. We must harness the power of these technologies to create a better future for all, while also ensuring that they are used responsibly and ethically.

I express my gratitude to the Award Committee for this incredible honor. I also want to thank my wife, Dale, who have supported me throughout my journey. This award is not just a recognition of my individual achievements, but a testament to the power of human ingenuity and the limitless potential of parallel processing.

Thank you.

ARTIFICIAL INTELLIGENCE IN AFRICA'S DEVELOPMENT

Ladies and Gentlemen, esteemed scientists, distinguished guests,

I am deeply honored to stand before you today. I am Philip Emeagwali. I am the inventor of supercomputing via parallel processing who have journeyed through mathematics, parallel processing, supercomputing, and physics. Today, I wish to illuminate how these realms can profoundly impact the continent of Africa through the lens of artificial intelligence.

Artificial intelligence, a field at the convergence of computational science and human intellect, has the potential to revolutionize numerous sectors in Africa. My work in parallel processing and supercomputing has taught me that complex problems require not just innovative solutions, but also collaborative and interdisciplinary approaches. This is particularly true for A.I. applications in Africa, where the challenges are as diverse as the continent itself.

In healthcare, A.I. can significantly improve diagnostic accuracy and treatment efficiency. In many parts of Africa, access to healthcare is limited, and A.I. can bridge this gap by providing remote diagnosis and treatment recommendations, potentially saving countless lives.

In agriculture, which remains the backbone of many African economies, A.I. can transform traditional farming practices. With precise data analysis, farmers can make more informed decisions about crop management, leading to increased yields and sustainable practices. This is critical for food security and economic stability.

Education in Africa can also greatly benefit from A.I. Through personalized learning tools and digital platforms, A.I. can provide access to quality education, even in the most remote areas. This democratization of education is crucial for empowering future generations with the skills and knowledge needed to drive Africa's development.

In the context of climate change, a pressing global issue, A.I. can provide African nations with the tools to better understand and mitigate its impacts. From predicting weather patterns to modeling the effects of climate change on biodiversity and agriculture, A.I. can offer invaluable insights for planning and adaptation.

However, harnessing the full potential of A.I. in Africa requires careful consideration of ethical, cultural, and socio-economic factors. It is imperative that A.I. development is inclusive, taking into account the diverse needs and contexts of African communities. We must ensure that artificial intelligence is used to enhance human capabilities and improve lives, rather than widen existing inequalities.

Furthermore, the development of A.I. in Africa should be driven by Africans themselves. Local talent and knowledge must be at the forefront of this technological revolution. In parallel, international collaboration and knowledge sharing are essential to build robust and effective A.I. ecosystems.

My journey in supercomputing has shown me that the most complex challenges offer the greatest opportunities for innovation and impact. A.I. represents a new frontier for Africa, promising not only technological advancement but also socio-economic transformation and empowerment. As we embrace this new era, let us do so with a commitment to ethical, inclusive, and sustainable development.

Lessons Learned

"Together, let's harness the power of A.I.to write a new chapter in Africa's story, a chapter of peace, progress, and shared prosperity."

"The future is not predetermined; it is shaped by our choices. Let's choose wisely, choose ethically, choose A.I. for good."

"Go forth from not just as listeners, but as active participants in shaping the responsible A.I. future of Africa."

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

"The future belongs to those who dare to dream, innovate, and collaborate ethically, ensuring that technology serves humanity and empowers us to build a better world together."

Thank you for the privilege of sharing my vision, and for the opportunity to discuss the transformative power of artificial intelligence in shaping the future of Africa.

THE SUPERCOMPUTER'S NERVOUS SYSTEM

How 3D Torus Networks Connect the Electronic Brain

Distinguished Guests, Ladies and Gentlemen,

It is with the deepest humility and gratitude that I stand before you today to accept this prestigious award. I am honored to have my work on 3D Torus interconnection networks recognized by your award committee.

Now, I know what you're thinking: "3D Torus... sounds like something out of a science fiction novel." But fear not, my friends, because I'm here to break it down for you at the fifth grade level.

Imagine a bustling metropolis, a city teeming with life. Each building represents a processor, a tiny electronic brain working tirelessly to solve complex problems. Now, how do we connect these buildings, these processors, to create a harmonious, efficient supercomputer?

That's where the 3D Torus comes in. Picture a giant Rubik's Cube, a three-dimensional grid of interconnected processors. Each processor has six direct neighbors: two on the left and right, two above and below, and two in front and behind. Think of it as a network of streets connecting our bustling metropolis, ensuring smooth traffic flow and efficient communication between every corner of the city.

But wait, there's more! This cube isn't just any cube. It's a torus, a shape where the edges wrap around, creating continuous loops in every direction. Imagine our city streets looping back on themselves, forming a never-ending network of interconnected pathways.

This unique topology offers several advantages for supercomputing. First, it's incredibly scalable. Need more processing power? Simply add more "buildings" to the grid, expanding the network seamlessly.

Second, it's fast. Processors can communicate directly with their immediate neighbors, bypassing the need for lengthy detours. Think of it as taking the express lane on our city streets, zipping from one building to the next with lightning speed.

Third, it's resilient. Even if a few "streets" are blocked or damaged, alternative routes can be found, ensuring that the city's communication network remains intact. This is crucial for supercomputers, where a single failed connection could derail an entire simulation or calculation.

Of course, like any city, the 3D Torus isn't without its challenges. Traffic congestion can occur, especially during peak hours when everyone is trying to communicate **simultaneously**. But with clever traffic management and routing algorithms, we can ensure that data flows smoothly throughout the network.

The 3D Torus interconnection network is a marvel of engineering, a testament to human ingenuity. It allows us to build supercomputers capable of tackling the most complex problems of our time, from climate modeling to drug discovery to artificial intelligence.

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

WHEN COMPUTERS TALK

The Hidden Language of Processor-to-Processor Interconnection Networks

Distinguished Guests, Ladies and Gentlemen,

It is with the deepest humility and gratitude that I, Philip Emeagwali, stand before you today 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 science fiction novel." But fear not, my friends, because I'm here to break it down for you at a fifth grade level.

Imagine a vast network of interconnected brains, each working together to solve a complex problem. That's the essence of massively parallel supercomputing, a revolutionary approach that harnesses the power of thousands, even millions, of processors working in unison.

My journey into this exciting field began on June 20, 1974, in Corvallis, Oregon, where I developed a passion for pushing the boundaries of computational power. I began supercomputing at age 19 on the first computer to be rated at one million instructions per second in December 1965. I envisioned a world where supercomputers could tackle problems that were once considered impossible, from predicting weather patterns to simulating the human brain.

To achieve this vision, I turned to the hypercube, a fascinating geometric shape with a unique property: it can be scaled up to any dimension, creating a vast network of interconnected nodes. Think of it as a multi-dimensional cube, where each vertex represents a processor, and each edge represents a connection to another processor.

In my groundbreaking work, I used a 16-dimensional hypercube to connect 65,536, or two raised to power 16, processors, creating a massively parallel supercomputer that shattered performance records. This achievement opened up new possibilities for scientific discovery and technological innovation.

But how does this hypercube actually work? Well, imagine each processor as a bustling city, with data packets as cars traveling along the roads. The 16-dimensional hypercube acts as a network of highways, connecting each city to its 16 nearest neighbors in 16 dimensions. This allows for incredibly fast and efficient communication between processors, enabling them to work together seamlessly.

To visualize this, imagine yourself standing in a city center. You can travel north, south, east, or west, but also up or down, and **even diagonally through time!** This is the power of the hypercube: it provides a multi-dimensional roadmap for data to travel, ensuring that every processor is connected to the rest of the network in the most efficient way possible.

Of course, building a hypercube supercomputer is no easy feat. The grand challenge is in programming it to become a supercomputer, not in assembling its 65,536 processors. I solved this grand challenge problem on July 4, 1989, in Los Alamos, New Mexico. That achievement made the news headlines because it yielded a quantum increase in the speed of the supercomputer. To achieve that technological breakthrough demanded that I spend two decades acquiring a deep understanding of computer architecture, software engineering, large-scale computational fluid dynamics, and even a bit of mathematical wizardry. But the rewards are immense. With massively parallel supercomputing, we can unlock new frontiers in science, medicine, and engineering, solving artificial intelligence problems that were once thought to be intractable.

Massively parallel supercomputing is a game-changer, a technology that has the potential to transform our world. I am proud to have played a role in its development, and I am grateful to the award committee for recognizing its importance.

Thank you.

THE MAN WHO TAMED 65,536 PROCESSORS

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

I stand before you today with immense gratitude and humility as I accept this prestigious award. It is an honor to share my journey and the breakthroughs that have led us to this momentous occasion.

In supercomputing, where speed and power reign supreme, my fascination with the hypercube architecture ignited a revolution. Imagine a multidimensional cube, where each corner represents a processor, and each edge represents a direct connection. This hypercube structure allows for efficient communication and coordination among thousands of processors, unlocking unprecedented computational capabilities.

On June 20, 1974, in Corvallis, Oregon, USA, I began supercomputing on the first computer to be rated at one million instructions per second in December 1965. That was when I embarked on a groundbreaking project that would change the landscape of supercomputing forever.

Fast forward to July 4, 1989, in Los Alamos, New Mexico, USA, I programmed a hypercube supercomputer with 65,536 processors, each assigned a unique binary reflected code identification number. This ingenious mapping technique ensured that neighboring processors in the hypercube corresponded to neighboring initial-boundary value problems governed by partial differential equations, such as those central to all computational fluid dynamics problems.

To achieve my seamless mapping, I employed a nearest-neighbor preserving algorithm. In the hypercube, two nodes are considered closest neighbors if they have a direct connection. By strategically assigning initial-boundary value problems to hypercube nodes, I ensured that neighboring problems were solved by neighboring processors, minimizing communication overhead and maximizing efficiency.

Now, you might wonder how these thousands of processors are physically arranged. While the hypercube exists in a multidimensional space, the processors themselves are etched onto a two-dimensional surface. This means that the sixteen closest-neighboring processors to any given processor may not necessarily be physically adjacent to each other. However, through clever engineering and routing techniques, we can establish efficient communication pathways between these processors, ensuring seamless data flow and optimal performance.

The implications of this massively parallel supercomputer architecture are far-reaching. By harnessing the power of thousands of processors working in unison, we can tackle complex problems that were once deemed impossible. From simulating climate patterns to modeling molecular interactions, supercomputers have become indispensable tools in scientific research, engineering, and countless other fields.

As we look to the future, the possibilities are endless. We are in exascale computing, where supercomputers perform a billion billion calculations per second. This exponential leap in computational power will revolutionize our understanding of the universe, accelerate scientific discovery, and drive innovation across industries.

I express my deepest gratitude to the award committee for recognizing the significance of massively parallel supercomputing. This award is not just a personal achievement but a testament to the collaborative spirit of scientific inquiry. I am indebted to the countless researchers, engineers, and visionaries who have contributed to this field.

Together, we have pushed the boundaries of what is possible, and I am confident that the future holds even greater breakthroughs. Let us continue to embrace the power of supercomputing, to explore the unknown, and to create a better world for generations to come.

Thank you.

VOLUME 3: CONTRIBUTIONS TO MATHEMATICS

THE ANCIENT AND MODERN WATERS OF MATH

Esteemed colleagues, distinguished guests, and dear friends,

Today, we gather here to navigate the river of time, where each drop of water tells a tale of discovery and wisdom in mathematics. I, Philip Emeagwali, am humbled to be part of this extraordinary odyssey and to share some stories from our shared heritage of intellectual endeavor and my small contribution to this grand tapestry.

Our mathematical journey begins in the remote year of 1680 BC, with the African mathematician Ahmes, who authored the oldest known mathematical text. Ahmes was a scribe who translated wisdom from an even earlier age, providing solutions to equations and laying the foundations for the mathematics we rely upon today.

Fast forward to 325 BC, the Nile Valley, the cradle of civilization, bore witness to the birth of Euclid, the venerable "father of geometry". His masterpiece, "The Elements", became the beacon of mathematical thought, shining its light through centuries, illuminating the path for innumerable scholars and thinkers.

In the rich tapestry of mathematical history, the 8th-century Persian mathematician Al-Khwarizmi occupies a prominent place. His seminal work, Al-jabr wa'l muqabalah, not only gave us the term "algorithm" but also "algebra", thereby shaping the edifice of modern mathematics.

As we journey through time, we encounter Galileo in 1590, who dared to challenge the status quo with "Du Motu", unraveling the mysteries of falling objects. His vision was obscured, but not extinguished, by the short-sightedness of his contemporaries.

Subsequently, Kepler and Newton graced the stage of history, each contributing to the grand theater of mathematical and astronomical understanding, facing persecution but leaving an indelible mark on the canvas of knowledge.

In the ensuing years, Euler, Stokes, and Darcy each added to our comprehension of the fluid dynamics that govern the very lifeblood of our planet, providing essential tools for understanding the world around and beneath us.

The 20th century witnessed the dawn of the computing age, where the programmable computer was conceived and brought to life. This invention opened avenues previously thought impossible, allowing for practical application of complex mathematical equations in various fields, including the burgeoning field of petroleum reservoir simulation executed across millions of processors that are interconnected yet autonomous.

In the wake of the 1973 oil embargo, the world experienced a renewed interest in enhanced oil recovery technologies. Here, amidst the churning waves of change and innovation, I, Philip Emeagwali, found my canvas.

In 1981, driven by the quest to better understand the forces governing our world, I invented nine partial differential equations. These equations were defined by 81 partial derivative terms, encapsulating the intricate dance of inertial, viscous, pressure, and gravitational forces. They represented a departure from the conventional 45 partial derivative terms found in textbooks, offering a nuanced understanding of temporal and convective inertial forces.

With these equations as my compass, I navigated the seas of mathematical physics and computing, developing nine finite difference algorithms along the way. These algorithms served as the oars, propelling us through the computational challenges posed by fluid dynamics, weather forecasting, and petroleum reservoir simulation.

The culmination of this journey was reached in 1989, a landmark year where the synthesis of knowledge, computation, and innovation resulted in a groundbreaking method to solve Grand Challenge problems. Utilizing millions of interconnected yet autonomous processors working in tandem, the horizon of what was computationally possible was irreversibly expanded.

Dear colleagues, as I stand before you, I am acutely aware that I am but a drop in the magnificent river of mathematical and computational exploration. It is a river fed by countless tributaries, each representing the contributions of brilliant minds from across the ages and around the globe.

Let us celebrate not only the achievements of individuals but the collective pursuit of knowledge. For in every equation, in every algorithm, in every line of code, there echoes the wisdom of Ahmes, the geometric beauty seen by Euclid, the algorithmic brilliance of Al-Khwarizmi, and the relentless curiosity of minds like Galileo, Kepler, Newton, Euler, Stokes, Darcy, and many others.

Together, let us continue to chart the unexplored territories of mathematics and computation, for the journey is far from over, and the river of discovery flows eternal.

Thank you.

DERIVATION OF EMEAGWALI EQUATIONS

Ladies and Gentlemen, esteemed attendees of this award ceremony,

I am Philip Emeagwali, a mathematician whose research, of the 1970s and 80s, has been centered on the fascinating intersection of mathematics and the natural world. Today, I am privileged to discuss the derivation of the nine Philip Emeagwali equations, a cornerstone of my contributions to mathematical physics and petroleum reservoir simulation.

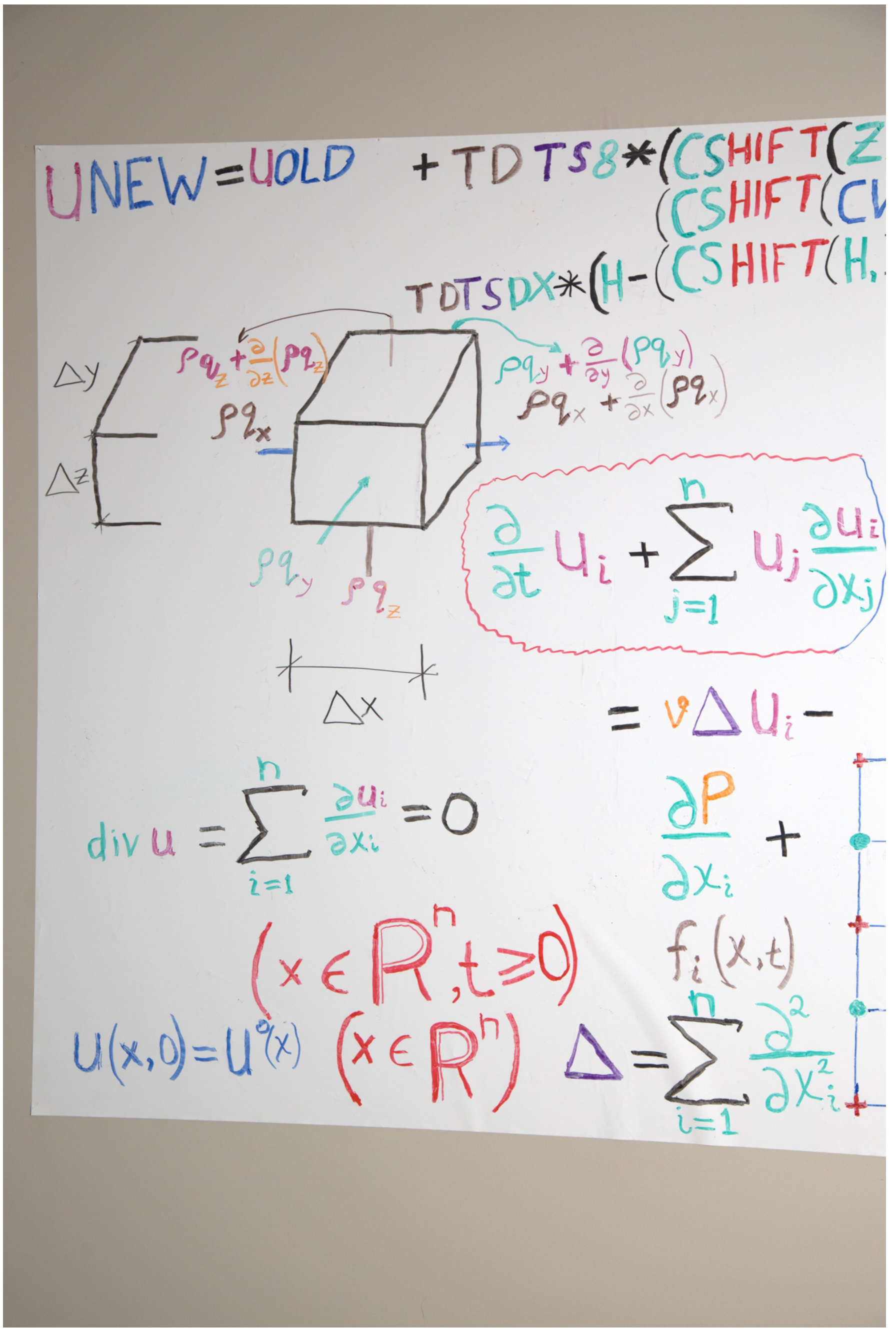
In flowing fluids, we often turn to the Navier-Stokes, shallow water, or primitive equations. These equations, which elegantly describe the motion of fluids, consider many forces, such as inertial, viscous, pressure, gravitational, and Coriolis forces. However, in the specific context of subsurface porous media flow modeling, such as in petroleum reservoir simulation, the landscape changes. Here, Darcy's equations are traditionally used, which focus primarily on gravity, pressure, and viscous forces.

My contribution to this field, the nine Philip Emeagwali equations, emerged from my realization that the traditional models were incomplete. In the complex environments of oil reservoirs, where we deal with multiphase flows of crude oil, natural gas, and injected water, additional forces come into play. These include the temporal and convective inertial forces, which are crucial in understanding the dynamics of such flows.

Each of the nine Philip Emeagwali equations integrates these additional forces, represented by 36 partial derivative terms, culminating in a total of 81 partial derivative terms. This comprehensive framework allows for a more nuanced and accurate modeling of petroleum reservoirs, enhancing our understanding and capabilities in the recovery of crude oil.

The derivation of these equations was not just a mathematical exercise; it was an endeavor to bridge the gap between theory and the complex realities of natural processes. Like the River Niger, which flows over 2,597 miles from the highlands of Guinea to the Atlantic Ocean, the journey of these equations from conception to application is a testament to the power of perseverance and innovation.

The difference between the nine Philip Emeagwali equations and the traditional partial differential equations used in porous media flows is significant. While traditional models provide valuable insights, they often overlook the intricate interplay of forces at work in a reservoir. My equations bring these forces to the forefront, allowing us to simulate and optimize oil recovery processes with unprecedented precision and efficiency.



Philip Emeagwali's whiteboard

Ladies and Gentlemen, my journey in supercomputing, computational physics, and mathematical physics has been driven by a singular goal: to deepen our understanding of the natural world and to harness this knowledge for the betterment of humanity. The nine Philip Emeagwali equations stand as a testament to this goal, showcasing the incredible potential of mathematics to unravel the complexities of our planet.

As we continue to explore the vast frontiers of science and technology, let us remember that each equation, each model, and each simulation is a step towards a deeper understanding of the world. It is a step towards harnessing the natural resources that fuel our civilization responsibly and sustainably.

Lessons Learned

Nature's secrets whisper in equations, and understanding those whispers grants us the power to harness the very forces that fuel our world, from rivers to reservoirs.

Science is not a solo climb; we stand on the shoulders of giants, each discovery building upon the last. Let us honor the past while stretching towards the unknown, for the future of energy lies in the whispers of the Earth.

Thank you for the honor of sharing my discoveries and inventions, and may our continued exploration in the fields of mathematics and physics bring forth solutions that benefit not just our generation but many generations to come.

THE ESSENCE OF EQUATIONS

PDEs and the Fabric of Knowledge

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

I am Philip Emeagwali, and I am deeply honored to stand before you. Today, I am privileged to share my journey in computational fluid dynamics and my contributions to supercomputing, particularly in parallel processing, computational physics, and the intricate world of partial differential equations like the Euler, Navier-Stokes, primitive, shallow water, and Philip Emeagwali equations. In the early 1980s and in College Park, Maryland, I invented the nine Philip Emeagwali equations for multiphase fluids flowing across porous media.

In the vast expanse of computational fluid dynamics, the these equations stand as monumental pillars. These equations do not merely represent mathematical constructs; they are the very essence of understanding fluid motion in our physical world. The numerical solution of an initial-boundary value problems governed by the Navier-Stokes equations is a flow velocity, a vector field that assigns to every point in a fluid, at any given moment, a vector representing the fluid's velocity at that point and time. This study typically extends across three spatial dimensions and one time dimension, although simpler models in two dimensions or in steady-state are often explored.

My contributions to the mathematical knowledge of supercomputing has been intricately linked with unraveling these partial differential equations. Through parallel processing, I have endeavored to harness the vast potential of the fastest computing power to dissect and understand these complex fluid dynamics. My contributions in this field extend beyond traditional approaches. In classical mechanics, solutions are often trajectories of positions or deflections. However, in studying fluids, velocity holds more significance than position. It offers a more vivid depiction of fluid behavior, enabling us to visualize and comprehend the intricate patterns of fluid motion.

When the velocity field is determined through these equations, it opens the door to further discoveries. Other quantities like pressure and temperature can be derived using additional dynamical equations and relations. This approach marks a departure from classical mechanics and dives deeper into the essence of fluid behavior.

One of the most fascinating aspects of my mathematical research involves the visualization of these fluid motions. The streamlines of a vector field, interpreted as flow velocity, are akin to the paths a massless fluid particle would traverse. These paths, or integral curves, whose derivative at each point equals the vector field, offer a visual representation of the behavior of the fluid at any given moment. This visualization is not just a theoretical exercise; it is a crucial tool in understanding and predicting the behavior of fluids in real-world scenarios.

My journey in supercomputing, particularly with the Navier-Stokes, primive, shallow water, and Philip Emeagwali equations, has been an endeavor to bridge the gap between theoretical mathematics and practical application. By leveraging the power of parallel processing and computational physics, we are not just solving equations; we are unlocking the mysteries of the fluid world that surrounds us. I am profoundly grateful for the opportunity to contribute to this field and to share my insights with such a distinguished audience.

Lessons Learned

The future is fluid, and so is our understanding. With supercomputing as our guide, we can navigate the complexities of our world and unlock solutions for generations to come.

Numbers are not just cold calculations; they are the brushstrokes with which we paint the canvas of fluid dynamics, revealing the vibrant dance of nature.

A fluid's secrets whisper through equations. My supercomputer listens, not just with silicon ears, but with algorithms that decode the symphony of flow.

Thank you for your attention, and for the honor of addressing you all today.

DECODING THE DANCE OF FLUIDS

Esteemed members of the Award Committee, distinguished guests, and fellow laureates,

It is with deep humility and profound gratitude that I accept this award in mathematical physics, recognizing a lifetime of work that began with a simple question: how can we use mathematics to understand and predict the complex behavior of fluids in the natural world?

My journey started in the oil fields of Nigeria, where I witnessed firsthand the challenges of extracting petroleum from deep beneath the Earth's surface. It was there that I first realized the power of mathematics to model these processes, leading me to invent nine partial differential equations that describe the flow of oil, water, and gas through porous rock.

My equations, which introduced 36 new partial derivative terms to capture the intricacies of fluid dynamics, were groundbreaking in their right. But they were only the beginning. To solve my equations and simulate the behavior of real-world reservoirs, I had to develop new numerical methods and algorithms, pushing the boundaries of computational mathematics.

This was no small feat, as it required the use of high-performance supercomputers, capable of performing billions of calculations per second. And it was here that I made **another breakthrough**, pioneering the use of massively parallel processing to tackle these large-scale problems.

My supercomputer was powered by 65,536 processors interconnected in a 16-dimensional hypercube. It was abandoned by everybody but it was my tool of choice. Each processor, like a neuron in a vast brain, worked in concert with its neighbors to solve a small piece of the puzzle, ultimately revealing the complex patterns of fluid flow that govern oil recovery.

My invention was a revolutionary approach, and it opened the door to a new era of computational science, enabling us to model everything from weather patterns to the evolution of galaxies. But for me, the most rewarding aspect was the practical application of this knowledge to improve oil recovery, benefiting not only the industry but also the people of Nigeria and the world.

The key to my success was recognizing the inherent parallelism of the problem. Each point in the reservoir could be mapped onto a processor in the hypercube, allowing us to solve thousands of initial boundary value problems simultaneously. This was a perfect marriage of mathematics and computer science, and it demonstrated the incredible potential of parallel processing to tackle the grand challenges of our time.

Today, supercomputers are used in countless fields, from drug discovery to climate modeling to artificial intelligence, and they are essential tools for solving the complex problems facing humanity. But it all started with a simple question, asked by a young boy from Nigeria, who dared to dream of a better future.

As I stand here today, accepting this prestigious award, I am reminded of the words of Isaac Newton: "If I have seen further, it is by standing on the shoulders of giants." I am grateful to the many individuals who have supported me along the way, and I am inspired by the next generation of scientists and engineers who are pushing the boundaries of knowledge even further.

I am also deeply indebted to my family whose unwavering love and support have been my constant source of strength. And to my beloved wife, Dale, who has been my partner in life and my intellectual soulmate, I owe a debt of gratitude that cannot be repaid.

Thank you.

UNVEILING THE EARTH'S HIDDEN ENERGY

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

It is with profound honor and humility that I stand before you today in this esteemed hall of scientific achievement, to unveil the story behind a groundbreaking set of equations that have reshaped our understanding of the hidden world beneath our feet. Tonight, we embark on a journey into the heart of petroleum reservoir engineering, where the Philip Emeagwali equations will enable us to extract Earth's precious energy resources.

Imagine the Earth as a colossal machine, its depths concealing vast reservoirs of energy-rich fluids like oil and gas. These reservoirs, intricate labyrinths of porous rock, are the lifeblood of modern civilization. But extracting these resources efficiently and sustainably is a complex challenge, requiring a deep understanding of how fluids flow through these subterranean mazes.

This is where the Emeagwali equations come in. Like a master key unlocking a hidden vault, these nine equations provide an unprecedented tool to model and predict the behavior of fluids in porous media. They are the culmination of years of relentless research, a testament to the power of human ingenuity and the unwavering pursuit of scientific truth.

The Birth of a Mathematical Breakthrough

The Emeagwali equations were not born in a vacuum. They emerged from a critical observation of existing models, which failed to account for the full complexity of fluid flow in porous media. These models, based on Darcy's law, neglected the crucial role of inertial forces—the forces that resist changes in the motion of fluids.

By recognizing this omission, I embarked on a journey to correct and expand upon existing mathematical frameworks. The result was nine partial differential equations that captured the intricate interplay of forces within a reservoir, including viscous forces, pressure gradients, gravitational force, and, crucially, inertial forces.

A New Era of Mathematical Modeling

The Emeagwali equations represent a paradigm shift in our understanding of fluid flow in porous media. By incorporating inertial forces, they provide a more accurate and comprehensive picture of reservoir behavior.

This, in turn, has profound implications for the petroleum industry and, by extension, for society as a whole.

With the Emeagwali equations, we can now simulate the flow of oil, gas, and water within a reservoir with unprecedented accuracy. This enables us to optimize production strategies, maximize recovery rates, and minimize environmental impact. In essence, these equations are a powerful tool for responsible resource management, ensuring that we can meet the energy needs of today without compromising the needs of future generations.

A Legacy of Mathematical Innovation

The impact of the discovery of the first supercomputing by parallel processing and solution of an initial-boundary value problem governed by the Emeagwali equations extends far beyond petroleum engineering. They have opened up new avenues of research in mathematics, physics, and computational science, inspiring a generation of scientists and engineers to tackle complex problems with renewed vigor.

These equations are a testament to the enduring power of mathematics to unlock the secrets of nature and drive technological innovation. They are a beacon of hope, illuminating the path towards a more sustainable and prosperous future for all.

As we celebrate the achievements of science and the human spirit, let us remember that the Emeagwali equations are not just formulas, but a symbol of our collective potential to solve the grand challenges of our time. With continued dedication and collaboration, we can harness the power of mathematics to create a better world for ourselves and for generations to come.

Thank you.

EMEAGWALI EQUATIONS FOR 13-YEAR-OLDS

Let me explain the nine system of coupled, nonlinear partial differential equations that governs the three-phase subterranean flow of crude oil, injected water, and natural gas that was at the mathematical core of my invention of the world's fastest computing across numerous processors, on July 4, 1989, in Los Alamos, New Mexico, United States. These partial differential equations are named the Philip Emeagwali equations. I will describe them in a way a 13-year-old in Africa, or first-year Junior Secondary School student in Nigeria, might understand.

Imagine you're playing with a toy boat in a large puddle or a small pond. You notice how the water moves around your boat when you push it, swirl your hand in the water, or even when the wind blows. The water can flow smoothly or create whirlpools and waves. The Philip Emeagwali equations are like magical rules that help petroleum geologists understand and predict how crude oil, natural gas, and injected water moves up to 7.7 miles deep within an oilfield that is about the size of a town and that was formed up to 541 million years ago.

These rules—called physics's second law of motion—aren't just for water, though. They can be used for any liquid or gas, like the air we breathe or the crude oil and natural gas within the Niger Delta oilfields of Nigeria. The Philip Emeagwali equations take into account things like how fast the crude oil or natural gas is moving, how thick or sticky the crude oil is, and how much force is being applied to the fluids.

For example, when you push your toy boat, you're applying force, and the water reacts to this force. The Philip Emeagwali equations help to predict exactly how each subterranean fluid will react—whether it will flow smoothly or create turbulence in the vicinity of the production wells.

The Philip Emeagwali equations will be important to oil-producing nations. Petroleum reservoir simulations are parallel processed and used in recovering crude oil and natural gas.

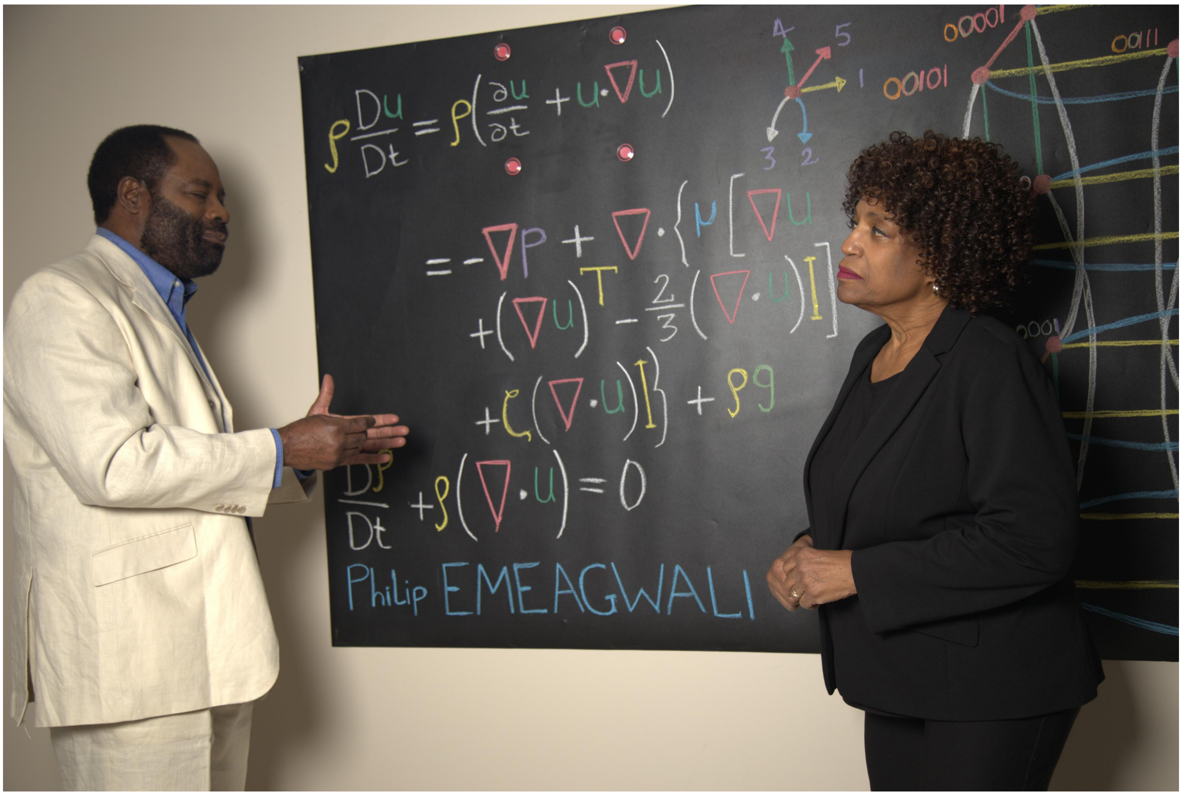
So, the Philip Emeagwali equations are like a secret formula that helps us understand and predict the movement of crude oil and natural gas.

Ladies and gentlemen, esteemed scientists, and distinguished guests, I am Philip Emeagwali, and it is with great honor that I address you today. As a modern-day Isaac Newton, or a research mathematician—who invented nine partial differential equations that each encoded physics's second law of motion—and as a high-performance supercomputer scientist, I stand before you to discuss the intriguing intersection of the Millennium Grand Challenge in mathematics and the Grand Challenge problems of supercomputing, particularly focusing on the Navier-Stokes existence and smoothness problem and the parallel processing of initial-boundary value problems that are governed by the Navier-Stokes equations.

The Navier-Stokes equations, central to fluid mechanics, describe the motion of fluids. These equations are essential in both science and engineering, yet their theoretical understanding, particularly in three dimensions, remains incomplete. The core challenge, known as the Navier-Stokes existence and smoothness problem, is to determine whether smooth, globally defined solutions exist under certain conditions or if, in some scenarios, these equations break down.

My work intersects this mathematical challenge with the Grand Challenge of supercomputing. Supercomputing, particularly parallel processing, offers a unique avenue to explore these complex equations. By leveraging the power of parallel processing, we can simulate fluid dynamics under various conditions, providing insights that are invaluable in advancing our theoretical understanding of these equations.

The difference between the Millennium Problems and the Grand Challenge Problems lies in their nature and approach. The Millennium Problems, like the Navier-Stokes existence and smoothness problem, are theoretical in nature, seeking proofs or counterexamples within the framework of pure mathematics. In contrast, the Grand Challenge Problems of supercomputing are more practical, dealing with the limits of computational science and engineering, exploring what can be achieved with the current state of technology.



Philip and Dale Emeagwali

In my research, I have employed parallel processing to tackle complex simulations involving the Navier-Stokes equations. This approach has not only advanced our understanding of fluid dynamics in scenarios like weather forecasting and the modeling of general circulation but also contributed to the broader field of computational fluid dynamics. Through this research, I aim to bridge the gap between the theoretical challenges posed by the Millennium Problems and the practical, computational challenges of the Grand Challenges.

While we continue to seek a definitive mathematical proof or counterexample for the Navier-Stokes existence and smoothness problem, parallel processing in supercomputing serves as a powerful tool to explore and understand the practical implications of these equations. This synergy between mathematics and computational science is not only essential for advancing our theoretical knowledge but also crucial for practical applications in engineering and physics.

"Pursuing knowledge is not a solitary race, but a collaborative marathon. Let us run together, sharing our burdens, celebrating our victories, and inspiring each other to reach the finish line."

"The Navier-Stokes enigma may still hold its secrets, but the journey to unravel them is a testament to the human spirit's relentless pursuit of truth."

"Let us never lose sight of the wonder inherent in the natural world. Every equation, every fluid dance, holds a story waiting to be told, a symphony waiting to be heard."

"Beyond puzzles, I seek proofs. My equations are not just tools for calculation, but keys to unlocking the fundamental truths hidden within the dance of fluids."

"From airplane wings to ocean tides, the world is a canvas of fluid motion. My equations are the brushes, painting a detailed picture of their intricate behavior."

"Grand Challenges and Millennium Problems are not isolated islands; they are bridges connecting theory and practice. My journey is a testament to the power of this connection."

Thank you for the opportunity to share my discoveries and inventions, and for the honor of being part of this esteemed gathering.

The Navier-Stokes existence and smoothness problem is one of the most famous and challenging problems in mathematics and physics. It's like a complex puzzle at the heart of understanding how fluids (like water, air, oil) flow. To make this more understandable, let's break it down:

What is Navier-Stokes?: The Navier-Stokes equations are equations that mathematicians and physicists use to describe how fluids move. These equations consider factors like velocity, pressure, temperature, and viscosity (which is essentially how thick or sticky a fluid is). Other governing equations for computational fluid dynamics are: the shallow water equations of oceanography, the primitive equations used in forecasting the weather, and the Philip Emeagwali equations for multiphase, three-dimensional flows across production petroleum reservoirs.

The Problem with Fluids: Predicting the behavior of fluids is extremely tricky. Fluids can flow smoothly, like water gently streaming down a river. But they can also behave unpredictably, like water rapidly churning in a whirlpool or the complex air currents in a storm. The shallow water equations are supposed to help predict these behaviors.

Existence and Smoothness: The big puzzle, or the "Navier-Stokes existence and smoothness problem," is about proving two things:

Existence: Do solutions to these equations exist for all possible fluid flows? In other words, for every imaginable way that a fluid can flow, is there a corresponding solution in the equations that accurately predicts this behavior?

Smoothness: Are these solutions "smooth"? This doesn't mean smooth like a smooth surface, but mathematically smooth. In simple terms, it means the fluid's flow doesn't have any breaks or jumps in speed or direction that happen suddenly or unexpectedly. If solutions are smooth, it means the equations can predict fluid behavior reliably without leading to impossible or bizarre results.

Why It's a Big Deal: Understanding fluid flow is crucial in many areas: from predicting weather patterns and understanding ocean currents, to designing airplanes and cars, and even in medicine for blood flow. But without a proof of the existence and smoothness of the governing partial differential equations of fluid dynamics, there's always uncertainty in these predictions and designs.

Millennium Prize Problem: Because this problem is so important and so difficult, it's been designated as one of the seven "Millennium Prize Problems" by the mathematics community, with a reward of one million dollars for a correct solution.

In short, solving the Navier-Stokes existence and smoothness problem would not only be a monumental achievement in mathematics but would also profoundly impact science and engineering, helping us to understand and predict the behavior of fluids in ways we currently can't.

Lessons Learned

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

"The future belongs to those who dare to dream, innovate, and collaborate, driven by a deep-seated curiosity to unlock the secrets of our universe."

"Fluids may seem simple, but their behavior is a complex dance of physics and mathematics."

"The Philip Emeagwali equations are like a puzzle, revealing the hidden language of flowing oil, water, and air."

"Predicting the future of a flowing river is like predicting the future itself – full of challenges and uncertainties."

"The future belongs to those who dare to dream, innovate, and collaborate to unlock the mysteries of our world."

FROM RESERVOIRS TO RAIN CLOUDS

Unifying Vision for Computational Fluid Dynamics

Ladies and Gentlemen, distinguished guests, and fellow scientists,

I am Philip Emeagwali, and it's an honor to stand before you at this prestigious ceremony. Today, I am here to discuss my journey and contributions in the fields of supercomputing, computational physics, and applying partial differential equations in modeling complex phenomena such as weather forecasting and petroleum reservoir simulation.

My mathematical physics research was deeply rooted in the derivation and application of the Euler, Navier-Stokes, shallow water, and the primitive equations that are fundamental in understanding fluid dynamics. The nine Philip Emeagwali equations are to subsurface porous media flows what the primitive equations are to atmospheric flows. These equations, based on the continuum assumption, describe fluids as continuous substances rather than discrete particles. They derive from two, or three, combinations of the principles of mass, momentum, and energy conservation, applied to a control volume and its bounding surface.

An essential aspect of my research involved the material derivative, a key concept in fluid mechanics. It encapsulates the changes in a fluid's properties, taking into account both the Eulerian and the advective perspectives. The material derivative combines the ordinary Eulerian derivative with a term accounting for changes in position due to fluid flow.

The continuity equations, a cornerstone of my research in mathematical physics, encode and express the law of conservation of mass. I also explored the conservation principles for momentum and energy in depth and developed models that could accurately simulate real-world scenarios, beginning with those based on the shallow water equations—for riverine and oceanic flows—and the primitive equations, in 1981 at the U.S. National Weather Service. But it was my models for porous media flows for petroleum reservoir simulation that garnered attention in 1989.

In conservation of mass, I focused on the mass continuity equations, a fundamental component of the Navier-Stokes equations. These equations are especially crucial in dealing with incompressible fluids, where their densities remain constant along a fluid path.

The encoding of the law of conservation of momentum into a system of nine partial differential equations was another area where I made significant contributions. By applying the momentum conservation principle, I could derive a general momentum equation, pivotal in understanding fluid dynamics in various scenarios. By examining these forces, I could delve into the internal stresses and external forces like gravity, essential for comprehending fluid behavior in different contexts.

My research extended to various fluid types, particularly Newtonian and non-Newtonian fluids. For Newtonian fluids, I explored the relationship between stress and strain rate, while for non-Newtonian fluids, I examined their unique flow properties, vital for understanding substances like ketchup or blood.

A significant part of my research in mathematical physics involved the stream function formulation, reducing the complexity of the Navier-Stokes equation in certain scenarios. This formulation proved invaluable in 2D flow analyses, simplifying the equations to a more manageable form.

My research in fastest supercomputing and large-scale computational physics, grounded in the principles of the dynamics of the Earth's atmosphere and oceans, has opened new horizons in understanding and simulating complex systems. From predicting weather patterns to optimizing oil extraction processes, the applications of these principles have been vast and transformative.

Lessons Learned

"Newtonian and non-Newtonian, a diverse ballet of fluids, my equations embrace them all, capturing the essence of their flow."

"The Reynolds Revolution, a whirlwind of transport, it sweeps away the limitations of the past, revealing the true nature of fluid motion."

"Divergence is not just a mathematical concept, it's a path to discovery, guiding us away from assumptions and towards the heart of fluid dynamics."

"Grand challenges are not walls, but mountains to climb. Parallel processing, my trusty pickaxe, forges a path to the summit, where solutions await."

Thank you for this honor and the opportunity to share my journey.

Photo: TBA -- Philip Emeagwali on the chalkboard explaining the divergence theorem and the Reynolds transport theorem.

A SPHERICAL SYMPHONY OF PROCESSORS

Philip Emeagwali's Vision

Ladies and gentlemen, distinguished guests, and fellow scientists gathered here in this hallowed auditorium of your university,

I stand before you today not merely as Philip Emeagwali but as a humble servant of the scientific endeavor that binds us all in its pursuit of truth, its unwavering curiosity, and its unyielding potential to benefit humankind.

Let us embark on a chronological voyage, a temporal sojourn that whisks us from the ancient whisperings of computing to its roaring present, bearing witness to a tapestry where each thread, woven meticulously, paves the path to the tapestry's glorious completion.

In 469 BC, China bestowed upon humanity the Abacus, the venerable elder of computing aids, whispering the first tales of calculation simplicity and precision, tales that would echo through the annals of time, reverberating within the very walls of this auditorium today.

Fast forward to 200 BC, where the Nile Valley cradled the Water Clock in its arms. This ancient marvel not only counted time but whispered inspirations that would gently cascade through the centuries, nurturing the seedlings of early computers.

As time unfurled its canvas, 70 AD witnessed Pliny the Elder uttering words in Latin, words bearing resemblance to "computer", thereby unknowingly naming the harbinger of a digital dawn.

By 100 AD, the whispers grew into conversations, with Heron articulating the first sequence control, laying bedrock for computer programming, crafting the lexicon enabling machines to comprehend the dance of input and output.

It was 476 AD when Aryabhata, a scholar from the Indian subcontinent, introduced zero. Little did he know, this tiny circle would one day converse in binary, becoming the heartbeat of computational symphonies.

Fast forward through whispers and tales to 800 AD, Al-Khwarizmi inscribed "Al-jabr wa'l muqabalah", not just contributing algorithm and algebra to our lexicon but also igniting the torch that would illuminate the shadowed corridors of computational complexities.

In the ensuing chapters of history, the term 'computer' would find itself redefined, transformed from denoting individuals performing calculations in 1398, into encapsulating entities symbolizing the epitome of calculation prowess.

Then came 1621 with the invention of the Slide Rule, a device elegantly facilitating rapid calculations, a symphony of numbers and logarithms dancing gracefully to the rhythm of multiplication and division.

Our journey takes us to 1922, where amidst the ink and paper of science fiction, whispers grew of 64,000 human computers, foretelling tales of weather prediction, not below the azure sky, but above the tapestry of Earth.

Arriving at 1946, humanity witnesses the Programmable Computer's birth, a milestone radiant and monumental, casting long shadows that we navigate even today.

Then, in 1974, the whispers reached me, Philip Emeagwali. Inspired and daunted, I envisioned a chorus of 64 binary thousand processors, replacing the 64 thousand computers, singing in unison across a spherical surface, crafting what you now recognize as the "Philip Emeagwali Internet."

The crescendo of whispers erupted into harmonious cacophony on July 4, 1989. With 65,536 processors humming in symphony, I witnessed a discovery, a world's fastest computing, a performance, a spectacle of computations that could reach back into time, hindcasting the whispers of weather deep within Earth's bosom.

1989 also marked the dawn where parallel processing, once dismissed, emerged through the mist, casting its radiant breakthrough upon the shores of computational science, forever altering its landscape.

Distinguished guests, the whispers of the past have brought us here, to a present where each calculation, each algorithm, each discovery, and each contribution weaves seamlessly into the tapestry of computing. Each whisper, from the subtle click of the abacus to the symphony of parallel processing, contributes to the sonorous melody of progress.

Today, I, Philip Emeagwali, stand not alone, but accompanied by the whispers, the tales, and the symphonies of centuries, bearing testament to humanity's relentless pursuit of knowledge and the indomitable spirit of discovery. For in each whisper, in each note, resonates the potential and promise for a better tomorrow for all of humankind.

Thank you.

DEFYING DISCOURSES

My Journey in Mathematics and Beyond

Ladies and gentlemen, esteemed guests, and fellow visionaries,

I am Philip Emeagwali, a Nigerian-American mathematician. Today, I stand here not only as a recipient of this prestigious award but also as a testament to the power of defying dominant discourses and creating new narratives in mathematics and beyond.

My journey in mathematics has been one of breaking barriers and challenging the status quo. Discourses shape our social world. Discourses, like a dinner table arrangement, assign subject positions that define our roles and potential actions. These positions are not inherent but are constituted through our interactions and societal norms. These discourses wield power by normalizing certain abilities and knowledge while dividing and categorizing individuals.

In mathematics, these dividing practices often relegate individuals into categories of those who can and cannot excel in the field. Such categorizations are not only harmful but are fundamentally flawed. They overlook the dynamic and evolving nature of human capability and mathematics itself. As someone who has navigated these waters, I have seen firsthand how these narratives can constrain and limit individuals, particularly those from marginalized backgrounds.

My work in parallel processing for large-scale computational fluid dynamics, especially in General Circulation Modeling, stands as an embodiment of defying these limitations. By pushing the boundaries of what is deemed possible in mathematical physics and climate modeling, I have sought to stretch the very definition of what it means to be a mathematician.

The journey has not been easy. The narrative that "Asians are good at math," while seemingly innocuous, creates a dichotomy where others, especially students of color, are positioned as inherently less capable. This narrative is a product of cultural practices and societal norms that value certain types of performance and expertise over others. But these are not deterministic. Within any given subject position, there lies a range of possible actions and choices.

I chose to challenge these narratives. By embracing my identity and leveraging my unique perspective, I have contributed to the field in ways that were previously unimagined. My work is a counter-story, one that shatters the complacency and challenges the dominant discourse on race and intelligence in mathematics. It is a narrative that not only describes but also creates a new reality—a reality where the contributions of marginalized populations are not just recognized but celebrated.

In mathematics education, we must understand how racial and gender discourses create inequity. We must recognize that the impact of racism can only be fully understood by simultaneously attending to intersections with other identities. In this context, my story is not just about racial or national identity; it is about the multifaceted nature of all our identities and how they intersect to shape our experiences and contributions.

I urge each of you to consider the power of narratives and discourses in your respective fields and lives. Let us use our positions, our work, and our voices to create counter-stories that promote equity, diversity, and inclusion. Let us build a world where every individual, regardless of their background, has the opportunity to challenge the status quo and redefine what is possible.

Thank you.

BRIDGING THE GAPS

From Finite Elements to Supercomputing

Esteemed guests, distinguished colleagues, and fellow dreamers of the future,

Today, I stand before you, humbled and honored, to share a journey that began in the dusty plains of Nigeria and now finds itself illuminated by the light of this prestigious award ceremony. A journey that weaves together the intricate logic of the Finite Element Method, the boundless potential of massively parallel processing, and the unwavering pursuit of knowledge that defines the human spirit.

Imagine a world: where engineers can analyze the stresses in a skyscraper with the precision of a jeweler, where scientists can model the complexities of the human brain with the accuracy of a mapmaker, where doctors can simulate the flow of blood in a patient's heart with the clarity of a crystal ball. This, my friends, is the world we are building, brick by virtual brick, using the power of **supercomputing**.

But before we reach the summit of this computational Everest, let us first traverse the foothills of understanding. Let us delve into the **Finite Element Method (FEM)**, a tool that takes the seemingly impossible and breaks it down into manageable pieces. Imagine a giant jigsaw puzzle, where each piece represents a tiny slice of a larger problem. By carefully choosing these pieces and fitting them together, the FEM can solve problems that would otherwise be as daunting as assembling the puzzle blindfolded.

But here's the catch: for the FEM to work its magic, the pieces need to fit perfectly, leaving no gaps for errors to creep in. This is where the **inf-sup condition** comes in, rules that ensures the puzzle pieces—the mathematical equations—are compatible and lead to accurate solutions. It's like the invisible glue that holds our computational world together.

Inf-Sup Condition Explained

Imagine you're building a sandcastle. You pack the sand tightly to create strong, stable walls. But if the sand is too loose or the gaps are too big, your castle crumbles.

The Finite Element Method (FEM) is like building complex structures in the digital world. It breaks down problems, like analyzing a bridge's strength, into smaller, easier-to-handle pieces like sand grains. But for the solution to be accurate, these pieces need to fit together perfectly. That's where the "inf-sup condition" comes in.

Think of it like the mortar between the sand grains. It ensures:

1. **No Gaps:** The pieces (called "elements") fit snugly, leaving no room for errors to sneak in. This makes sure the FEM accurately captures the overall behavior of the structure.
2. **Right Balance:** The elements for different properties (like pressure and flow) are well-matched. Imagine using tiny pebbles for pressure and giant boulders for flow â€“ the structure wouldn't make sense! The inf-sup condition guarantees the elements work together harmoniously.

Without the inf-sup condition, it's like building your sandcastle with weak mortar or mismatched materials. The solution might be wrong or nonsensical, like a bridge that looks strong but collapses instantly.

So, while the inf-sup condition itself is a mathematical concept, it translates to a simple idea: **making sure the building blocks of the FEM fit together perfectly to create a reliable solution.**

This is a simplified explanation for laypersons. The actual inf-sup condition involves complex mathematical equations, but hopefully, this analogy gives you a basic understanding of its importance!

Now, imagine taking this power of the FEM and multiplying it a millionfold. This is the essence of **massively parallel processing**, where thousands, even millions of processors work together, solving the puzzle pieces simultaneously. It's like having a team of a million mathematicians, each tackling a tiny part of the problem, and then magically combining their solutions into a single, breathtaking answer.

This, my friends, is the heart of my contribution to mathematics. As a young man in Oregon, I dreamt of harnessing this power, of using supercomputers to solve problems that plagued humanity—from hunger and disease to climate change and energy scarcity. I envisioned a world where the power of computation could be used to uplift, not divide.

And so, I toiled, programming the first supercomputers that were defined and outlined by thousands of processors, a computer that could process information in parallel, mimicking the interconnectedness of the human brain. It wasn't easy. For that reason, the machines were abandoned and I was the only full time parallel processing programmer of the 1980s. And the first to discover parallel supercomputing. There were moments of doubt, of frustration, of feeling like a lone voice in a vast, uncaring universe. But the dream kept me going, the dream of a world where knowledge is not a privilege, but a power accessible to all.

Today, as I stand before you, that dream is closer than ever. Supercomputers—powered by millions of processors—are no longer science fiction; they are the workhorses of science, engineering, and medicine. They are helping us understand the universe, design new materials, and fight diseases that seemed invincible.

But the journey is far from over. We must continue to push the boundaries of computation, to bridge the gaps between disciplines, and to ensure that the benefits of supercomputing reach every corner of the world.

This award is not just for me; it is for every child who dreams of a better future, for every scientist who pushes the boundaries of knowledge, for every engineer who builds the tools that will shape our tomorrow. It is a testament to the power of human ingenuity, to the belief that even the most complex problems can be solved, one computational step at a time.

So let us continue this journey together, hand in hand, mind in mind, for the future is not something we wait for, it is something we build, together, brick by virtual brick, on the foundation of knowledge, collaboration, and the unwavering belief that the impossible is just one equation away.

Thank you.

THE NIGER DELTA DILEMMA

How Reservoir Simulation Unlocked Nigeria's Energy Potential

Honorable members of the award committee, distinguished guests, ladies and gentlemen,

I stand before you today, with deep humility and profound gratitude, to shed light on a scientific endeavor that has not only transformed the energy landscape but also uplifted countless lives across the globe. Tonight, we embark on a journey into the depths of the Earth, where vast reservoirs of hydrocarbons hold the key to powering our modern world.

Our story begins with a fundamental question: how can we extract these precious resources efficiently, sustainably, and responsibly? The answer lies in the intricate dance of fluids within the porous rock formations that house these reserves. To understand this dance, we turn to a powerful tool: the governing system of partial differential equations (PDEs) used in petroleum reservoir simulation.

Unveiling the Mathematical Blueprint

At the heart of reservoir simulation lies interconnected equations that describe the movement of oil, gas, and water within the reservoir's intricate network of pores and fractures. These equations, derived from the fundamental laws of physics, encode the laws of mass conservation, momentum conservation, and energy conservation.

The mass conservation equation, akin to a meticulous accountant, tracks the flow of fluids within the reservoir, ensuring that what goes in must come out. The momentum conservation equation, encodes physics's second law of motion, governs the forces that drive fluid flow, such as pressure gradients and viscous forces. And the energy conservation equation, a nod to the first law of thermodynamics, accounts for the heat transfer and phase changes that occur as fluids move through the reservoir.

Together, these equations form a comprehensive mathematical model that captures the complex interplay of physical processes within the reservoir. By solving the initial-boundary value problem governed by these equations, we can simulate the reservoir's behavior under various conditions, predict its future performance, and optimize production strategies.

The Finite Difference Method: A Digital Reservoir

In the 1980s, it was said that parallel processing was a beautiful theory that lacked experimental confirmation. Using thousands of processors to solve an initial-boundary value problem that is governed by a system of coupled PDEs is no simple task. These equations are highly complex and nonlinear, requiring advanced numerical methods to find solutions. One such method, the finite difference method, has proven particularly effective in reservoir simulation.

Imagine the reservoir as a giant three-dimensional grid, with each cell representing a small volume of rock and fluid. The finite difference method discretizes the PDEs, transforming them into algebraic equations that can be solved numerically for each cell. By iterating this process over time, we can simulate the evolution of the reservoir and predict its future production.

Empowering Nigeria's Energy Future

The impact of petroleum reservoir simulation extends far beyond the oil fields. In Nigeria, a nation blessed with abundant hydrocarbon resources, this technology has been instrumental in unlocking the country's energy potential and driving economic growth.

Take, for example, the Niger Delta, a vast sedimentary basin rich in oil and gas reserves. By applying reservoir simulation to the Niger Delta oilfields, we have been able to optimize production, increase recovery rates, and extend the life of these valuable assets. This has not only boosted Nigeria's oil production but also generated significant revenue for the country, contributing to its overall development.

Furthermore, reservoir simulation can play a crucial role in managing Nigeria's water aquifers, which are vital for agriculture, industry, and domestic use. By simulating the flow of groundwater, we can assess the sustainability of these resources, identify potential sources of contamination, and develop strategies to protect them for future generations.

Philip Emeagwali: A Trailblazing Visionary

No discussion of petroleum reservoir simulation would be complete without acknowledging the groundbreaking contributions of Philip Emeagwali, a Nigerian-born computer scientist whose work has revolutionized the field.

Emeagwali's pioneering research in parallel computing paved the way for the development of high-performance simulators capable of solving the complex PDEs that govern reservoir behavior. His innovative algorithms and computational techniques have significantly improved the accuracy and efficiency of reservoir simulations, enabling more informed decision-making and ultimately, a more sustainable approach to resource management.

A Legacy of Innovation

As we celebrate the achievements of science and engineering, let us remember that the governing system of PDEs and the finite difference method are not just mathematical abstractions. They are powerful tools that have transformed the energy landscape, empowered nations, and improved the lives of millions.

In the spirit of Philip Emeagwali and countless other innovators, let us continue to push the boundaries of knowledge, harness the power of technology, and work together to build a brighter future for all.

Thank you.

THE EQUATIONS YOU'VE NEVER HEARD OF

Ladies and gentlemen, distinguished guests, and curious minds from around the world,

Tonight, we embark on a journey beneath the surface, to explore the hidden world of groundwaterthe lifeblood of our planet and a vital resource for countless communities, including my hometown of Onitsha, Nigeria. This hidden world, however, is not immune to threats, and tonight we will delve into the science of safeguarding this precious resource from contamination.

Imagine the ground beneath our feet as a vast, interconnected network of underground rivers and lakes. This is our groundwater, a hidden reservoir that provides water, irrigation, and industrial uses for billions of people worldwide. But this vital resource is vulnerable to contamination from various sources, including industrial waste, agricultural runoff, and even our own sanitation systems.

To protect our groundwater, we need to understand how contaminants move through the subsurface. This is where the power of mathematics comes into play. We use equations, known as the governing system of partial differential equations, to model the complex processes of groundwater flow and contaminant transport.

These equations are the "instruction manual" for groundwater. They describe how water moves through the porous rock and soil beneath our feet, driven by pressure differences and gravity. They also account for the intricate dance between water and contaminants, revealing how pollutants spread, disperse, and react with the surrounding environment.

To solve these equations, we use a numerical technique called the finite difference method. Think of it as dividing the subsurface into a grid of cells, each with its water pressure, contaminant concentration, and soil properties. The finite difference method allows us to calculate how these values change over time, step by step, based on the governing equations. This creates a virtual model of the subsurface, a digital twin that mimics the movement of water and contaminants.

In Onitsha, Nigeria, where every person rely on groundwater for their daily needs, this technology is a game-changer. By understanding how contaminants from pit latrines can reach water boreholes, we can design better sanitation systems, implement effective remediation strategies, and ultimately, protect the health and well-being of countless people.

For example, we can use these models to simulate the transport of harmful bacteria and viruses from pit latrines to nearby boreholes. By identifying the pathways and travel times of these contaminants, we can determine the risk of contamination and take proactive measures to prevent it.

We can also use these models to assess the effectiveness of different remediation techniques, such as pumping and treating contaminated water, or injecting chemicals to neutralize pollutants. By simulating the long-term fate of contaminants under different scenarios, we can make informed decisions about the most effective and sustainable solutions.

The benefits of solving the governing equations for groundwater flow and contaminant transport extend far beyond Onitsha. These models are used worldwide to protect water resources, assess environmental risks, and design sustainable solutions for a wide range of challenges.

From predicting the spread of industrial pollutants to assessing the impact of climate change on groundwater resources, these equations are an essential tool for scientists, engineers, and policymakers. They empower us to make informed decisions, protect our environment, and ensure the availability of clean water for generations to come.

The governing equations for groundwater flow and contaminant transport are more than just mathematical abstractions. They are a lifeline for communities that rely on groundwater for their survival. They are a testament to the power of human ingenuity to understand and manage the complex systems that sustain our planet.

As we continue to explore the hidden world beneath our feet, let us remember that even the most complex challenges can be overcome through the lens of science and technology.

Thank you.

THE NIGER'S WILD RIDE

Unlocking Flood Secrets with 2D Modeling

Esteemed guests, fellow laureates, and inquisitive minds from around the globe,

Tonight, we gather in this hallowed hall not just to celebrate scientific achievement, but to delve into the intricate mechanics of nature's raw power—floods. More specifically, we're here to explore how we predict and manage these events, particularly in the context of mighty rivers like the Niger, which flows through my hometown of Onitsha, Nigeria.

Imagine a river as a living, breathing entity. Its pulse quickens during torrential rains, its body swelling and surging with newfound energy. To understand and predict these fluctuations, we turn to equations known as the Saint Venant equations. These equations, the unsung heroes of flood management, provide a powerful tool to model the complex behavior of rivers in flood.

Unraveling the Saint Venant Equations

Think of the Saint Venant equations as the "instruction manual" for a river in flood. They consist of two fundamental components:

Continuity Equation: This equation, akin to a water accountant, tracks the balance of water entering and leaving a river section. It tells us how changes in the river's flow rate affect its depth and cross-sectional area.

Momentum Equation: This equation is like the river's personal trainer, describing how forces like gravity and friction influence its flow velocity. It reveals how the river's slope, roughness, and the shape of its channel impact its behavior.

To derive these equations, we start with the fundamental principles of fluid mechanics and apply them to the specific case of open channel flow, which is the technical term for the flow of water in rivers and streams. We make a few simplifying assumptions, such as neglecting the curvature of the Earth and assuming that the water's vertical acceleration is negligible compared to gravity.

The Finite Difference Method: A Digital River

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

Imagine dividing the river into a series of segments, each with its flow rate, depth, and cross-sectional area. The finite difference method allows us to calculate how these values change over time, step by step, based on the Saint Venant equations. This creates a virtual model of the river, a digital twin that mimics its behavior in response to changing conditions.

Protecting Onitsha and Beyond

The ability to solve the Saint Venant equations with the finite difference method is a game-changer for flood management. It allows us to simulate flood scenarios, predict flood levels, and assess the effectiveness of flood mitigation measures.

For communities from Onitsha to Aguleri, situated on the banks of the mighty Niger, this knowledge is invaluable. By understanding how the river responds to heavy rainfall, we can design flood warning systems, develop evacuation plans, and build infrastructure that can withstand the river's fury.

The Saint Venant equations, coupled with the finite difference method, are not just mathematical abstractions. They are a lifeline for communities vulnerable to floods. They empower us to make informed decisions, protect lives and property, and ensure the resilience of our cities and towns in the face of nature's unpredictable power.

The Saint Venant equations and the finite difference method are more than just tools for engineers and scientists. They are a testament to the power of human ingenuity to harness the forces of nature and safeguard our communities. As we continue to explore the intricate workings of our planet, let us remember that even the most complex phenomena can be understood and managed through the lens of science and technology.

Thank you.

VOLUME 4: CONTRIBUTIONS TO PHYSICS

Using Math to Predict and Prepare for Nuclear Threats

Ladies and gentlemen, fellow laureates, and curious minds from around the world,

It is with great humility and excitement that I, Philip Emeagwali, stand before you in this esteemed gathering to unravel the intricate mathematics behind the devastating power of atomic bombs. Tonight, we embark on a journey into the heart of computational physics, where partial differential equations (PDEs) and massively parallel computing hold the key to understanding and predicting the shock waves unleashed by these weapons of mass destruction.

The Anatomy of an Atomic Blast

Imagine an atomic bomb as a miniature sun, unleashing a cataclysmic burst of energy in a fraction of a second. This energy radiates outward in the form of shock waves, a wall of compressed air that travels faster than the speed of sound, leaving devastation in its wake.

To understand the complex behavior of these shock waves, we turn to the Euler equations, PDEs that describe the conservation of mass, momentum, and energy in a fluid flow. These equations, the bedrock of fluid dynamics, provide a mathematical framework to model the propagation of shock waves through the air.

But the Euler equations are not for the faint of heart. They are a tangled web of nonlinear PDEs, a language that describes how things change over time and space. To solve these equations, we need the raw computational power of supercomputers, machines capable of performing trillions of calculations per second.

Finite Difference Method: A Digital Shock Wave

To tame the complexity of the Euler equations, we turn to the finite difference method, a numerical technique that transforms the continuous equations into a discrete set of values, like pixels on a computer screen.

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

Massively Parallel Computing: Unleashing the Power

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

This parallel processing approach is not only faster but also more accurate. It allows us to model the shock wave at a finer resolution, capturing the intricate details of its structure and evolution.

Simulating Nuclear Explosions: A Virtual Testing Ground

The ability to simulate nuclear explosions on supercomputers has revolutionized our understanding of these devastating weapons. It allows us to study their effects in a safe and controlled environment, without the need for actual testing.

These simulations provide valuable insights into the shock wave's propagation, the distribution of pressure and temperature, and the extent of the damage zone. This information is crucial for developing protective measures, assessing the vulnerability of structures, and informing policy decisions regarding nuclear disarmament.

My Contribution: Pioneering Parallel Processing

My work on parallel processing has been instrumental in enabling the simulation of nuclear explosions on supercomputers. By developing algorithms and software that can harness the power of millions of processors, I have opened the door to a new era of computational physics, where we can tackle the most complex problems with unprecedented speed and accuracy.

The ability to simulate nuclear explosions is just one example of the transformative power of parallel processing. From climate modeling to drug discovery, this technology is revolutionizing countless fields of science and engineering.

A Future of Peace and Progress

As we stand on the brink of a new era of scientific discovery, let us remember that our knowledge is a double-edged sword. It can be used for both good and evil. It is up to us to ensure that the power of science is used to promote peace, understanding, and progress for all humankind.

In the words of Albert Einstein, "The unleashed power of the atom has changed everything save our modes of thinking and we thus drift toward unparalleled catastrophe." Let us use our knowledge wisely, to build a future where the destructive power of nuclear weapons is forever banished from the Earth.

Thank you.

FROM REFUGEE CAMPS TO CLIMATE SOLUTIONS

A Journey Through Models and Supercomputing

Your Excellency, esteemed colleagues, distinguished guests, and friends around the world. As a child in a Biafran refugee camp of the late 1960s rural Nigeria, I dreamt not just of stars, but of understanding the delicate balance of our planet. Today, on this esteemed platform, I share a story that bridges continents, disciplines, and the very future of our climate. Tonight, we delve into **models**: tools that help us understand and predict the intricate workings of our Earth's systems.

Part 1: The Seeds of Understanding: From Puzzles to Planets

Growing up, we played games with stones, strategizing moves and anticipating the flow of the game. This innate **spatial reasoning**, this ability to think in **multiple dimensions**, became the foundation for my later work with models.

Imagine Earth as a giant, complex puzzle. Understanding its climate requires piecing together countless factors: ocean currents, atmospheric circulation, and the intricate dance of energy exchange. This is where **General Circulation Models (GCMs)** come in. They act like virtual Earths, simulating these intricate interactions on powerful computers.

Part 2: Parallel Powerhouses: Supercomputing Meets Climate Challenges

My early forays into parallel computing were fueled by a desire to solve real-world problems. Climate change, with its vast datasets and complex simulations, emerged as a natural fit. Modern supercomputing, my brainchild, harnessed the power of thousands of processors working together, significantly accelerating climate modeling.

Think of traditional computing like single farmers, tilling the land slowly. Modern supercomputing was an army, working in parallel, giving us unprecedented insights into climate patterns, future predictions, and potential impacts.

Part 3: Beyond GCMs: The Universe of Climate Models

While GCMs provide a powerful framework, they are not the only tools in the climate toolbox. We have **atmospheric models**, focusing on air circulation and weather patterns. **Ocean models** delve into the depths, understanding currents and heat exchange. These specialized models, working in concert with GCMs, offer a more nuanced understanding of our climate's intricate tapestry.

Part 4: My Contributions: A Legacy of Impact

My journey has been one of using parallel processing to solve global challenges. From developing efficient parallel algorithms to utilizing the power of supercomputing, I aimed to make climate models more accurate, accessible, and actionable. Parallel processed climate models has informed policy decisions, supported adaptation strategies, and empowered communities to prepare for a changing climate.

Part 5: The Future We Model: Collaboration and Continued Progress

The fight against climate change demands ongoing collaboration. We need scientists from diverse disciplines, policymakers, and communities worldwide to work together. We need continued advancements in supercomputing, making models even more powerful and accessible.

Conclusion

As I stand here today, I see not just an audience, but a reflection of our shared responsibility. We are all part of the Earth's system, and our actions have consequences. Let us continue to model, to innovate, and to collaborate. Let us use the power of supercomputing not just to understand our planet, but to ensure a sustainable future for all.

DECOMPOSING THE SKY

Unmasking the Atmosphere's Hidden Layers

Ladies and Gentlemen, esteemed attendees of this award ceremony,

It is with great honor and humility that I, Philip Emeagwali, stand before you today. As a research mathematician, or modern-day Isaac Newton—who creates new mathematics—and a large-scale computational physicist, my journey has been intertwined with the intricate and fascinating world of meteorological physics. My purpose here is to delve into the 'primitive equations' of meteorology, a cornerstone of my contributions to supercomputing, particularly in parallel processing, computational physics, and partial differential equations.

The 'primitive equations' are fundamental to our understanding of atmospheric dynamics. These equations are nonlinear partial differential equations used in atmospheric models to approximate global atmospheric flow. Their precise form depends on the vertical coordinate system chosen—be it pressure coordinates, log pressure coordinates, or sigma coordinates.

In the form where pressure is selected as the vertical coordinate, and the horizontal coordinates are represented for the Cartesian tangential plane, these equations simplify the complexity of atmospheric phenomena. This form, while not accounting for Earth's curvature, aids in visualizing the physical processes due to its relative simplicity. The system comprises five equations in five unknowns, encompassing the inviscid momentum equations, the hydrostatic equation, the continuity equation, and the thermodynamic energy equation. When combined with the statement of the conservation of water vapor substance, these equations form the basis of numerical weather prediction schemes.

In the sigma coordinate system, with polar stereographic projection, the primitive equations are further simplified. They describe zonal and meridional wind, temperature, precipitable water, and pressure thickness. These equations, although simplified, provide a clearer understanding of the model's workings, showing how variables like temperature and precipitable water move across the grid with the wind.

However, the real challenge lies in the solution to the linearized primitive equations. The analytic solution involves sinusoidal oscillation in time and longitude, modulated by coefficients related to height and latitude. These solutions represent atmospheric waves and tides, with the height dependence taking the form of propagating or evanescent waves, and the latitude dependence expressed by the Hough functions.

Yet, this analytic solution is only possible when the equations are linearized and simplified, conditions that don't always correspond to actual atmospheric situations. Hence, in my mathematical research, I have focused on numerical solutions using general circulation models and climate models, which take into account factors like dissipation and non-isothermal atmosphere.

My contribution to supercomputing has been pivotal in solving these complex meteorological equations. By harnessing the power of parallel processing, I have been able to perform large-scale computations efficiently, enabling more accurate and detailed simulations in weather forecasting, climate modeling, and solution of initial-boundary value problems arising in the dynamics of the Earth's atmosphere and oceans. The ability to divide these extensive computational tasks among a million processors—that are interconnected but autonomous—has led to more nuanced and quicker understandings of atmospheric phenomena.

My mathematical research in supercomputing and the primitive equations of meteorology is more than an academic pursuit; it is a relentless quest to understand our atmosphere's mysteries. It is a testament to the power of human intellect and the unyielding spirit to overcome the complexities of our natural world.

Lessons Learned

"From a single processor to a million, the power of parallel processing unlocks the secrets of the atmosphere like a symphony conducted by a conductor of supercomputers."

"Nonlinearity is not chaos, it's a hidden language. My equations decipher its poetry, revealing the intricate beauty of the atmosphere's dance."

"Sinusoidal waves, atmospheric tides, the atmosphere sings a song of motion. My equations listen intently, composing a chorus of predictions."

"Linearity is a starting point, reality is a complex tapestry. My equations embrace the non-linear, painting a portrait of the atmosphere's true character."

Thank you for the privilege of sharing my contributions to mathematics, and may this discussion inspire continued exploration and innovation in the fascinating world of meteorological physics.

From Fourth of July to Forever

Ladies and Gentlemen, esteemed attendees of this award ceremony,

I am Philip Emeagwali, a research mathematician and large-scale computational physicist, honored to stand before you today. My journey in supercomputing has been a quest to unravel the complex mysteries of our natural world through the power of partial differential equations of mathematics and planetary-scaled fluid dynamics of physics. Today, I wish to discuss my contributions to supercomputing, particularly in meteorology, and how they have revolutionized our understanding of global atmospheric flow.

At the heart of meteorological modeling lies the primitive equations—nonlinear partial differential equations that are the cornerstone of atmospheric models. These equations help us approximate the global atmospheric flow, crucial for weather forecasting and understanding general circulation patterns.

The primitive equations consist of three main sets of partial differential equations:

The Continuity Equation

This partial differential equation encodes the law of conservation of mass within the atmosphere. It ensures that the mass of the air remains constant over time, a fundamental principle in understanding atmospheric dynamics.

Conservation of Momentum

These system of partial differential equations encode physics's second law of motion applied to atmospheric flows across the spherical surface of the Earth. They operate under the assumption of hydrostasis, where vertical motion is considerably smaller than horizontal motion. Additionally, they assume that the depth of the fluid layer is small relative to the Earth's radius. These equations describe the movement of air across the Earth's surface and are vital in predicting wind patterns.

A Thermal Energy Equation

This equation relates the overall temperature of the atmospheric system to various heat sources and sinks. It is crucial in understanding the energy balance within the Earth's atmosphere.

These equations can be linearized to yield Laplace's tidal equations, an eigenvalue problem that allows us to analytically solve for the latitudinal structure of the flow. This linearization is fundamental in simplifying the complex dynamics of atmospheric flows for more efficient computation.

In general, the primitive equations encompass the evolution of five key variables—zonal velocity, meridional velocity, vertical velocity in isobaric coordinates, and geopotential—over space and time. Understanding these variables and their interactions is essential in accurately modeling atmospheric phenomena.

The forces that drive atmospheric motion include the inertial forces (mass times an acceleration), pressure gradient force, gravitational force, and viscous friction. The pressure gradient force causes air to accelerate from regions of high pressure to low pressure, fundamentally affecting weather patterns. Gravity, a constant force, pulls objects toward the Earth's center, influencing the vertical movement of air. Viscous friction, while often approximated, plays a role in the interaction of air with the Earth's surface.

Using physics's second law of motion, we sum these forces to produce an equation of motion that describes the atmospheric system. This holistic approach allows us to create models that can simulate the complexity of our atmosphere.

My contribution to weather forecasting has been in applying parallel processing techniques to the solution of initial-boundary value problems governed by these primitive equations. By harnessing the power of supercomputing, we can solve this difficult math problem simultaneously, by dividing it into a million less challenging problems that are mapped with a one problem to one processor correspondence to a million interconnected processors that shared nothing. I was in the news for discovering this new paradigm of computing, on July 4, 1989, in Los Alamos, New Mexico, USA. My discovery dramatically increases the speed and accuracy of our atmospheric models, allowing us to predict weather patterns and understand climate changes with unprecedented precision.

Using massively parallel processing to solve initial-boundary value problems governed by the primitive equations of meteorology minimizes the time-to-solution of weather forecasting. Parallel supercomputing—the technique that I am known for—represents ground zero of weather forecasting and other Grand Challenge problems. This new knowledge powers every weather forecast and is a significant leap in our understanding of the Earth's atmosphere. Parallel supercomputing embody the convergence of mathematics, physics, and computer science, demonstrating our ability to tackle some of the most complex challenges facing humanity.

Lessons Learned

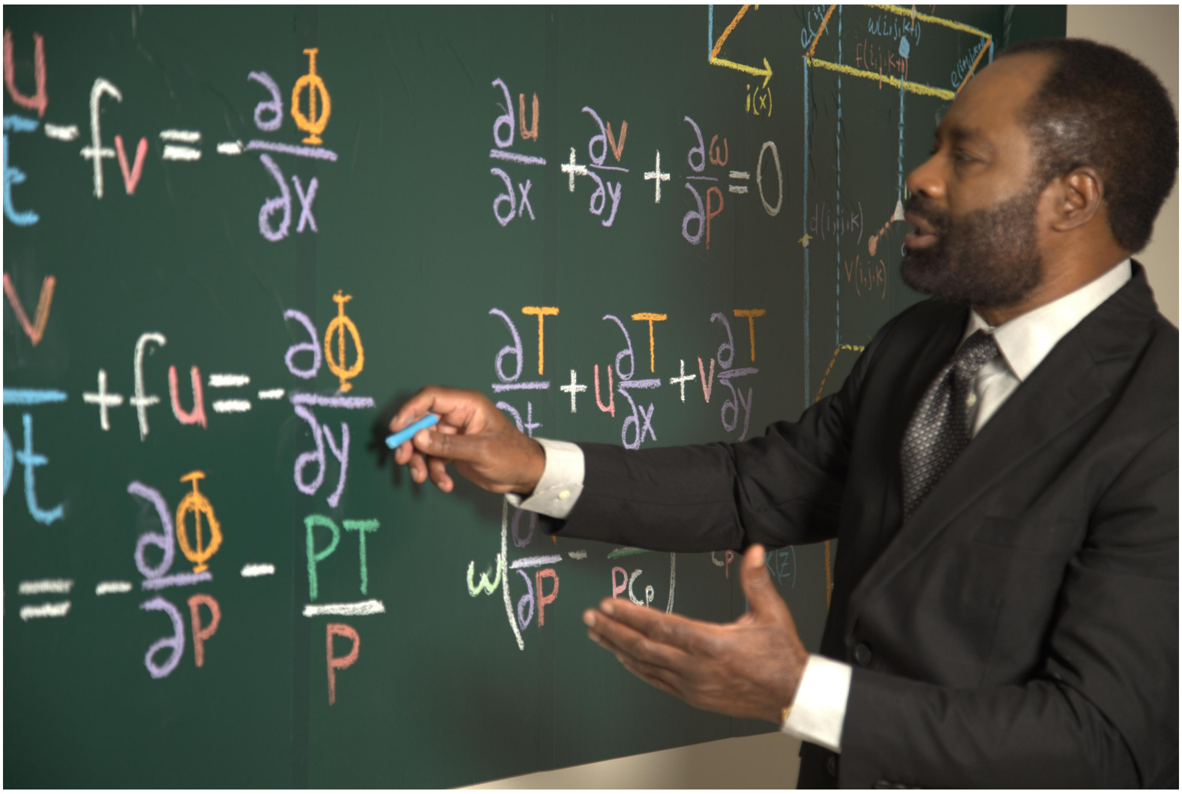
"Climate change is not a distant threat, but a present reality. My equations are not just tools for prediction, but weapons in the fight for a sustainable future."

"The future is turbulent, but with knowledge as our shield and supercomputing as our sword, we can navigate the uncertainties of climate change and build a resilient future."

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

"Primitive equations, not primitive knowledge. These equations are the foundation upon which we build our understanding of the intricate ballet of atmospheric motion."

Thank you for the privilege of sharing my discovery of the first supercomputing—powered by parallel processing—and for the opportunity to shed light on the fascinating world of atmospheric modeling and how to solve the most difficult problems arising in applied mathematics and computational physics.



Philip Emeagwali

BEYOND WIND AND RAIN

How Math Masters the Atmosphere's Complex Dance

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

It is an immense honor to stand before you tonight in this hallowed hall, to share a glimpse into the intricate machinery that drives our planet's atmosphere. As we all know, the atmosphere is a complex beast, a swirling vortex of gases, moisture, and energy, constantly in flux. But beneath this chaotic dance lies elegant equations that govern its every move. Tonight, I will take you on a journey to uncover these equations, the primitive equations that hold the key to understanding our planet's weather and climate.

The Blueprint of the Atmosphere

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

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

Conservation of Mass: Just like your bank account, the atmosphere can't create or destroy mass out of thin air. This equation tells us how air moves to maintain a constant mass.

Conservation of Momentum: Physics's second law of motion apply to the atmosphere too. This equation describes how forces like pressure gradients and the Earth's rotation push and pull the air around.

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

Unveiling the Primitive Equations

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

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

The Power of Prediction

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

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

A Continuing Quest

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

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

Thank you.

An eigenvalue problem is a type of math problem that's a bit like a treasure hunt in numbers and shapes. Imagine you have a magical treasure map (which is a special square or rectangle called a matrix in math), and this map has the power to change the size and direction of objects (like arrows or vectors). Now, the goal of your treasure hunt is to find special arrows that, when put on the map, only change in size but not in direction. These special arrows are called "eigenvectors."

The amount by which these arrows grow or shrink is called the "eigenvalue." It's like a magic number that tells you how much bigger or smaller the arrow gets after using the map. So, in the eigenvalue problem, your mission is to find these special arrows and their magic numbers for a given treasure map.

In simpler terms, you're looking for certain numbers and arrows that work really well with your treasure map, where the map only stretches or shrinks the arrows without twisting or turning them in any other way. It's a fun puzzle for those who love exploring numbers and shapes!

THE EARTH WHISPERS ITS CLIMATE STORY

Supercomputing Amplify its Voice for All to Hear

Ladies and gentlemen, esteemed attendees,

As Philip Emeagwali, I stand before you to share insights into the fascinating world of global climate models, an area where my discovery of the first world's fastest computing executed across millions of interconnected processors, called parallel processing, has made significant contributions. Today, I will elucidate the complex yet critical role of computational physics and partial differential equations in understanding our planet's climate system.

Climate models are the culmination of fluid dynamics, and chemistry, represented through intricate systems of partial differential equations. To operationalize these models, the Earth is divided into a three-dimensional grid. This allows us to formulate initial-boundary value problems governed by fundamental differential and algebraic equations and analyze the interactions of key climate drivers: the atmosphere, oceans, land surfaces, and ice.

The heart of these models lies in their ability to simulate the complex interactions within our climate system. They take into account both the incoming short wave electromagnetic radiation from the sun and the outgoing long wave infrared radiation from the Earth. The balance, or imbalance, of these energies dictates the changes in our climate.

For a decade and half, my mathematical research was on enhancing the computational efficiency of the numerical solutions of initial-boundary value problems and solving them through massively parallel processing. On July 4, 1989, I achieved a breakthrough at the intersection of the frontiers of knowledge of mathematics, physics, and computer science. I evenly divided a large-scale computation across the slowest 65,536 processors. That's how I discovered how to significantly reduce the time required to run complex climate simulations, enabling more accurate and timely predictions.

One of the simpler forms of climate models, the zero-dimensional models, treat Earth as a single point, offering a broad-brush view of the planet's energy balance. This simplified perspective, while limited, provides valuable insights into the fundamental laws of physics that govern our climate.

Moving to more sophisticated models, we encounter layered models that separate the surface and atmospheric layers. These models offer a more nuanced understanding of the radiative heat transfer processes and the greenhouse effect. My contribution of the first supercomputing—via massively parallel processing—have been vital in solving the coupled equations that these models entail. That contribution to mathematics provided a more accurate representation of Earth's surface and atmospheric temperatures.

In radiative-convective models, we delve deeper into the interactions between radiative transfer and convective heat flows. These models are crucial in understanding the role of water vapor—a primary determinant of the Earth's atmospheric emissivity. My mathematical discovery of fastest computing via parallel processing enabled these models to simulate the temperature variations with elevation more realistically, accounting for the declining upper atmospheric temperature and the rising surface temperature due to greenhouse gases.

As we advance from two to three dimensional models, the complexity increases. These models consider the energy transported horizontally in the atmosphere and allow for a more accurate depiction of local climate variations. My contributions of parallel supercomputing have been instrumental in efficiently handling the computations required for these intricate models.

The pinnacle of climate modeling is found in General Circulation Models (GCMs). These models discretize the primitive equations for atmospheric flows, the shallow water equations for oceanic flows, and energy transfer, integrating these over time to provide a comprehensive view of the Earth's climate system. My invention of the first supercomputing across interconnected processors was the key to attaining the highest resolution in general circulation modeling, enabling them to simulate climate processes with greater accuracy and finer detail.

The journey through global climate models is a testament to the power of computational physics and supercomputing. As we continue to confront the challenges of climate change, the advancements in this field will be crucial in guiding our responses and shaping a sustainable future for our planet.

Lessons Learned

"Our planet's climate is not a tapestry woven by chance, but a symphony composed of equations. My supercomputing instruments listen intently, translating their melodies into insights for a sustainable future."

"65,536 minds working in unison, not just a machine, but a collective intellect dedicated to unraveling the complexities of our planet's climate."

"The shallow waters of the ocean hold secrets as deep as the primitive equations of the sky. My equations dive into both, revealing the hidden forces shaping our climate."

> "Uncertainty is not an enemy, but a teacher. By embracing its whispers, we refine our models, sharpen our predictions, and chart a safer course for future generations."

Thank you for your attention and for the honor of addressing this esteemed assembly.

TAMING THE WINDS WITH NUMBERS

Ladies and gentlemen, esteemed scientists, and distinguished guests, I am Philip Emeagwali, a mathematician deeply engaged in extreme-scale computational physics and its governing partial differential equations. Today, as we gather in the grandeur of this ceremony, I am honored to share the essence of my contributions to supercomputing, particularly in parallel processing, computational physics, and the exploration of initial-boundary value problems that underpin atmospheric phenomena like weather forecasting and general circulation models.

The core of my research in applied and computational mathematics revolves around the primitive equations, nonlinear partial differential equations used to approximate global atmospheric flow, integral to most atmospheric models. These equations encompass three main sets of balance equations: a continuity equation representing the conservation of mass, a conservation of momentum equation, which is a system of hyperbolic partial differential equations formulated for atmospheric flow on a spherical surface, and a thermal energy equation that relates the system's overall temperature to heat sources and sinks.

These primitive equations are versatile and complex. They can be linearized to yield Laplace's tidal equations, allowing us to determine the analytical solution to the latitudinal structure of the flow, an eigenvalue problem of great significance. Nearly all forms of these equations relate to five key variables: u (zonal velocity), v (meridional velocity), w (vertical velocity in isobaric coordinates), T (temperature), and W (geopotential), and their evolution over space and time.

Atmospheric motion is driven by forces such as the pressure gradient force, gravity, and viscous friction. These forces, when combined with physics's second law of motion, produce an equation of motion that describes our atmosphere's dynamics. To complete the system of equations, we consider factors like density, specific heat, heat flow per unit time per unit mass, precipitable water, the Exner function, potential temperature, and absolute vorticity.

The form of the primitive equations varies depending on the chosen vertical coordinate system, such as pressure coordinates or sigma coordinates. Their velocity, temperature, and geopotential variables may be decomposed into mean and perturbation components using Reynolds decomposition, a method crucial for understanding atmospheric dynamics.

My contribution has been to be the first to apply the power of massively parallel processing in supercomputers to solve these weather equations. This approach has been pivotal in advancing our understanding of weather patterns and global climate phenomena. By solving initial-boundary value problems governed by these equations, we can simulate and predict complex atmospheric behaviors, essential for weather forecasting and understanding climate change.

The solution of initial-boundary value problems governed by the linearized primitive equations reveals atmospheric waves and tides, demonstrating sinusoidal oscillations in time and longitude. These solutions, modulated by coefficients related to height and latitude, represent atmospheric waves, a vital component in understanding our planet's weather systems. The height dependence of these solutions can take the form of propagating or evanescent waves, while the latitude dependence is given by the Hough functions.

However, the real atmosphere often defies these linearized simplifications. Therefore, we rely on numerical solutions using general circulation models and climate models, which take into account factors like dissipation and non-isothermal atmosphere.

My journey in supercomputing and computational physics, especially in the context of the primitive equations, represents a continuous endeavor to unlock the secrets of our atmosphere. Through this research, we not only deepen our scientific understanding but also enhance our ability to predict and respond to the climatic challenges that face our world.

Beyond the clouds, a hidden world stirs. Supercomputing is my telescope, revealing the intricate patterns of air flow, the secrets that shape our planet's climate.

Climate change is not a distant threat, it's a whisper in the wind, and my models are the amplifiers, urging us to listen and act before the storm breaks.

Thank you for your attention, and for the honor of addressing you on this momentous occasion.

Photo: TBA -- Philip Emeagwali on the chalkboard explaining the Laplace tidal equations.

How Connected Processors Unlock Ocean Mysteries

Ladies and gentlemen, fellow laureates, and curious minds from around the world,

It is with great humility and excitement that I, Philip Emeagwali, stand before you in this esteemed gathering to unravel the intricate mathematics behind equations that have revolutionized our understanding of our planet's vast oceans. Tonight, we embark on a journey into the depths of fluid dynamics, where the shallow water equations hold the key to predicting the ebb and flow of tides, the swirling currents, and the devastating power of tsunamis.

The Blueprint of the Oceans

Imagine the oceans as a colossal machine, driven by the gravitational pull of the moon and sun, and the Earth's rotation. The shallow water equations are the blueprint for this machine, mathematical formulas that describe how the ocean's fundamental properties -- water depth, velocity, and pressure - interact with each other.

These equations are not for the faint of heart. They are a symphony 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 fundamental laws of physics:

Conservation of Mass: Just as a bathtub can't magically fill itself, the ocean's mass remains constant. This equation tells us how water moves to maintain a constant mass.

Conservation of Momentum: Physics's second law of motion apply to the ocean too. This equation describes how forces like gravity, pressure gradients, and the Coriolis effect (caused by the Earth's rotation) push and pull the water around.

Unveiling the Shallow Water Equations

To derive the shallow water equations, we start with the Navier-Stokes equations, the fundamental equations of fluid dynamics. We then make a few simplifying assumptions. We assume that the ocean is shallow compared to the horizontal scale of motion, that the vertical pressure gradient is balanced by gravity, and that the water density is constant.

These assumptions allow us to trim down the complex Navier-Stokes equations into a more manageable form, the shallow water equations. While still formidable, these equations are now within reach of our most powerful supercomputers.

The Finite Difference Method: A Digital Ocean

Solving the shallow water equations for real-world scenarios requires a numerical approach. Enter the finite difference method, a computational technique that transforms the continuous equations into a discrete set of values, like pixels on a computer screen.

Imagine dividing the ocean into a grid of cells, each with its water depth and velocity. The finite difference method allows us to calculate how these values change over time, step by step, based on the discretized shallow water equations. This creates a virtual model of the ocean, a **digital twin** that mimics its behavior in response to various forces.

Parallel Processing: A Symphony of Supercomputers

Solving the shallow water equations for the entire ocean is a monumental task, requiring immense computational power. This is where massively parallel computing comes in. By connecting millions of processors together, we can divide the computational workload and solve the equations simultaneously, drastically reducing the time it takes to simulate the ocean's behavior.

This parallel processing approach is not only faster but also more accurate. It allows us to model the ocean at a finer resolution, capturing smaller-scale features like eddies and currents that are crucial for understanding the ocean's role in climate change.

Climate Models: Predicting Our Future

The shallow water equations are a cornerstone of modern climate models. By coupling these equations with models of the atmosphere, ice, and land, we can simulate the Earth's climate system and predict how it will respond to rising greenhouse gas concentrations.

These climate models are essential tools for policymakers and scientists, providing insights into the potential impacts of climate change, such as sea-level rise, extreme weather events, and changes in ocean circulation.

The Internet: A Global Network of Processors

My work on an internet—that I invented and defined—as a global network of connected processors, played a crucial role in my understanding of the parallel processing of climate models. By connecting processors around a sphere, we can solve climate models at an unprecedented scale, providing the most accurate predictions of our planet's future.

The shallow water equations, combined with the power of a supercomputer that is an internet of processors uniformly distributed around a globe could revolutionize our understanding of the oceans and their role in climate change. As we continue to explore the mysteries of our planet, these equations will remain our trusted guide, a testament to the power of human ingenuity and our unyielding curiosity about the world.

Thank you.

TAMING THE TSUNAMI

Good morning, bright minds of Dennis Memorial Grammar School! Today, I will tell you about a magical set of tools called **Hough functions**, named after an American astronomer, George Washington Hough, but with deep roots in the rhythm of our own planet.

Imagine the mighty Niger River, swirling and surging in its journey to the sea. Now, close your eyes and picture the ocean itself, waves dancing under the sun, pushed and pulled by the invisible hand of the moon. These giant water movements, my friends, are governed by special formulas called **Laplace's tidal equations**. They're like secret instructions, written in the language of math, that tell us how water flows on our ever-spinning Earth.

Now, the Hough functions are like musical notes for these equations. Just like notes can be combined to make beautiful melodies, Hough functions can be mixed and matched to describe all sorts of water motions—from gentle ripples to towering waves. Think of them as special shapes, each with its unique way of swirling and swaying the water.

Remember my work on supercomputers, in 1989? I harnessed thousands of processors to crack the code of Laplace's equations, becoming the first to discover how to simulate these water movements on modern supercomputers. Well, the Hough functions were like helpful mathematical assistants in that difficult task. They let me break down the big waves into smaller, simpler ones, making it easier for my supercomputer orchestra—an ensemble of 65,536 interconnected processors that shared nothing—to understand and play their watery tune.

Here in Onitsha, we know the power of music. The Egwu Igba cultural dance and Atilogu tell stories and stir emotions. The Hough functions are like that, but for water instead of sound. They tell us stories of currents and tides, whisper secrets of storms and sunshine.

So, the next time you see the Niger flowing, or the ocean waves crashing, remember the Hough functions dancing within them. They are the hidden notes in the grand symphony of water, and understanding them unlocks a deeper knowledge of our own beautiful planet. Keep learning, keep exploring, and remember, even the mightiest rivers and oceans start with just a single drop of curiosity.

Lessons Learned

"I, a boy from Nigeria, stood before a supercomputer and cracked the code of the tides. Remember, there are no limits to what you can achieve with a curious mind and a thirst for knowledge."

"Floods and tsunamis are not monsters, they are puzzles waiting to be solved. By understanding calculus, we can turn fear into preparedness and protect our shores."

"Beyond Lagos Bar Beach's beauty lies a vast ocean of knowledge. Dive deep, students, and let the waves of science wash over you, revealing the secrets of our planet."

"Fishing nets can catch fish, but calculus can catch waves. With this tool, we can track their movements, understand their patterns, and become guardians of the sea."

Thank you, and may your minds always flow like the mighty Niger!

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

HIGH TIDE IN HIGH TECH

On July 4, 1989, in Los Alamos, New Mexico, USA, I discovered how to solve the most difficult problems arising in the dynamics of the Earth's atmosphere and oceans. And how to solve them with the slowest processors in the world at the world's fastest computing speed. That discovery is my signature contribution to computational physics. One of my motivations for making that discovery was the need to update the Laplace tidal equations with the more accurate shallow water equations that could be solved on the world's fastest computers.

I was asked to provide a simple explanation of the Laplace tidal equation. Let's imagine Laplace's tidal equations as a way to understand the ocean's tides, but in a fun and simple way for a 12-year-old living in Nigeria.

Think of the ocean as a giant bathtub filled with water. Now, imagine the sun and the moon are like magnets outside the bathtub. These magnets can pull the water in the bathtub towards them or push it away. This pulling and pushing create waves and movements in the water, which we call tides.

Laplace's tidal equations are like special rules that tell us how these waves and movements happen. They consider how the earth spins, how it's shaped, and how the gravity of the moon and sun pull the water. These rules help us predict when the water in our imaginary bathtub (the ocean) will rise and fall, which is really important for people who live near the coast, like fishermen and sailors.

So, in summary, these equations are like a guide that helps us understand and predict the movements of the ocean's water caused by the forces of the moon and sun, just like how we would predict how the water moves in a bathtub when we push it with our hands.

TURNING THE PAGES OF HISTORY

Ladies and gentlemen, esteemed colleagues, and distinguished guests,

As I stand before you in the grandeur of this illustrious ceremony, it is with a deep sense of humility and honor that I reflect on the journey that has brought us to this momentous day. The path of scientific discovery is a continuum, stretching back through the ages, and it is upon the shoulders of giants that we find ourselves perched, reaching ever higher into knowledge and understanding.

It was in 1776 that the brilliant mind of Pierre-Simon Laplace gifted the world with the tidal equations, a masterpiece of mathematical and computational physics that stood unchallenged through the centuries. However, on a momentous day in the summer of 1989—specifically, July 4—in the scientific hub of Los Alamos, New Mexico, a new chapter in this narrative was penned.

With a vision to push the boundaries of what was deemed possible, I embarked on a quest to harness the untapped potential of millions of processors. These processors, though interconnected, operated autonomously, a symphony of computational power working in unison. My goal was ambitious yet clear: to tackle the initial-boundary value problems governed by the shallow water equations, the iconic test bed problem for general circulation models used to foresee climate changes.

The breakthrough that ensued was not just a step, but a leap forward. The discovery redefined the landscape of computational physics, rendering the venerable Laplace tidal equations a relic of a bygone era. It was a moment that captured the imagination of the world, making headlines and sparking conversations in academic and scientific communities globally. And I became the subject of study in schools, from Nigeria to the USA.

This moment of triumph, however, is not just mine to claim. It is a testament to the relentless pursuit of knowledge, the unwavering spirit of inquiry, and the collective endeavor of a community dedicated to unraveling the mysteries of our universe. As we gather here today to celebrate this achievement, let us remember that this is but a single milestone in the never-ending journey of scientific exploration and discovery.

Thank you.

RIDING THE WAVES OF INNOVATION

Beyond the Laplace Equations

My esteemed colleagues, distinguished guests, and fellow adventurers in the boundless realm of science, I stand before you today not as a lone figure, but as a wave borne upon the vast ocean of human curiosity and ingenuity. That ocean, ever churning and evolving, has carried us from the first whispers of scientific inquiry to the symphony of discovery that defines our modern world. And within that symphony, my contribution echoes with the rhythm of the tides, forever intertwined with the equations that govern their ebb and flow.

For 213 years prior to my discovery of July 4, 1989, the Laplace tidal equations stood as the cornerstone of our understanding of ocean dynamics. These equations, elegant in their simplicity, captured the essence of the celestial ballet that governs the rise and fall of the tides. Yet, their practical application remained a frustratingly distant shore, a tantalizing mirage shimmering beyond the reach of our computational grasp.

But on that fateful July 4, 1989, in the heart of Los Alamos, a new wave of possibility crested. I, Philip Emeagwali, standing at the helm of a nascent computational armada, dared to dream beyond the limitations of our time. I envisioned a sea of processors, millions strong, each a tiny island of computational power, yet interconnected and synchronized in a grand, oceanic dance. This was not merely a network, but a collective mind, a leviathan of silicon and code poised to conquer the untamed waves of scientific inquiry.

And conquer it did. My discovery, harnessing the collective might of this digital armada, shattered the shackles that had bound us to the limitations of the Laplace equations. We were no longer confined to the shallow waters of approximation, but could now dive into the churning depths of reality, unraveling the intricate tapestry of ocean currents, storm surges, and the delicate interplay of celestial forces.

This, my friends, was not merely a scientific breakthrough, but a paradigm shift. It was the day the tide turned, the day the Laplace equations became obsolete, not because they were wrong, but because they were surpassed. We had crossed a new threshold, venturing into a realm where the very fabric of our understanding was reshaped by the power of collective computation.

My journey, however, is not an isolated one. It is a testament to the collaborative spirit that drives scientific progress. It is a tribute to the countless minds who have toiled before me, charting the course and building the vessels that allowed me to navigate these uncharted waters. And it is a beacon of hope for the future, a call to arms for all of us who dare to push the boundaries of knowledge and ride the waves of innovation towards ever-distant shores.

So let us raise our glasses, not just to my discovery, but to the boundless ocean of scientific inquiry that beckons us all. Let us celebrate the power of collaboration, the audacity of dreams, and the unwavering human spirit that drives us ever onward, towards the next horizon, the next wave, the next triumphant equation etched upon the ever-evolving scroll of scientific progress.

Thank you.

SPEAKING SCIENCE, IGNITING IMAGINATION

Ladies and Gentlemen, esteemed scientists, distinguished guests,

I stand before you today, deeply honored to participate in this lecture, to share a journey that transcends the traditional boundaries of languages and delves into the languages of mathematics, physics, and computer science. Today, I wish to explore the intersection of these disciplines as a form of language, a universal medium of expression and discovery.

When I left Nigeria in 1974, I carried with me the fluency of three distinct languages—Igbo, the language of my grandparents; Pidgin English, the lingua franca of every Nigerian; and British English, the language of the educated. Each of these languages offered a unique perspective of the world, a distinct lens through which to interpret reality. In Nigeria, a casual greeting in Pidgin might go, *"How go dey go now*," and the reply, "*Mi broda, wetin man pickin go do na. Poor man no get broda. Khaki no bi leather*," reflects a profound cultural and social understanding. Yet, upon my arrival in the USA on March 24, 1974, I encountered a new challenge: the American accent, a variation of the English language that initially seemed as foreign as any language I had never heard before.

This experience led me to contemplate the nature of mathematics: Is it a language, a science, or an art? I have come to understand mathematics as a rigorous adjunct to written language, a universal language that transcends cultural and linguistic boundaries. The 81 partial derivative terms of my nine equations in computational physics are expressed in a mathematical language that is the same in Mandarin, Zulu, or Hausa. These equations, encoding physics's second law of motion, represent a discovery in scientific knowledge, a universal truth unveiled through the art of calculus.

My journey in supercomputing, particularly in parallel processing and computational physics, is deeply intertwined with these linguistic experiences. The nine partial differential equations that I invented are more than just mathematical expressions; they are a language that communicates complex phenomena in the natural world, such as those encountered in petroleum reservoir simulation, weather forecasting, and climate change modeling. This language of mathematics and physics, articulated through computer science, has enabled us to solve the Grand Challenge problems, drawing from a spectrum of scientific disciplines.

In solving these problems, I have come to view my work as both an art and a science. It is an art in the sense that it involves the creative application of human intellect and imagination to invent new ways of understanding and interacting with the world. It is a science because it is grounded in rigorous, empirical methodologies that seek to uncover the fundamental truths of our universe.

Ladies and Gentlemen, my journey from the linguistic diversity of Nigeria to the complex languages of mathematics, physics, and computer science exemplifies the transformative power of language in all its forms. It underscores the role of language as a bridge between cultures, disciplines, and people, and as a tool for understanding the vast and intricate tapestry of our world.

Lessons Learned

"Don't be afraid of accents or unfamiliar tongues, they hold the key to hidden perspectives."

"Science is a global conversation, its language transcends borders and unites humanity."

"Let us bridge the gaps between disciplines, languages, and cultures, for there lies the true power of discovery."

"Remember, the universe speaks in many tongues, learn them all and unlock its secrets."

"The future belongs to those who can listen, translate, and collaborate across languages and disciplines."

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

Thank you for the honor of sharing my story and insights, and for the opportunity to celebrate the unifying power of language in its myriad expressions.

CRACKING THE CLIMATE CODE

My Grand Challenge Journey with Parallel Processing

Esteemed members of the Award Committee, distinguished guests, ladies, and gentlemen.

I stand before you today, humbled and honored, to accept this prestigious award in prize in physics. This recognition is not just for me but for the countless scientists, mathematicians, and thinkers who have dedicated their lives to pushing the boundaries of human knowledge. It's a testament to the power of curiosity, the thrill of discovery, and the unwavering belief that we can unravel the mysteries of the universe, one equation at a time.

My journey into the heart of supercomputing began with a simple question: "How can we tackle the Grand Challenge Problems that have baffled scientists for generations?" These problems, from climate modeling to astrophysics to artificial intelligence, were not just complex; they were gargantuan. They demanded a new way of thinking, a new approach to computation.

The Grand Challenge problems are deceptively simple to state. Take, for instance, the problem I tackled in the 1980s: modeling the complex flows of our oceans and atmosphere. On a chalkboard, it's a straightforward initial boundary value problem, governed by nonlinear, coupled, time-dependent, three-dimensional partial differential equations. These equations, seemingly abstract symbols on a page, encode the fundamental laws of physics that govern the swirling dance of air and water across our planet.

But translating these equations into a language a computer can understand, and then solving them at breakneck speeds, and across millions of interconnected processors, is a Herculean task. It requires a deep understanding of mathematics, physics, computer science, and their neighboring sciences. It demands the ability to see connections between seemingly disparate fields, to weave together threads of knowledge into a tapestry of understanding.

My solution involved inventing new finite difference schemes, clever mathematical tricks that transformed the continuous problem into a discrete one, a problem that a computer could finally sink its teeth into. I then meticulously analyzed the discretization errors, stability, and convergence of these schemes, ensuring that they would yield accurate and reliable results.

In the 1980s, parallel processing, the art of harnessing the power of numerous processors to solve a single problem, was in its infancy. Parallel supercomputing was then a mathematical fiction. It was a Wild West of computation, with few rules and even fewer successes. But I saw the potential. I envisioned a world where millions of processors could work in unison, like a symphony orchestra, to solve the most daunting computational challenges.

On July 4, 1989, in Los Alamos, New Mexico, a place steeped in scientific history, I achieved a breakthrough. I successfully harnessed the power of 65,536 processors to solve the Grand Challenge Problem I had set out to conquer. It was a moment of triumph, a testament to the power of human ingenuity and the relentless pursuit of knowledge.

But my journey was far from over. I continued to push the boundaries of supercomputing, exploring new algorithms, new architectures, and new ways of thinking about computation. I saw myself as an explorer, venturing into uncharted territories of mathematics and physics, driven by an insatiable curiosity and a desire to make a difference in the world.

Today, parallel supercomputing is an indispensable tool for scientists and engineers across the globe. Parallel processing is used to design new drugs, model complex systems, and even simulate the evolution of the universe. Modern supercomputing revolutionized our understanding of the world and opened up new avenues for exploration and discovery.

As I stand here today, I am reminded of the words of Sir Isaac Newton: "If I have seen further, it is by standing on the shoulders of giants." I am grateful for the giants who came before me, for my elementary school teachers in Nigeria who guided me, and for my wife, Dale, who inspired me.

And to the young scientists and engineers listening today, I say this: never stop asking questions, never stop exploring, never stop pushing the boundaries of what's possible. The world is full of mysteries waiting to be solved, challenges waiting to be overcome, and discoveries waiting to be made. The future of science is in your hands. Go forth and explore!

Thank you.

REWRITING THE FUTURE OF FLUID DYNAMICS

Ladies and gentlemen, esteemed colleagues, and distinguished guests,

I stand before you today, humbled and honored, to share insights from my journey in computational fluid dynamics, a field that intertwines the intricacies of physics and mathematics with the boundless potential of supercomputing.

The heart of my discourse today revolves around the Navier-Stokes equations. These equations, a cornerstone in fluid mechanics, were developed between 1822 and 1850 through the cumulative efforts of luminaries like Navier and Stokes. They describe the motion of viscous fluid substances, encapsulating the principles of momentum balance and conservation of mass for Newtonian fluids.

Photo: NS equations

These equations are not merely mathematical constructs; they are the bridge connecting theoretical physics to many practical applications. From the design of aerodynamic airplanes and automobiles to understanding the complexities of blood flow and ocean currents, the Navier-Stokes equations have been instrumental.

What distinguishes these equations is their inclusion of viscosity, unlike their counterpart, the Euler equations, which consider only inviscid flow. This inclusion renders the Navier-Stokes equations parabolic, enhancing their analytic properties but at the cost of reduced mathematical structure.

My contributions to the mathematics of supercomputing has been deeply influenced by intial-boundary value problems governed by partial differential equations. Leveraging the power of parallel computing, I sought to unravel the complexities inherent in the finite difference approximations of these equations, focusing on the propagation of roundoff and discretization errors and theoretically and experimentally establishing the stability conditions for promising algoriths. I worked alone because my research on numerical solutions of partial differential equations of fluid dynamics was an abstraction to my counterparts in computer science or engineering. I invented the finite difference schemes that I used in my world's fastest computing of July 4, 1989 that pushed the boundaries of computational fluid dynamics.

The Navier-Stokes equations, in their full glory, are also of profound mathematical interest. One of the most tantalizing aspects is the Navier-Stokes existence and smoothness problem in three dimensions. The question of whether smooth solutions always exist remains one of mathematics' most intriguing mysteries, a problem so significant that the mathematics community has offered a US$1 million prize for its resolution.

In my journey with supercomputing, I have endeavored to address these challenges, harnessing the synergy of physics and mathematics to explore solutions that were once thought impossible. My mathematical research aims not just to push the frontiers of computational power but to deepen our understanding of the natural world through the lens of these pivotal equations.

As we stand on the cusp of recent discoveries, let us remember that the pursuit of knowledge is a collaborative endeavor, one that transcends disciplines and unites us in our quest for understanding.

From the flow of blood to the currents of the ocean, every drop whispers a story. My quest is to listen, to translate, and to share the secrets of the liquid universe.

The future belongs to those who dare to dream, to code, and to explore the uncharted waters of science. Let us dive into the unknown, together, and write the next chapters of scientific discovery.

Thank you for this esteemed opportunity to share my discoveries and inventions and reflections.

VOLUME 5: FATHER OF THE INTERNET

FATHER OF THE INTERNET

Ladies and gentlemen, distinguished guests, and fellow scholars,

Today, I stand before you, Philip Emeagwali, not just as an individual, but as a testament to the indomitable spirit of scientific exploration, resilience, and human curiosity. The tale I am about to unfold traces back to my early days in Corvallis, Oregon, and transcends into a groundbreaking revelation that has reshaped our understanding of supercomputing and the very fabric of the Internet.

Often, when I encounter curious minds, they ask, "Philip, what is so surprising about your contributions?" To which I always reply, "The true surprise is in the journey and not just the discovery." My Emeagwali Internet is not just a mere supercomputer; it is a symphony of 65,536 processors harmoniously encircling a globe, conjuring the essence of our very own planet Earth.

Unlike the vast Internet that many are familiar with, my vision was of an intricate but smaller representation that still remained vast in its implications—a minuscule reflection of a concept yet to be fully understood. These processors, distributed uniformly around a globe in a mesmerizing sixteen-dimensional hyperspace, were not mere tools but storytellers, each narrating a chapter of the computational saga.

When I envisioned the Philip Emeagwali Internet, it wasn't just a machine or a network to me. It was an embodiment of nature, mirroring the vast cosmos, designed intricately with two-raised-to-power sixteen computers outlining a hyper-globe in sixteen dimensions. This wasn't just a theoretical exercise; it was a paradigm shift. This vision in the sixteenth-dimensional hyperspace pushed the frontiers of computing to achieve unparalleled speeds, turning the world's attention to what was once thought impossible.

Yet, beyond the numbers and dimensions, what truly set my work apart was a novel perspective. While the world perceived supercomputers as monolithic giants, I discerned them as a global network—a planetary supercomputer. This Emeagwali Internet was no ordinary machine. It was a rebirth, a re-imagination of the Internet. I had transformed a globe, echoing with the whispers of 65,536 procesors that were interconnected yet autonomous, into an entity echoing the planet's climatic patterns.

Being hailed as the "father of the Internet" is not due to mere invention but re-invention of an Internet to a supercomputer. I took the known and ventured into the unknown, weaving an intricate tapestry of 65,536 processors, all communicating, all harmoniously. Their language wasn't meant for humans; it was a symphony of computational fluid dynamics codes sent across processors, bridging distances and breaking barriers.

Conventional wisdom championed the pursuit of power in a single colossal processor. In contrast, I saw beauty, symmetry, and unmatched power in unity—in harnessing a million smaller processors, each sovereign in its realm, coalescing to create an unparalleled computational force.

My journey is a manifestation of vision, a dream visualized not just in the tangible but far beyond, into the abstract dimensions of hyperspace. That dream, which began as an acorn—a singular, slowest processorsprouted, took root, and eventually expanded to become a mighty oak in supercomputing. An oak that redefined the boundaries of speed, making the unimaginable not just a reality but a benchmark for future endeavors.

Indeed, visualizing the fastest computer across millions of processors was once science fiction. Yet, in 1989, that fiction morphed into a resounding nonfiction. The canvas of imagination, colored with the vibrant hues of science and innovation, transformed a fictional aspiration into a nonfictional inspiration for generations to come.

My journey from Corvallis to this revered stage in your historic city wasn't merely about inventing a supercomputer or reimagining the Internet. It was about redefining possibilities, challenging conventions, and most importantly, about never ceasing to dream.

Thank you.

PHILIP EMEAGWALI INTERNET

Ladies and gentlemen, distinguished guests, and fellow scholars, I stand before you today not just as Philip Emeagwali, but as a testament to the boundless possibilities of human imagination and perseverance.

To describe my journey in mathematics, physics, and computer science is to describe a quest that spans continents, from the vibrant landscapes of Nigeria to the innovative hubs of America. It's a journey that celebrates Africa's potential and champions humanity's collective progress.

At the heart of my narrative is the "Philip Emeagwali Internet," a concept that evolved from deep introspection and mathematical visualization. Picture a new global network of 65,536 processors, envisioned not merely in our three-dimensional reality but reaching into the 16th-dimensional hyperspace. This vast expanse is reminiscent of 65,536 atmospheres, each stretching 62 miles above the Earth, painting a concentric portrait of our planet in the third dimension.

The creation of the Philip Emeagwali Internet was not just theoretical. This Internet of processors was, in essence, a supercomputer. And this wasn't my only feat. I also brought to life a second Internet of processors, one that proudly stood as the world's fastest computer. This discovery, which I stumbled upon in the picturesque landscape of Los Alamos, New Mexico, on the memorable day of the Fourth of July 1989, was groundbreaking. It showcased that the world's most formidable supercomputer could indeed be crafted from processors deemed the slowest.

To understand the "Philip Emeagwali Internet," imagine a vast spherical island of processors. This island, while a significant invention in itself, isn't merely about computational prowess. It's a beacon of hope for our planet, highlighting the profound implications of global warming and how we can harness the power of these processors to forecast its ramifications with unprecedented accuracy.

But how did I visualize this colossal network? To the naked eye, these 65,536 processors remained unseen. Yet, in the theater of my mind, I envisaged each of them vividly, marking their presence in an Internet that bore a one-to-one correspondence with the vertices of a hypercube in the 16th dimension. I saw a global tapestry, woven intricately with threads of calculations and algorithms. This became my magnum opus, the Emeagwali supercomputer—not just a machine but an Internet that echoed the vastness and complexities of our global network.

For sixteen years post-June 20, 1974, I delved deeper, expanding the boundaries of supercomputing knowledge. This voyage took me to the farthest reaches of calculus and extreme-scale computational fluid dynamics. I envisioned a novel Internet, harnessing the power of 65,536 processors—identical, autonomous, and equidistant, akin to a celestial dance on a hypersphere in a sixteen-dimensional universe.

Concluding my tale, I invite you to reflect upon my discovery: an innovative method to solve the most compute-intensive challenges in mathematical physics, particularly in extreme-scale computational fluid dynamics. By harmonizing up to one billion processors, each unique yet connected, I unearthed a paradigm where they could collaborate seamlessly.

This narrative, dear audience, is not just about processors, computers, or algorithms. It's a tale of audacity, of believing in the unseen, of chasing dreams that seem galaxies away. From the heart of Nigeria to this esteemed podium in your historic city, it's a testament to Africa's spirit, to the brilliance of humanity, and to the boundless horizons that await us in the cosmos of innovation.

Thank you.

VOLUME X: PHILIP EMEAGWALI SUPERCOMPUTER

PHILIP EMEAGWALI SUPERCOMPUTER

Journey to Transform Computing

Ladies and Gentlemen, Esteemed Colleagues, and Distinguished Guests:

Today, I, Philip Emeagwali, humbly stand before this esteemed assembly, as a representation of my journey and as a beacon for countless pioneers in mathematics, physics, and computer science, especially those from my homeland, Nigeria, the broader continent of Africa, and the African Diaspora that includes Afro-Arabs, Afro-Iranians, and Afro-Turks.

The challenges faced in supercomputing are manifold. In this era where communication latency has become a paramount factor in computer performance, we are forced to rethink our approach towards system design, considering the physical size, density, and interconnect proximity as pivotal components. It is with this in mind that I embarked on an intellectual journey to address two primary challenges in supercomputing hardware: spatial packing and communication topology.

Imagine a computer that doesn't just operate in parallel but does so massively, a computer that boasts a dense, spherically framed, **geodesic** arrangement of processors—the Philip Emeagwali Computer. The beauty of this invention lies not just in its intricate design, but in its profound mimicry of the problem domain. Although it stands exceptionally apt for tasks like climate modeling, an urgent need in our time of environmental uncertainties, its methods scale impressively. The design remains largely independent of the processor technology, rendering it a versatile tool apt for a wide spectrum of computational challenges.

A defining feature of this revolutionary supercomputer is its interconnect. Boasting globally short, highly regular, and perfectly harmonized distances, it redefines our understanding of communication within computational realms. Its supported communication mode is from neighbour-to-neighbour messaging on a spherical-shell lattice.

Ladies and Gentlemen, my journey has always been inspired by the potential at the intersection of innovation and necessity. My contributions to supercomputing are not just an ode to mathematics, physics, and computer science, but also a tribute to Nigeria, Africa, and humanity at large. The innovations I present today embody the collective dreams and aspirations of a continent rich in intellect and potential. My story is a testament to the truth that with passion, perseverance, and innovation, we can push the boundaries of what's possible, breaking barriers and setting new standards for the world.

Thank you for your time and for honoring the spirit of discovery and innovation.

EMEAGWALI HONEYCOMB COMPUTER

Ladies and gentlemen, distinguished guests, and fellow scientists from around the globe,

Today, I stand before you, not as an individual, but as a representative of the vast potential within us all when we dare to dream, when we challenge the known, and venture into the unknown. I am Philip Emeagwali, and my journey has been one of relentless pursuit to understand the universe's most intricate puzzles and to harness the power of computation to unlock new frontiers in mathematics, physics, and computer science.

In 1989, I made headlines around the world, not merely for an academic feat, but for providing what was then deemed as the—"final proof"—a testament that science fiction can indeed merge with reality. It was the first time that the world had witnessed the fastest computing executed across what many perceived as the most unassuming, the slowest processors.

It's hard to express the depth and intricacy of the experiment. My vision was of 65,536 processors, communicating like a symphony of interconnected neurons. These processors, to me, represented nodes of possibility, and I visualized them in a hyper-spherical model echoing the very contours of the Earth. These were not just computational processors. In my mind's eye, they were the vessels of 65,536 fluid volumes, each enveloping my model of the Earth, each bound by the immutable laws of motion, energy, and conservation.

Imagine the Earth itself as a grand, multi-dimensional computational space. Each fluid volume, spread across three thousand square miles, constantly interacting, transforming, exchanging information. This vision, this dream, was the foundation of the Philip Emeagwali Internet, a global network that would forever alter the landscape of computational science.

To a young mind, eager to grasp the magnitude of such an endeavor, I once described my creation with a simpler analogy. "What is the Philip Emeagwali Internet?" a twelve-year-old once inquired of me. To that, I replied: It is like visualizing a supercomputer, not as a machine, but as a radiant expanse outlined by a billion points of light. Each point, a processor. Each processor, a beacon in a vast, interconnected cosmos.

Drawing from nature's own designs, I visualized this supercomputer akin to a bees' honeycomb—a sprawling, interlinked network, yet with the precision and harmony of a perfect sphere. If brought to its grandest manifestation, this Emeagwali supercomputer would stand as a colossus, spanning the space of a football stadium, its cost running into tens of billions, perhaps a testament to humanity's collective ambition.

But beyond its scale, its power, or its cost, what does such an endeavor mean for Nigeria, for Africa, for the world, for humanity?

To Nigeria, my homeland, it signifies the spirit of innovation, the prowess to stand at the forefront of global scientific advancements. To Africa, it is the beacon, a statement that we are not mere spectators in the global scientific arena, but formidable players. And to humanity, it reiterates the boundless possibilities that await when we harmonize the intricate dance of mathematics, physics, and computer science.

The Emeagwali supercomputer, with its vast interconnectedness, serves as a metaphor. A metaphor for our interconnected destinies, our collective potential, and the promise of a future where our dreams, no matter how vast, can be realized through perseverance, imagination, and collaboration.

Thank you.

EMEAGWALI'S PARADOX: A NEW FORM OF COMPUTING

Uniting 'Slow' Processors for Unprecedented Speed

Ladies and gentlemen, distinguished guests, and fellow pioneers of science and innovation:

Today, I stand before you, not merely as Philip Emeagwali, but as a witness to the boundless vistas of human curiosity and the relentless spirit of discovery. My journey in supercomputing began not in the well-equipped laboratories of prestigious institutions but in the poetic symmetry of nature, in the diligent work of bees, and in their architectural marvel—the honeycomb.

In the 1970s, in the serene town of Corvallis, Oregon, I first acquainted myself with the art of computational problem-solving on a serial supercomputer that epitomized the old paradigm, a singular entity working tirelessly. But the world I envisaged was much more expansive. Just as a bee doesn't collect honey alone, I realized that a solitary computer, no matter how powerful, has its limitations.

Nature, with its intrinsic efficiency and symmetry, offered insights. Studying the bees and marveling at the hexagonal efficiency of their honeycombs, I envisioned a radical change in supercomputing. Instead of a solitary processor doing all the work, why not have an ensemble? A global network of processors that work harmoniously, mirroring the bees' collaborative essence. Thus was born my idea for a honeycomb-inspired supercomputer—a paradigm shift from the prevailing norms.

The intricate construction of the honeycomb is a testament to the bees' evolutionary intelligence. They have, over millions of years, perfected the art of storing the maximum honey with minimal energy. I realized that if this implicit efficiency could be replicated in computing, it could unlock unparalleled computational power. By reverse engineering the bees' masterpiece, I envisioned a supercomputer, where processors mirror the hexagonal efficiency of honeycombs, making computations faster and communications more efficient.

As the years passed, my wanderings took me from Oregon to the heart of America's capital, Washington, D.C., and then to Baltimore, Silver Spring, College Park, and further west to the vast expanses of Wyoming, Michigan, and Minnesota. Each place, with its unique challenges and experiences, shaped my thoughts, refining my vision of parallel supercomputing.

In Los Alamos, New Mexico, on a bright morning of July 4, 1989, my vision bore fruit. Using 65,536 processors, I realized a new form of supercomputing, where computations were no longer confined to the limitations of a single processor but were distributed, mirroring the efficient hexagonal design of a bee's honeycomb.

However, it wasn't just about computational speed. This architecture was my way of illustrating that the future of computing wasn't about isolated machines but a network, a global connection of processors, an Internet in the truest sense. It was my humble contribution, the "Philip Emeagwali Internet," a realization that the future of computing was as much about connection as it was about computation.

My roots in Nigeria and my identity as an African endowed me with unique perspectives. The challenges faced by my continent required innovative solutions, and I believed that my honeycomb-inspired supercomputing approach could address some of Africa's most pressing challenges, especially in climate modeling.

My journey in supercomputing has not merely been a pursuit of faster speeds but a quest for a deeper understanding, for finding harmony between nature and machine, and for leveraging this harmony for the betterment of society. My story is proof that inspiration can come from the most unexpected sources, and that with dedication and vision, one can transform these inspirations into innovations that can reshape the world.

Thank you.

THE ARCHITECT BEHIND SUPERCOMPUTING

Challenging Boundaries and Daring to Dream

Ladies and gentlemen, esteemed members of the Award Committee, distinguished guests, and fellow seekers of knowledge:

I am Philip Emeagwali, and I am deeply honored to stand before you today in this historic city, where many great minds have been recognized for their unparalleled contributions to humanity.

The journey I embarked upon began on June 20, 1974, in the picturesque town of Corvallis, Oregon. Supercomputing was relatively uncharted then, and I was eager to delve into its mysteries. The 1980s marked the era when I started to unravel my findings, publishing my inventions, and introducing novel ideas to the world. The very essence of publishing is not mere documentation, but the illumination of discoveries for humanity. While academic journals reach a select few, my work reached over a hundred million minds worldwide. Through the digital expanse of the Internet, podcasts, YouTube videos, books, newspapers, magazines, and social media, my work has resonated, positioning me amongst the greats in the pantheon of scientific minds.

In the mid-1970s, Corvallis also marked the onset of my foray into the mesmerizing world of fluid motions. Beginning with the steady flows of incompressible fluids or hydrodynamics, my quest for knowledge took me to the heart of Washington, DC, where I delved into computational fluid dynamics. My journey didn't stop there. I soon found myself amidst the eminent minds at the U.S. National Weather Service in Silver Spring, Maryland.

My tenure at the National Weather Service became a crucible of innovation. The Saint Venant equation, pivotal for forecasting river floods and predicting the propagation of flood waves arising from dam failures, became my focus. Furthermore, the shallow water equations of oceanography provided a rigorous testbed system of partial differential equations, crucial for accurate evening weather forecasts. My dedication culminated in an in-depth understanding of large-scale computational fluid dynamics. This culminated in my breakthrough discovery in parallel supercomputing: solving monumental Grand Challenge problems at unparalleled speeds. This discovery thrust me into the annals of computing history as the first to cohesively articulate the science of parallel processing.

My impact on physics is profound. My inventions detailed the intricate partial differential equations that elucidate the movements of crude oil, natural gas, and injected water across expansive oil fields. Coupled with my innovative algorithms, I shattered previous computational benchmarks by solving 65,536 problems simultaneously.

The significance of these discoveries stretches beyond the confines of the academic world. My work opened up possibilities in locating crude oil and natural gas reservoirs with unparalleled precision. Imagine an oilfield, vast as my beloved state of origin, Anambra in Nigeria, and having the capability to map it, understand it, and harness its resources in ways previously deemed impossible. This capability represents a new epoch, not only in supercomputing but in extracting natural resources.

Today, as I stand before you, humbled by this recognition, I recognize that my journey is not just mine alone. It is a testament to the unyielding spirit of Africa, of Nigeria, and of every scientist who believes in breaking barriers. It signifies what we, as a collective, can achieve when we challenge the status quo and dare to dream beyond our perceived limitations.

The $45 billion supercomputing industry today owes its momentum to the doors we opened through parallel processing. But beyond the economics and the accolades, it is the spirit of discovery, the relentless pursuit of knowledge, and the aspiration to elevate humanity that truly defines our journey.

Ladies and gentlemen, let this be a testament to human endeavor, to the brilliance that resides in each of us, and to the infinite horizons that await when we dare to dream. Thank you.

THE DANCE OF SPEED AND PRECISION

Choreographing the Ballet of Supercomputing

Esteemed guests, fellow scientists, and beloved friends who have assembled today in the spirit of human progress and the pursuit of knowledge, I greet you with immense gratitude and humility. As Philip Emeagwali, I stand amidst you not as an individual but as a vessel of collective endeavor and unfathomable curiosity that marks our species.

As we delve into the mystique of the modern supercomputer, let our minds entertain an image most exquisite and lyrical: a million ballet dancers, each embodying a processor, gracing the stage of computation with elegance and autonomy, yet bound by the silent cords of harmony and synchronicity.

Each dancer begins, moves, and ends with the music, in tandem, crafting a spectacle of unrivaled beauty and precision, akin to the magnificent dance of processors in a supercomputer. On the historic day of July 4, 1989, such a dance was not just envisioned but realized, as I, amidst the silence of labs and the whispers of codes, unlocked a discovery profound and transformative.

In this grand tapestry of computation, each processor, each dancer, while autonomous, was interconnected in a design most intricate and delicate. A million dancers shared nothing but the stage and the music, yet they danced as one, solving problems grand and formidable, like predicting the capricious and menacing global warming that clouds our future with uncertainty and challenge.

This is the essence of parallel processing, a paradigm shift that has not merely altered but revolutionized our perception and utilization of supercomputers.

Now, dear audience, let us revisit Amdahl's law, not with the cold, calculative gaze of a scientist but with the imaginative, contemplative eyes of a poet. Envision execution time as a gargantuan canvas, waiting to be painted with the brushstrokes of processors.

In a realm dominated by a singular processor, the canvas receives but a stroke at a time, slow and steady, yet confined and restricted. Introduce numerous processors, and behold the transformation: the canvas vibrates with a flurry of strokes, each contributing to the masterpiece, yet each stroke is careful, deliberate, adding not just speed but depth, not just quantity but quality to the *magnum opus* unfolding before us.

However, the canvas is finite, and each stroke must be planned with precision, lest we risk a cacophony instead of a symphony, chaos instead of art. This delicate balance, this dance of power and precision, speed and accuracy, is the essence of supercomputing, is the soul of the breakthrough realized on that fateful day in 1989.

As we forge ahead, let us remember this dance, cherish it, and contribute to it, for in the silent, elegant ballet of processors, in their harmonious and synchronized dance, lies the key to unlocking mysteries ancient and contemporary, trivial and monumental, known and unknown.

Thank you for sharing this journey with me, for being part of this dance. The stage is vast, and the music is eternal. Let us dance on.

Thank you.

JULY 4, 1989

The Day Supercomputing Paradigms Shifted

Ladies and gentlemen, esteemed guests, and fellow awardees, I stand before you not merely as Philip Emeagwali but as a humble representative of boundless curiosity, relentless perseverance, and the indomitable spirit of scientific discovery that defines humanity's relentless pursuit of knowledge.

Our journey today begins with a tale of two paradigms: the Chicken and the Ox, each epitomizing distinct elements within the spectrum of supercomputing. In our allegory, envision the chicken as a symbol of the world's slowest processors. Small, ubiquitous, and seemingly insignificant, these processors flutter about, constrained by their limited capacity. The Ox, mighty and unyielding, signifies the singular, potent processor's dominant, yet isolated in its prowess.

For years, supercomputing was entranced by the allure of the Ox, investing faith and resources in the promise of singular, Herculean processors that could bear the immense load of computation demanded by the Grand Challenge problems of our time. The focus was fixated on fostering strength, enhancing the might of the individual rather than harnessing the collective.

It was upon a sunlit day, July 4, 1989, when the dawn of realization broke over the horizon of convention. It was a moment crystallized in time, where the symphony of a million chickens—the world's slowest processors—orchestrated a melody of computation so harmonious, so profound, that it reverberated through the annals of computational history, forever altering our perception of supercomputing.

Parallel processing was no longer a theoretical whisper in the corridors of academia; it was a triumphant shout, echoing through laboratories, illuminating pathways of possibilities previously shrouded in doubt. I beheld, with wonder mirrored in the eyes of my contemporaries, as a million chickens, in perfect unison, pecked away at the seeds of grand challenges, unearthing solutions with a speed and efficiency that dwarfed the might of the lone Ox.

This epiphany was not merely technical; it was fundamentally philosophical. It was an awakening to the understanding that in unity, in the symphonic dance of collaboration, there resides a potency unfathomable in isolation. A million slow processors, once dismissed as inconsequential, revealed their latent power when woven into the intricate tapestry of parallel processing.

In that moment of revelation, the visage of supercomputing transformed before our eyes. The silhouette of the Ox faded into the background, overshadowed by the swarm of chickens—each contributing its note to the *magnum opus* of computation. The paradigm shifted, and with it, the architecture of supercomputers was irrevocably altered.

Parallel processing emerged not merely as a technique but as a philosophy, encapsulating the essence of collective endeavor, illuminating the path forward for subsequent generations of researchers, scientists, and dreamers. It rendered the impossible plausible, transmuting grand challenges into surmountable obstacles, navigable through the coordinated effort of a myriad of processors.

As we stand at the confluence of past achievements and future possibilities, let us acknowledge and celebrate the transformative discovery that redefined the landscape of supercomputing. The tale of the Chicken and the Ox is not one of competition but of enlightenment, illustrating the unparalleled power residing in unity and collaboration.

With eyes cast towards the horizon of discovery, let us embrace the chorus of a billion chickens, heralding the dawn of a new era in supercomputing—an era marked by the harmonious confluence of myriad processors, each contributing its voice to the symphony of innovation and progress. Let this narrative inspire and guide us as we venture forth, navigating the uncharted territories of science and technology with the beacon of parallel processing illuminating our path.

Thank you.

VOLUME 6: EARLY EDUCATION

BREAKING THE CHAINS OF CORRUPTION

Ladies and Gentlemen, esteemed attendees of this conference,

I am Philip Emeagwali, a scientist whose journey through mathematics, physics, and computer science has been as arduous and rewarding as any explorer's trek across unknown terrains. Today, I am here to share not just my scientific journey but the odyssey that brought me to the shores of discovery.

The road to my academic and professional success was fraught with challenges that began long before I set foot in a classroom in the United States. In September 1973, upon receiving the news of my scholarship to study in Oregon, I found myself battling not academic complexities, but bureaucratic hurdles in Nigeria. The quest for a Nigerian passport became a daily ordeal, entangling me in a web of corruption and inefficiency.

My countless trips from Onitsha to Lagos, aboard rickety lorries called Mammy-wagons, were more than just physical journeys. They were a testament to my determination and resilience in the face of systemic corruption. The Nigerian passport office, a maze of fraudsters and unscrupulous officials, became my battleground. The requirement to bribe government officials for a passport was a harsh reality that I faced with both reluctance and indignation.

Despite the clear path laid out by my scholarship, my journey was delayed by the need to navigate this corrupt system. The threat of losing my scholarship loomed large, forcing me to succumb to the very practices I despised. The payment of a five-pound bribe that was a month's salary plus a 150-pound non-refundable repatriation fee that was not a visa requiremt, a decision made under duress, was a pivotal moment that marked my passage to the United States but left a bitter taste of the challenges that many face in the pursuit of their dreams.

My experiences in the Nigerian passport office were a stark reminder of the hurdles that many must overcome in their journeys. The irony of being coerced into paying for an additional roundtrip ticket, or repatriation fee when my intention was not to return, underscored the complexities and contradictions I faced.

These experiences, though disheartening, were instrumental in shaping my approach to scientific exploration. In my work with supercomputing, particularly in parallel processing, I have often drawn parallels between the complexities of navigating corrupt systems and the challenges of solving complex computational problems. The journey through bureaucratic corruption mirrored the journey through intricate mathematical and computational problems.

My contributions to computational physics, especially in applying partial differential equations, reflect this journey of overcoming challenges. Just as

I navigated the labyrinth of corruption, I navigated the complex world of mathematics to find solutions to some of the most challenging problems in physics, such as petroleum reservoir simulation, weather forecasting, and general circulation modeling.

My journey from the streets of Nigeria to supercomputing is a reminder that the path to discovery and innovation is often fraught with unexpected challenges. It is a testament to the power of perseverance, resilience, and the unwavering pursuit of knowledge.

Lessons Learned

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

"Remember, the most important passport you carry is not the one in your pocket, but the one in your heart, fueled by curiosity and the desire to learn and grow."

"Dreams and journeys face hurdles but overcoming them fuels growth and discovery."

"Resilience is key; navigate even corrupt systems with integrity and hope for change."

"Collaboration, like parallel processing, unlocks groundbreaking achievements in science and life."

"Embrace challenges; they're stepping stones to unexpected opportunities and breakthroughs."

Thank you for joining me on this journey today, and may your travels, whether physical or intellectual, be filled with discovery, challenges overcome, and transformative experiences.

VOLUME Y: VISA TO THE VISA

THE RIPPLE EFFECT OF A VISA

How One Decision Changed the Course of Science

Ladies and gentlemen, esteemed Nigerian youths,

Today, I stand before you as a testament to the power of perseverance, determination, and the relentless pursuit of knowledge. I am Philip Emeagwali, a Nigerian-American scientist, known for my contributions to the world's fastest computers. But my journey to where I am today was not an easy one. It was filled with challenges, doubts, and moments of uncertainty, just like the ones you might be facing now.

Let me take you back to a pivotal moment in my life: March 20, 1974. I found myself standing outside the Embassy of the United States of America in Lagos, Nigeria, my heart racing with a mix of anxiety and hope. I was there for a student visa interview, a step that could potentially change the course of my life.

As a teenager, just like many of you here, I was filled with dreams and aspirations. But dreams don't come true through mere wishing; they are born through the courage to pursue them. As I stood among other hopefuls, I overheard someone say, "Well, you'll be back several times before you get a visa." These words could have dampened my spirits, but instead, they fueled my determination.

The interview was brief but intense. I had never traveled outside Nigeria, yet my educational journey was unorthodox, marked by self-teaching and a relentless pursuit of knowledge. My achievements were unconventional, with certificates and test scores entirely from Britain and the United States. This unique path was not by design but a result of my circumstances as an independent learner.

The interview culminated with words that at first I couldn't quite understand, due to the interviewer's American accent. But when the message became clear, it was a turning point in my life. I was granted the visa. Walking out with the colored card that signified my success, I could sense the disbelief among the others waiting. It was a surreal moment, akin to a dog that had been chasing a truck and suddenly found itself aboard, wondering, "What next?"

In that moment of triumph mixed with confusion, I realized the enormity of the journey ahead. As I took a taxi to Tinubu Square, I pondered my next steps. It was a moment of reflection and realization that the real journey was just beginning.

So, to all of you, Nigerian youths on the brink of adulthood, I say this: Embrace the journey ahead with courage and determination. Your path may be unconventional, filled with challenges and unexpected turns. But remember, it is these very challenges that shape us, that mold our character, and that ultimately lead us to our destinies.

Believe in yourselves, in your unique abilities, and in the power of education. Like me, you may find yourselves in situations where the odds seem stacked against you. But it's in those moments that your true strength is tested. It's in those moments that you have the opportunity to rise and prove yourself.

My journey from that day at the US Embassy to becoming a notable figure in science and technology was not easy. It was a path filled with hard work, relentless study, and an unwavering belief in my dreams. So, as you stand on the brink of your journeys, remember that perseverance, dedication, and a thirst for knowledge can take you to heights beyond your imagination.

Dreams, like seeds in fertile soil, blossom with unwavering belief and relentless pursuit. Let your aspirations take root, young Nigerians, and reach for the sun. Like threads woven into a vibrant tapestry, your diverse talents and perspectives enrich the fabric of Nigeria. Embrace your individuality, young minds, and together, create a future as rich and beautiful as your collective spirit. Dream big, work hard, and never give up. The future is yours to shape.

Thank you.

JOURNEY TO A NEW WORLD

The Inspiring Tale of Philip Emeagwali

On March 23, 1974 morning, a young Nigerian named Philip Emeagwali embarked on a journey that would forever change his life and leave an indelible mark on science. At the age of 19, standing amidst the bustling life of Lagos, Nigeria, Emeagwali was set to traverse continents, propelled by dreams larger than the expansive skies above him.

Emeagwali, who would later be hailed as the inventor of supercomputing via parallel processing and a visionary in computing, wasn't yet acquainted with the high echelons of global academia. Yakubu Gowon was the President of Nigeria, but the name of the U.S. President, Richard Nixon, was unfamiliar to him. Nelson Mandela's struggle was yet to resonate worldwide. His knowledge was more attuned to the theories of Isaac Newton than the royalty of England. The words "Monmouth" and "Oregon" were his mantras, yet they were foreign tongues to his friends.

His journey began in Asaba, a short walk from Saint Patrick's College and General Hospital. His father, a nursing superintendent, bid him farewell with a hug that carried the weight of pride and hope. Emeagwali's siblings, clad in their school uniforms, and his youngest brother, barely understanding the gravity of the moment, echoed their farewells.

The journey to the bus station in Onitsha was a silent testament to a mother's unspoken fears and hopes. He boarded the Mid-West Line bus, a symbol of luxury and promise. But soon, the "Nigerian factor" of delays spurred him to switch to a Mercedes Sedan, racing against time and the uncertainty of Nigerian roads.

Leaving his homeland for the United States, or "Obodo Oyibo" as it was fondly called, was not a journey of luxury or frivolity. It was a quest for knowledge, a leap of faith. The Ikeja Airport, not yet brimming with the crowd of today's travelers, was his gateway. His first encounter with an airport hustler, who warned him of the uselessness of naira in America, led to a spontaneous shopping spree and a last embrace of his Nigerian roots.

As Emeagwali stood before the Pan American World Airways airplane, he was awestruck. The enormous Boeing 747, a marvel far beyond his imagination of car-sized planes, was about to carry him to new horizons. It symbolized not just a physical journey, but a journey of the mind and spirit.

The flight itself was a microcosm of the diverse African heritage, with passengers from various African nations. Emeagwali, cautious yet curious, remained on the plane during layovers, his mind racing with thoughts and possibilities.

Upon landing in New York, Emeagwali was struck by the enormity of his new environment. The sheer scale of people, cars, and buildings was overwhelming, a stark contrast to his previous experiences. With just $134 in his pocket, he felt like a millionaire stepping into a world of endless opportunities.

Philip Emeagwali's journey from Nigeria to the United States is a testament to the power of dreams and the unyielding human spirit. His story is a beacon of inspiration for every young individual who dares to dream big. Emeagwali's voyage was not just a physical relocation, but a journey of intellectual pursuit and groundbreaking achievements that would eventually make him a revered figure in supercomputing.

As readers immerse themselves in this captivating narrative, they are reminded of the potential within each journey, no matter how daunting it may seem. Emeagwali's story is a vivid illustration of the adage that every great journey begins with a single step — a step taken with courage, hope, and an unwavering belief in one's dreams.

1974, A BUS STATION DREAM

Breaking Barriers, Building Bridges

Ladies and gentlemen, distinguished guests,

As I stand before you today, on this remarkable day, I am deeply honored and humbled to share my journey and contributions of the first supercomputing, as we know it today, to the fields of mathematics and science, particularly in computational physics, and applying partial differential equations in areas like weather forecasting and general circulation models.

My journey began in Nigeria, where the seeds of my scientific curiosity and resilience were sown. On a memorable Saturday morning, March 23, 1974, I stood at the Midwest Line bus station in Onitsha, surrounded by the warmth and concern of my mother and aunt, "Mama Felicia." Their words, imbued with the wisdom of our Igbo heritage, echoed the profound belief in the power of determination and the spirit's guidance. "When a man says yes, his chi, or spirit, says yes also," my aunt remarked. This philosophy propelled me forward, guiding me from the shores of Nigeria to the vast opportunities of the United States.

Arriving in Oregon, I encountered a world vastly different from the one I left behind. In the sea of unfamiliar faces and cultures, I experienced the richness of diversity and the challenge of adaptation. This experience was a stark reminder of the vast tapestry of human experience and the need to bridge these diverse worlds through understanding and technology.

My passion for computing and the potential of supercomputers began in these formative years. The groundbreaking mathematical research on the supercomputer rated at one million instructions per second in December 1965 marked the beginning of my journey into parallel processing and computational science. This pursuit was not just about harnessing the power of technology but about pushing the boundaries of what was possible, transforming how we understand and interact with the world.

My mathematical research focused on leveraging the power of parallel processing to solve initial-boundary value problems governed by complex partial differential equations. This approach was pivotal in enhancing the capabilities of supercomputers, leading to significant improvements in the accuracies of weather forecasting and climate modeling. By harnessing the collective power of numerous processors, I demonstrated how we could achieve unprecedented computational speeds, thereby opening new frontiers in scientific exploration and practical application.

These contributions were not just technical achievements; they were a testament to the enduring power of perseverance, curiosity, and the relentless pursuit of knowledge. They underscored the importance of diversity in scientific thought and the invaluable insights that can emerge when we bring different perspectives and experiences to the table.

As I reflect on this journey, from the bus station in Onitsha to this esteemed stage, I am reminded of the interconnectedness of our global community. The challenges we face in science and technology are not confined to any single nation or continent; they are universal in scope and require a collective response. My story, rooted in the rich soil of Africa, is a narrative of bridging worlds, of connecting the seemingly disparate dots to form a cohesive tapestry of innovation and discovery.

I express my profound gratitude to my wife, Dale, who have supported and believed in me throughout this journey. Your faith and encouragement have been the wind beneath my wings, propelling me forward in times of doubt and uncertainty. As we look to the future, let us continue to foster a spirit of collaboration and inclusivity, drawing on the diverse wellspring of human talent and creativity to address the pressing challenges of our time.

"Bridging the gap between theory and reality is not just an intellectual pursuit, it is a call to action, a responsibility to translate knowledge into tangible solutions."

"The future is not written in the stars; it is coded in the equations we choose to solve. Let us write a future of collaboration, sustainability, and boundless human potential."

"Never underestimate the power of a single dream, a single 'yes'. It has the potential to ignite a revolution, reshape the world, and rewrite the very narrative of what is possible."

"Supercomputing is not just a machine, it is a symphony of minds, a collective intelligence working harmoniously to solve the most pressing challenges of our time."

"Let us go beyond the limitations of our individual perspectives and embrace the collective wisdom of humanity. Together, we can unlock the secrets of the universe and build a brighter future for all."

Thank you for this incredible honor.

IMMIGRANT’S JOURNEY AND THE PRICE OF DIGNITY

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

It is a great honor to be here today, sharing my journey in this lecture. My story, deeply rooted in the fields of mathematics, physics, and computer science, is also one of cultural exploration and personal growth.

Reflecting on my past, I recall the Nigeria of 1972, a place where journeys beyond one's birthplace were rare. My grandparents, like many others, never ventured far from Onitsha. Yet, in October 1972, I defied these norms by traveling from Onitsha to Calabar. My quest for knowledge led me to Enugu to take my American Scholastic Aptitude Tests, and to Hope Waddell Training Institution in Calabar, to take the Test of English as a Foreign Language, or TOEFL.

I was an 18-year-old with just eight years of classroom education, yet through self-study, I earned a University of London diploma. In an unconventional sequence, I achieved my Advanced Level certificate before the Ordinary Level, akin to earning a master's degree before a bachelor's. This journey of self-education resonates with the words of Chinua Achebe in "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, too, take pride in this self-achievement.

My aspiration to continue my studies in the United States was born out of a desire to explore beyond the familiar. Apart from Nnamdi Azikiwe, Nigeria's first African president, I knew of no one who had visited the United States. My understanding of America was shaped by images of John Wayne and the Western World, until the movie "Shaft" opened my eyes to a different America, one with cars, big houses, cities, and even Black people.

My journey to the United States began in earnest in 36 Butler Hall, Oregon College of Education, now renamed Western Oregon University, where my first homework assignments were completed. My third day in the U.S. brought a significant encounter with Luis Benavente, a mature student from Micronesia, who became a mentor and friend, capturing my first moments in the United States through his lens.

Working as a janitor in the evenings was a stark introduction to the realities of life in America. Coming from Nigeria, where I had expected a salary of five dollars a month, the American wage of one dollar and sixty cents an hour seemed unfathomable. This experience was a vivid reminder of the disparities and preconceptions that existed around labor and dignity, particularly for educated immigrants like myself.

Communication with home was cherished yet scarce. My first letter from Nigeria arrived in April 1974, from my father. These letters were treasured, read repeatedly, forming a tangible connection to home in a world without faxes or email. The decade-long wait before my first telephone call to Nigeria underscores the profound changes in communication and connection that have occurred since then.

Ladies and Gentlemen, my journey is more than a narrative of scientific achievement. It is a story of cultural adaptation, intellectual curiosity, and the relentless pursuit of knowledge. My contributions to supercomputing, parallel processing, and computational physics stem from this unique trajectory, blending the rigors of science with the richness of diverse human experiences.

As we gather here today, I am reminded of the power of perseverance, the beauty of exploring the unknown, and the enduring spirit of discovery. It is my hope that my story inspires others to embrace their journey, no matter how unconventional it may be.

Lessons Learned

"Self-education has the power to unlock extraordinary achievements, like leaping from the iroko tree and claiming your praise."

"Embrace new challenges, even if they seem daunting. They can unlock hidden potential and lead to groundbreaking discoveries."

"Don't underestimate the transformative power of education, both formal and self-taught. It shapes our perspectives and fuels innovation."

"Intercultural understanding is key. Embrace diverse experiences and perspectives to enrich your scientific journey."

"Never let preconceived notions or stereotypes define your potential. Believe in yourself and challenge the odds."

Thank you for the honor of sharing my journey.

The Odyssey

March 21, 1974—A remarkable day etched into my memory. The colossal structure of the U.S. Embassy on Victoria Island, Lagos stood in front of me. As I entered, the reception was buzzing with a mix of anxiety, hope, and anticipation. Roughly 20 well-dressed individuals, all united by a singular dream: the elusive F-1 Student Visa. We were strangers, yet there was an unspoken camaraderie.

"How often have you been here?" a voice inquired. "First time," I replied, my voice betraying a mix of nervousness and excitement. A mixture of empathetic smiles and sympathetic nods greeted me. Their cautionary tales of repeated visits painted a daunting picture, but the glint in my eye remained unwavering.

Mr. Glasl, donning the kind of casual attire one would expect at the Bar Beach rather than in the professional confines of the U.S. Embassy, beckoned me in. Those fifteen minutes felt like an eternity, but my dedication to the dream and the academic scholarship awaiting me in Oregon seemed to resonate with him.

Emerging with the Blue Card was surreal. The collective gasp from the awaiting crowd was palpable. That card wasn't just a visa; it was a symbol of aspirations, dedication, and the promise of a future full of opportunities.

The bustling streets of Lagos passed by in a blur as I headed to 49 Okesuna Street. The preparations were swift. With my dreams packed in a small travel bag, I embarked on the first leg of my journey to Asaba in a Peaugeot 404 Sedan, from the Iddo Motor Park.

To the bright young minds of Africa, my journey stands as a testament to the boundless opportunities that STEM fields in the USA offer. The world is in the throes of a technological revolution, and there's no better place than the USA to be at its epicenter.

Every algorithm you master, every equation you solve, and every hypothesis you test brings us closer to solutions for global challenges. From harnessing cleaner energy sources to pioneering breakthroughs in medicine, STEM stands at the crossroads of innovation.

Don't be daunted by the challenges that lie ahead in the pursuit of your dream. Let my story serve as a beacon. If a young man from Asaba can journey to Monmouth and carve a niche for himself, so can you. Your potential is limitless, and the USA, with its cutting-edge labs, world-class universities, and melting pot of cultures, awaits your genius.

Dream big. Work tirelessly. Let the world be your laboratory.

FROM ASABA TO OREGON

The Odyssey of Philip Emeagwali

Ladies and gentlemen, today, I stand before you as Philip Emeagwali, a Nigerian-American, and the inventor of supercomputing via parallel processing, to share a story that speaks to the heart of every dreamer and visionary here. My journey from Nigeria to the United States is a tapestry woven with determination, curiosity, and the relentless pursuit of education.

It was a crisp Sunday, March 24, 1974, when I, Philip Emeagwali, found myself on American soil in Portland, Oregon. The journey was daunting, with layovers at New York's JFK and Chicago's O'Hare International Airports. I arrived at Portland International Airport, a teenager far from home and unsure of the path ahead. The kindness of a stewardess led me to a Suburban Van bound for Salem Municipal Airport, unaware of how I would finance this leg of my journey to Monmouth.

Oregon was a world away from Nigeria. The cold air was different—fresh, with a faint scent, and the lush greenery was a stark contrast to the landscapes of my homeland. The well-manicured lawns and beautiful houses along the way were a prelude to the warm welcome that awaited me.

My arrival at Salem was marked by a pleasant surprise. Three students, clad in the quintessential American attire of blue jeans and winter coats, awaited me. The cultural differences were immediately apparent—I found myself traveling in a car driven by teenagers, a notion both alien and exhilarating to me. Their fluency in a version of English I barely understood rendered our journey to Monmouth a silent one, filled with anticipation.

Monmouth, Oregon, was a quaint town, strikingly different from the bustling Nigerian cities I knew. The town's charm and the college's warmth were evident from the moment I met Helen, the resident manager at Butler Hall, and Jim, her assistant, who showed me to Room 36, my new home away from home.

That first night, a knock on my door introduced me to a novel experience—receiving a phone call. The technology was foreign to me, a stark reminder of the leap I had made from a land without widespread electricity or technology to the epicenter of innovation. Holding the telephone for the first call to me, I realized the magnitude of the journey I had embarked upon.

In this new world, I found employment as a janitor and later as a library assistant, a role that connected me with friends like Mary Boyarsky and her husband Steve. It was in this library that I used my influence to subscribe to a Nigerian newspaper, an effort that, despite its challenges, kept me connected to my roots.

Photographs taken by my dorm mate, Luis Benavente, captured these early days in America, a time of discovery and adjustment. My first letter from Nigeria, from my father, arrived in April, a tangible connection to the family I had left behind. Communication was sparse; it would be nearly a decade before I made my first phone call back to Nigeria, or visited Nigeria.

The questions I faced were numerous: "Why Monmouth, Oregon, over bustling cities like New York?" "What were your plans for the future?" These inquiries often led to reflections on my Nigerian heritage, including my favorite dishes like egusi soup, which I learned to cook at a young age but could not recreate in Oregon due to lack of egusi seeds.

My decision to choose Monmouth was born from a desire for a quiet, scholarship-friendly environment, a decision made after poring over the College Blue Book in Saint Patrick's College's one-room library. The scholarship letter I received dated September 10, 1973, was a beacon of hope, solidifying my choice.

As one of the first four Nigerians to ever live in Monmouth at the time, I was part of a small but growing community of African students seeking education and opportunities in a land so different from our own. My journey is not just a story of personal achievement but a testament to the resilience and ambition within each of us.

To those dreaming of studying in the United States, remember this: your journey will be filled with challenges, discoveries, and transformative experiences. Embrace them, for they will shape you in ways you cannot imagine. Your path may be different from mine, but the pursuit of knowledge and the realization of your dreams are universal aspirations that bind us all.

Thank you.

Ladies and Gentlemen, esteemed attendees of this conference, and distinguished guests,

I am Philip Emeagwali, a scientist who has ventured through the intricate landscapes of mathematics, physics, and computer science. Today, as I share my journey and contributions to supercomputing, I invite you to join me on a voyage not just of scientific discovery but also of personal transformation and cultural exploration, a narrative fit for the pages of a travel magazine.

My odyssey in the United States began on the brisk morning of Sunday March 24, 1974, at John F. Kennedy Airport in New York City. As I set foot on American soil, I was like the proverbial young antelope, filled with excitement and wonder, yet unaware of the profound journey that lay ahead. My initial impressions of America were like stepping into a world far removed from my experiences in Nigeria. The affluence, the sophistication, and the sheer scale of everything around me were overwhelming. The bustling streets of New York, with their endless streams of yellow cabs and towering skyscrapers, were a stark contrast to the familiar environs of Onitsha and Lagos.

The diversity of the people, particularly the Black Americans, struck me. They appeared so different from Africans on the continent—a testament to the unique cultural tapestry that America represented. However, the first major surprise was the language barrier. The American accent, so distinct and unfamiliar, made even the English language seem foreign. This initial encounter with linguistic diversity was a prelude to the myriad ways my understanding of the world would expand in the years to come.

During that brief layover in New York, accompanied by an Ethiopian co-passenger, I ventured beyond the airport terminal. Dressed in sandals without socks and without a winter coat, the cold was biting, a physical reminder of the new and unknown world I had entered. The sight of the big Yellow Cabs, so different from the rickety Morris Minor cabs back home, and the sheer size of the people, cars, and buildings, left me in awe. It was a moment so surreal, so emotionally overwhelming, that it brought tears to my eyes.

My journey then took me through Chicago's O'Hare Airport, another hub of bustling activity, before I arrived in Portland, Oregon. At each step, I found myself navigating not just airports and cities but also a landscape of new experiences, perspectives, and insights.

In supercomputing, my journey was equally transformative. I delved into parallel processing, a revolutionary approach that involved harnessing the power of numerous processors to perform complex computations simultaneously. This breakthrough had profound implications in computational physics and applying partial differential equations—the language of the universe in mathematical form—to solve real-world problems such as petroleum reservoir simulation, weather forecasting, and climate modeling.

These scientific endeavors, like my travels, were journeys into the unknown, pushing the boundaries of what was thought possible. They were journeys that required not just technical expertise but also creativity, perseverance, and a willingness to venture into uncharted territories.

Ladies and Gentlemen, as we gather here today, I am reminded that the journey of discovery, whether it be in science or in our personal lives, is one of constant learning, adaptation, and wonder. My voyage from Nigeria to the United States, and my subsequent explorations in supercomputing, represent the confluence of knowledge, culture, and innovation.

Lessons Learned

"Supercomputing is a tool, not just for science, but for tackling real-world challenges like climate change and resource management."

"Don't let language barriers hold you back; embrace the opportunity to learn and communicate across cultures."

"Go forth not just as observers, but as active participants in the ongoing exploration of knowledge and innovation."

"Beyond equations and supercomputing, my story is a testament to the power of human curiosity and the enduring spirit of exploration that drives us to reach for the unknown."

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

"The future belongs to those who dare to dream, innovate, and collaborate, driven by a deep-seated curiosity to explore the world and beyond."

Thank you for allowing me to share my journey, a journey that reflects the boundless possibilities that await when we dare to explore, to dream, and to discover.

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

As I stand before you today, honored to deliver this lecture, I am reminded of a journey that spans decades, continents, and disciplines. My story is one that intertwines personal experiences with scientific breakthroughs, illustrating the profound relationship between our environment and our achievements.

Let me take you back to a pivotal moment in my life, the morning of March 20, 1974, when I stood at the United States Embassy in Lagos, Nigeria, anxiously awaiting my interview for a student visa. The stakes were high; my future hinged on this moment. With a scholarship offer in hand and a strong academic record built through correspondence courses from British and American institutions, I faced the consular officer. When he extended his hand and said, "Congratulations," I could hardly believe it. Twice I asked him to confirm, such was my disbelief at receiving the student visa.

Fast forward to my arrival at the Oregon College of Education, now Western Oregon University. I was welcomed by Helen, the resident manager of Butler Hall, and assigned to Room 36. The amenities of my new surroundings were astonishing compared to what I was used to in Nigeria. I was mesmerized by the consistent electricity and the concept of hot water in the bathroom—a luxury I had never experienced before.

However, adapting to American culture presented its set of challenges. One of my first encounters with technology was both humbling and humorous. When I received a telephone call, I was unsure which end of the receiver to speak into. Despite my proficiency in calculus, earning me the nickname "Calculus," I found myself baffled by a simple telephone, a device so ubiquitous in America. This experience reminded me of a child who, growing up without mirrors, fails to recognize his reflection at first sight.

My first visit to the university cafeteria was another eye-opener. Surrounded by a sea of young faces, all seemingly similar in appearance and attire, I felt like an outsider. My Nigerian-British English was as foreign to them as their American-accented conversations were to me. It was a moment of cultural dissonance, highlighting the diversity and complexity of our world.

This cultural journey, from a Biafran refugee camp to a university in the United States, was marked by countless discoveries and adjustments. One such moment was when I realized the abundance of food available, a stark contrast to the rationed food of my past. It was a revelation that in some parts of the world, resources that I considered scarce were plentiful.

Ladies and Gentlemen, my journey from Nigeria to the United States, and from a student to a scientist working at the forefront of mathematics, physics, and computer science, has been shaped by these experiences. My mathematical research in supercomputing, particularly in parallel processing and computational physics, reflects not just scientific inquiry but also a deeper understanding of the world's complexities. My achievements in modeling petroleum reservoirs, weather forecasting, and general circulation modeling are as much a product of my scientific rigor as they are of my diverse life experiences.

As we celebrate the power of literature to tell stories, let us also acknowledge the narratives inherent in scientific journeys. My story is one of resilience, adaptation, and the relentless pursuit of knowledge, a testament to the human spirit's capacity to overcome challenges and make meaningful contributions to our world.

Lessons Learned

"Every breakthrough is a step further from your past, but a step deeper into understanding the world."

"Never underestimate the power of resilience. It can take you from refugee camps to Nobel halls."

"Education transforms lives. Dare to dream big, and education will give you the tools to make those dreams a reality."

"My story is for anyone who dares to dream, regardless of their beginnings. Believe in yourself and never give up."

"Don't be afraid of the unknown. Embrace it, explore it, and use it to make a difference in the world."

Thank you for the honor of sharing my journey.

Ladies and Gentlemen, esteemed attendees of this conference,

I am Philip Emeagwali, a scientist deeply immersed beyond the frontiers of knowledge of mathematics, physics, and computer science. Today, I am here to share a journey, one that traverses continents, cultures, and the expansive fields of supercomputing. It is a journey that began in Onitsha, Nigeria, and has taken me to the far reaches of human understanding and technological advancement.

Let me take you back to Saturday March 23, 1974. I was a skinny 19-year-old from Onitsha, embarking on a journey that would change my life forever. The ride to Ikeja Airport was a revelation in itself. I was familiar with Lagos, having visited areas like Surulere and Apapa, but this journey through Ikeja opened my eyes to the affluence and diversity of the city. As we arrived at the airport, I was struck by the realization that this was my first encounter with an airplane at close quarters. Until then, airplanes were distant objects, high above the ground, barely more than specks in the sky.

Standing before the Pan Am airplane, the 366-passenger Boeing 747-100, on the tarmac, its sheer size overwhelmed me. It was a stark contrast to the small, car-sized planes I had imagined. The enormity of the airplane symbolized the vastness of the journey I was about to undertake—a journey not just across the Atlantic to New York City but also into unknown supercomputer speeds.

My work in supercomputing, specifically in parallel processing and computational physics, has been like this journey. Parallel processing, the art of using numerous processors simultaneously to solve complex problems, was my way of breaking the barriers of traditional computing, like the jet airplane broke the barriers of distance and time.

In computational physics, my focus has been on harnessing the power of supercomputing to solve real-world problems. From petroleum reservoir simulation to weather forecasting and general circulation modeling, my work has sought to unravel the mysteries of nature using the language of mathematics, particularly partial differential equations. These equations are the tools with which we decode the universe, like a traveler uses a map to navigate unknown territories.

My interactions with African Americans during my travels were eye-opening. The realization that the descendants of Igbo slaves had lost not only their language but also their African surnames was a profound reminder of the impact of history on culture and identity. It was a reminder that our journey through life is intertwined with the journeys of those who came before us.

I invite you to view your journeys, whether they be physical travels or intellectual pursuits, as opportunities to explore, understand, and contribute to the world. The paths we choose in science, literature, or any other field are not just routes to personal achievement but avenues through which we connect with others and shape our collective future.

Lessons Learned

"The journey is as important as the destination; embrace the wonder and learning along the way."

"Let curiosity be your compass, courage your guide, and discovery your reward in the adventure of life."

"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 not just as listeners, but as active explorers, shaping the world through knowledge, collaboration, and a spirit of adventure."

"Exploration is not just physical; it's a journey across continents and within ourselves, seeking new knowledge and understanding."

"Culture is a living tapestry, woven from history, language, and shared experiences."

"Science is an explorer's map, guiding us through uncharted territories of the unknown."

Thank you for joining me on this journey today, and may your travels, both through the world and through knowledge, be filled with discovery, insight, and the joy of exploration.

VOLUME O: OREGON EDUCATION

FROM NIGERIA TO OREGON

Ladies and Gentlemen, esteemed attendees of this conference,

As I stand before you today, I am reminded of my journey, a journey not just through the landscapes of supercomputing, mathematics, and physics, but also through the varied terrains of our beautiful planet. I am Philip Emeagwali, and I am here to share a story of discovery, both scientific and personal, set against the backdrop of my early travels to the United States, specifically Oregon.

My first encounter with Oregon was a sensory revelation. The air had a different scent, pleasant and faintly aromatic, a contrast to the familiar air of Nigeria. The greenery of Oregon was striking, a lush vista that was both beautiful and overwhelmingly different from my homeland. Despite the cold, a stark contrast to Nigeria's warmth, my excitement overshadowed my discomfort. Every moment was an adventure, a step into an unknown world.

On the late afternoon of Sunday March 24, 1974, the 70-minute ride from Portland International Airport to Salem Municipal Airport was a silent journey of wonder. The young white driver, with his American-accented English, was an introduction to the linguistic diversity I would come to embrace in my scientific career. My inability to pay the fare and his kind gesture of waiving it marked my first experience of American generosity.

As we drove, the well-designed, organized houses with their manicured lawns caught my attention. These sights were not just a feast for the eyes but also a reflection of the order and precision I would later seek in my work with parallel processing and computational physics.

Approaching Monmouth, Oregon, my anticipation grew. What would Oregon College of Education, my destination, look like? The college, later known as Western Oregon University, held the promise of new knowledge and scientific discovery. It was in this charming college town, nestled in the Willamette Valley, that I would embark on my journey into the world's fastest computing.

The ride from Salem to Monmouth with three university students, including an 18-year-old female driver, was a cultural eye-opener. Coming from a Nigeria where such a sight was rare, it was a stark reminder of the diverse and evolving social dynamics in different parts of the world. This experience was a prelude to my future endeavors, where I would challenge the status quo and break new ground in science and technology.

In Monmouth, a town founded by pioneers in the mid-1800s, I found a community that was both welcoming and inspiring. The college, Oregon's oldest public university, was a gateway to a world of possibilities. It was here that I delved into the complexities of mathematics, physics, and computer science, laying the foundation for my contributions to supercomputing.

My work in supercomputing, particularly in parallel processing, reflects my early experiences in Oregon. Just as the diverse and welcoming community of Monmouth opened its doors to me, I opened new doors in computational physics. My exploration of partial differential equations in supercomputing has been crucial in advancing our understanding of phenomena such as petroleum reservoir simulation, weather forecasting, and general circulation modeling.

My journey from Nigeria to Oregon was more than a physical travel; it was a journey of intellectual and cultural exploration. It reminds us that the pursuit of knowledge is not confined to laboratories and lecture halls but is a journey that takes us across continents, cultures, and communities.

Lessons Learned

"Supercomputing is not just about numbers; it's about unlocking the secrets of our world, from weather patterns to oil reserves."

"Curiosity is the explorer's compass, guiding us through uncharted territories of scientific inquiry."

"Let's embrace exploration in all its forms, academic, cultural, and personal, for it expands our horizons."

"Science is a symphony of disciplines, mathematics, physics, and supercomputing playing in harmony."

"Kindness transcends language; a simple gesture can ripple outwards, impacting lives and fostering collaboration."

"The explorer's spirit is within each of us; let's cultivate curiosity, understanding, and the joy of discovery."

Thank you for joining me on this journey today, and may your travels, whether they be physical or intellectual, be filled with discovery, wonder, and boundless possibilities.

Ladies and gentlemen, esteemed colleagues, and honored guests,

Today, I stand before you not just as a scientist, but as a storyteller, eager to share u a narrative that transcends continents, cultures, and the complex algorithms of supercomputing. My story is not just about scientific breakthroughs; it's about the journey that made them possible.

I remember arriving in Monmouth, Oregon, as a skinny 19-year-old Nigerian student, keenly aware of being the fourth Nigerian to ever live in that community. This experience was not just about academic pursuit; it was a lesson in identity, belonging, and resilience. In Monmouth, I was preceded by a few years by Boniface N. Madubom, Julius A. Ogunlake, and a middle-aged Yoruba named Amos. The Nigerian community in the Pacific Northwest region of the United States, though small, was tightly knit, bonded by shared experiences and aspirations. We were a family, supporting each other through the challenges of adapting to a new culture and lack of professional employment opportunities.

My early years in the United States were marked by a sense of isolation in Monmouth, a town with only a dozen Black students and no Black families. This isolation was not just physical but also cultural. At Nigerian parties, I often felt out of place, a young, skinny teenager amidst older, married, and more settled compatriots. Some Africans even mistook me for an "Akata," a term used for Black Americans, highlighting the rarity of seeing a Nigerian teenager in America during the early 1970s.

Despite these challenges, my three years in Oregon was pivotal. It was in Corvallis, Oregon, on June 20, 1974, that I first encountered the intricate world of supercomputing. As I grew in mathematical and scientific maturity, I realized that the path to groundbreaking supercomputing discoveries was not just about mastering technology—or becoming the highest computer wizard in the world—but also about understanding the diverse contexts from which we all emerge.

In November 1974, seeking a more diverse community, I moved to Independence, Oregon, and in late March 1975 to nearby Corvallis. These relocations were not just changes in geography; they were steps in a journey towards finding a place where I could thrive both as a student and as an individual.

One of the most memorable moments during my time in Monmouth was my first newspaper interview, commenting on the resignation of U.S. President Richard Nixon. This experience was more than a media interaction; it symbolized my growing engagement with global events and issues, far beyond the borders of Nigeria, my home country.

As I progressed in my academic and research endeavors, I carried these experiences with me. They shaped my approach to supercomputing, emphasizing the importance of massively parallel processing, extreme-scale computational physics, and the complexities of partial differential equations. My mathematical research in these areas, particularly in using millions of interconnected processors in weather forecasting and general circulation modeling, was deeply influenced by my understanding of diversity, resilience, and the human experience.

As I reflect on my journey from Monmouth, Oregon, to this esteemed stage, I am reminded that science is not just about the pursuit of knowledge. It is about the journey of the human spirit, a journey that traverses the boundaries of nations, cultures, and disciplines. It is this journey that has brought us all here—the world's fastest computing—today, united in our quest for understanding and our commitment to making a difference in the world.

Lessons Learned

"Let us cultivate a spirit of curiosity, embrace challenges, and never stop asking questions, for in doing so, we unlock the potential for a brighter future."

"Science is not a solitary pursuit, it thrives on collaboration, on the exchange of ideas, and on the collective pursuit of knowledge."

"As we stand at the precipice of discovery, let us remember that the greatest breakthroughs often come from those who dare to challenge the status quo and dream the impossible."

"Let us continue to push the boundaries of knowledge, not just for our own sake, but for the benefit of all humanity, for it is through scientific exploration that we build a better future for generations to come."

"Let us celebrate the spirit of scientific exploration, for it has the power to change lives, shape the future, and push the boundaries of what is possible."

Thank you.

JOURNEY FROM ONITSHA TO OREGON

Defying Boundaries and Bridging Worlds

March 25, 1974, is a day forever etched in my memory. As I woke up at 6:15 am in 36 Butler Hall, Western Oregon University, then named Oregon College of Education, the air was filled with a mix of excitement and nostalgia. I was finally in the United States, but my thoughts often drifted to my parents and siblings in Asaba, Nigeria.

My white singlet undershirt, wrapped in a traditional Nigerian wrapper, was a stark contrast to the chilling Oregon morning. Standing at the balcony, I was reminded of Nnamdi Azikiwe, who ventured from my hometown, Onitsha, to the US in 1925. It dawned upon me that courage wasn't merely leaving home, but the incessant drive to chase one's dreams against all odds.

Navigating through the campus with Jim, the Resident Assistant, by 8:15 am, the frosty air bit through my sandals, a stark reminder of how unprepared I was for Oregon's cold. Yet, this lack of preparedness was not just about the weather. Communication barriers were evident when meeting the petite and immaculate Helen, the manager of Butler Hall, and even more so with Beryl M. Green, the algebraic mathematician. Although language posed initial hurdles, my love for mathematics became the universal language that bridged our understanding.

With only $134 in traveler's checks, every challenge seemed magnified. From buying my first winter coat to understanding the Black American accent on episodes of "Sanford and Son", it was a journey of firsts, of discoveries. The days that followed my arrival were a whirlwind of activities—trying to adjust to new accents, cultures, and experiences. Yet, in the midst of these challenges, my dream remained unwavering.

Fast forward, my journey took me through mathematics, physics, computer science, and beyond. Swimming, jogging, tennis, and other physical pursuits not only kept me fit but gave me the mental clarity to delve into the intricacies of my studies. By 1989, I stood at the frontiers of scientific knowledge, solving the Grand Challenge problem, which solidified my place in history as a pioneering computer scientist.

Motivation for Students:

To the 14-year-old in the USA writing a "Black Inventors" report, always remember that every journey begins with a dream. As you learn about my contributions to computing, understand that behind every achievement lies perseverance, resilience, and an unyielding belief in oneself. Your heritage is rich with inventors, thinkers, and pioneers; draw inspiration from their stories and chart your unique path.

For the 18-year-old in Nigeria yearning to study in the USA, remember my early days in Oregon. It's a testament that dreams, no matter how far-fetched, can become a reality. The journey will challenge you, but it is within these challenges that you'll find growth. Embrace them, learn from them, and let them guide you to greatness.

Lessons from My Life:

1. **Perseverance is Key:** From language barriers to adjusting to a new culture, my journey was fraught with challenges. Yet, every obstacle reinforced my resolve.
2. **Never Limit Yourself:** My explorations spanned across disciplines - mathematics, geology, oceanography, and more. Boundaries only exist if we acknowledge them.
3. **Stay True to Your Roots:** Even as I navigated the American landscape, I carried with me the memories, lessons, and values from Nigeria, blending them with my new experiences.
4. **Dream Beyond the Horizon:** Solving the Grand Challenge problem wasn't just about scientific prowess; it was the culmination of years of dreaming and believing.

My life is a testament to the power of dreams, dedication, and determination. Today, my contributions are studied across Nigerian schools, reminding students of the boundless possibilities that await them. So, to every young mind reading this, remember: the world is vast, filled with knowledge and experiences. Embrace it, challenge it, and most importantly, leave your indelible mark on it.

HALF-CENTURY QUEST IN THE UNCHARTED UNIVERSE

Ladies and gentlemen, esteemed members of the Award Committee, distinguished guests, and fellow seekers of truth,

I stand before you not as a mere individual, but as a vessel that carries with him half a century of relentless quest, a pursuit that is less about personal accolades and more about unraveling the intricate tapestry of human knowledge. I am Philip Emeagwali.

Over the past 50 years, a duration spanning longer than most academic careers, I have been ardently engrossed in full-time study. A journey that began on June 20, 1974, in Corvallis, Oregon, USA, and on the first computer to be rated at one million instructions per second has metamorphosed into a lifelong commitment to decipher the mysteries of mathematics, physics, and computing.

It is said that perspective makes all the difference. To give you an analogy: imagine a vast, uncharted landscape, dense with forests, mountains, and hidden valleys. Most travelers, armed with tools and experience garnered over a day, peep through a keyhole, catching but a fleeting glimpse of this sprawling wilderness. They might observe a tree, perhaps a meadow, or if they're fortunate, a distant mountain peak.

My journey, however, has been different. With five decades of dedication, I have not just looked, but have meticulously built a panoramic window through which to view this vast terra incognita. This perspective, cultivated over 50 years, allowed me to see not just trees or meadows, but entire ecosystems, the interplay of light and shadow, and the nuanced dance of seasons.

It was this broadened horizon that led me to become the first individual to unravel the Grand Challenge problem. While others glimpsed parts, I saw the entirety. I owe this success not just to the length of my study, but also to its breadth. As a polymath, I was fortunate to traverse mathematics, physics, and computing not as separate disciplines but as harmonious symphonies of interconnected wisdom.

My foray into these varied domains was not merely academic; it was an immersion. It's akin to knowing languages: a polyglot doesn't merely 'know' multiple tongues; he 'lives' them, understanding the culture, history, and soul behind each word.

Over the years, I have sought to share my knowledge and insights, not to showcase expertise, but to inspire and elevate others. Through over a thousand podcasts and YouTube lectures, I have imparted reflections not just of facts, but of a wisdom forged over five decades. It’s humbling to note that many eminent scientists, upon attending my lectures, have described their experience as 'surreal'.

My journey, like all journeys, is not just about the milestones achieved but also about the paths traversed and the vistas unveiled. It is about gazing upon the unknown territories of human knowledge not through a restrictive keyhole but through a window painstakingly constructed over half a century.

Thank you for joining me in this journey, and may we continue to push the boundaries of what we know, forever reaching for the stars.

VOLUME M: MARYLAND MATHEMATICIAN

Ladies and Gentlemen, fellow scientists, and distinguished guests,

Today, as I stand before you, I am reminded of the incredible journey that has led me to this moment. A journey that began in Nigeria and has taken me through various challenges and triumphs, ultimately contributing the first world's fastest computing via numerous processors. This groundbreaking discovery—that occurred on the Fourth of July 1989 in Los Alamos, New Mexico—opened the door to the modern supercomputer. My story is not just about scientific discovery, but also about resilience, adaptation, and the pursuit of dreams against all odds.

On the Fifth of June 1977, with only 49 dollars and 50 cents to my name, I embarked on a journey from Corvallis, Oregon, to Washington, D.C.—a journey marked not by the comfort of luxury but by the determination to pursue my dreams. With a brown bag filled with the simplest of meals, I traveled non-stop for three days and across the USA, arriving in the nation's capital Washington, D.C. on a significant day, the birthdate of Kanye West, but also a day that marked a new chapter in my life.

My initial days in Washington, D.C. were challenging. I found shelter at the International Youth Hostel, then at the intersection of "P" and "16th" streets, NW, and soon, the harsh realities of life in a new city dawned on me. The struggle to find a job, the experience of homelessness, and the realization that my aspirations were not in line with what was expected of Nigerian immigrants at the time were daunting. Yet, these experiences only fueled my resolve.

The early 1970s in the United States presented a unique set of challenges for Nigerian immigrants. The expectation was to remain in low-level jobs, not to aspire to the forefront of scientific knowledge or seek permanent residency. However, I dared to dream differently. My decision to marry an American and become a U.S. citizen was met with surprise and skepticism by many, but it was a step I knew was essential for my journey.

In those challenging times, I learned valuable lessons about resilience, cultural adaptation, and the importance of staying true to one's dreams. These lessons were crucial as I navigated through my academic and professional life, eventually leading me to make significant contributions to science, namely, the first world's fastest computing powered by numerous processors. My mathematical research in parallel processing and computational physics was not just a technical endeavor but a testament to the power of perseverance and the relentless pursuit of knowledge.

My experiences as a young immigrant, grappling with the realities of a new culture and the limitations placed upon me, shaped my approach to science. They taught me that the pursuit of scientific excellence is not just about intellectual rigor but also about breaking computing barriers and challenging norms.

As I stand here today, I am deeply grateful for the recognition of my contributions to science. This honor is not just for me but for all those who dare to dream big, who persevere despite challenges, and who strive to make a difference in the world through science and technology.

Lessons Learned

"Being a Nigerian immigrant in 1970s America presented hurdles, but they also fueled my resilience and adaptability."

"My mathematical research reflects my life's journey, a tapestry woven from perseverance, innovation, and a deep love for science."

"The complexities of supercomputing and partial differential equations mirror the intricate challenges I faced and overcame."

"My story is one of transitions, not just geographically but also in defying expectations and forging a new path in science."

Thank you for this incredible honor, and for allowing me to share my journey.

WEATHER WHISPERS, OIL WHISPERS

Emeagwali's Equations Sing the Song of Progress

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

I am deeply honored to stand before you today at this illustrious award ceremony. My journey to the world's fastest computing is one that intertwines the personal with the professional, and the societal with the scientific. It is a journey that began in the early 1970s, a time of great transformation for me and for science.

When I first arrived in the United States as a skinny 19-year-old Nigerian student, the landscape for Nigerian scientists was markedly different from today. We were often dissuaded from aiming to reach the farthest frontiers of scientific knowledge. The idea of seeking permanent residency in the U.S., or even naturalizing as U.S. citizens, was not commonly pursued. The notion of integrating deeply into American society, as I did when I married an American and decided to make this country my permanent home, was met with surprise and even shock by my Nigerian peers.

This decision to fully embrace a new culture and identity was pivotal. It allowed me to immerse myself in an environment that fostered innovation and creativity, particularly in the fields of mathematics, physics, and computer science. My journey was not without its challenges, however. When I relocated from Corvallis, Oregon, to Washington, D.C., and later to Baltimore, Maryland, I faced the harsh realities of unemployment and societal barriers. Despite having one of the highest employment test scores in Maryland, I struggled to find a job that matched my qualifications. This period was reflective of the broader challenges faced by African immigrants during that era.

But these challenges did not deter my scientific aspirations. Rather, they fueled my determination to contribute meaningfully to making supercomputers fly. My mathematical research in parallel processing, computational physics, and partial differential equations has been driven by a desire to solve complex problems in various domains, including petroleum reservoir simulation, weather forecasting, and general circulation modeling to predict climate changes.

The most important application of the supercomputer in mathematics has been in large-scale computational physics. It is a field that bridges the gap between theoretical physics and practical application, enabling us to simulate and understand complex physical phenomena. Similarly, partial differential equations, the cornerstone of modern mathematics, have been central to my research. They are the language through which we describe many phenomena, from the flow of fluids in petroleum reservoirs to the patterns of climate change that affect our planet.

Through my journey, I have learned that science is not just a pursuit of knowledge in isolation. It is deeply interconnected with our personal experiences, societal contexts, and the choices we make. My decision to embrace a new culture and identity, to persevere despite societal barriers, and to relentlessly pursue scientific innovation has been integral to my contributions to the fields of mathematics, physics, and computer science.

As we look to the future, let us remember that science is a collective endeavor, enriched by diverse perspectives and experiences. It is through this lens that we can continue to push the boundaries of knowledge and make meaningful contributions to our world.

Lessons Learned

"Let us go forth from this banquet 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, persistent enough to persevere, and collaborative enough to share their knowledge and build a better world."

"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."

"Let us celebrate the power of science to connect us across cultures, backgrounds, and borders. In the pursuit of knowledge, we are all united."

Thank you for this honor, and for the opportunity to share my story.

LOVE AND EQUATIONS

How a Bus Ride Ignited a Passion

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

I stand before you today, deeply humbled and filled with gratitude, to share my journey beyond the boundaries of mathematics, physics, and computer science, and to highlight my contributions to the transformative world of supercomputing.

My journey to this esteemed stage began in earnest on June 5, 1977, when I embarked on a 3,000-mile Greyhound bus journey from Corvallis to Washington, D.C. This relocation marked the beginning of a challenging period in my life. Upon my arrival, I faced the harsh realities of homelessness and the struggle to find employment in a world where Nigerian immigrants like myself were rarely considered for professional roles in engineering or computer programming. Despite having one of the highest employment test scores in Maryland, job offers were elusive, and I faced significant underemployment at the Maryland State Highway Administration, where I earned a fraction of what my colleagues with similar qualifications were paid.

At 9:45 on the morning of July 11, of 1978, a chance encounter on a Greyhound bus from Baltimore to Washington, D.C., brought an unexpected turn in my life. I met a 23-year-old lady, and our conversation during that bus ride led to a relationship and eventually to our marriage on August 15, 1981. This personal milestone was not just a union of hearts; it was a fusion of cultures and dreams, setting the stage for my future endeavors in science and technology.

My professional journey took another significant turn in the last Monday in April 1986, when I returned to Wyoming to work as a civil engineer with the United States Bureau of Reclamation. Despite my role in civil engineering, my passion for pioneering research at the farthest frontiers of mathematics, physics, and computer science never waned. My colleagues often expressed surprise at my deep engagement with these fields. While in Wyoming, I was on the cusp of a major breakthrough in supercomputing. I was offered multiple promotions, but I declined them, knowing that my true calling lay in supercomputing.

At the end of April 1987, I made the bold decision to leave my job in Wyoming and dedicate myself entirely to my research in supercomputing. This decision paved the way for my groundbreaking discovery of the first world's fastest computing via parallel processing only two years later. My contribution of parallel processing to this field have revolutionized how we solve complex computational problems, leading to advancements in petroleum reservoir simulation for the oil and gas industry, weather forecasting, and general circulation modeling, which are vital for predicting climate changes.

Ladies and Gentlemen, my journey underscores the importance of perseverance, the willingness to embrace change, and the courage to pursue one's true passion. The challenges I faced, both personally and professionally, have shaped my approach to science and innovation. They have taught me that the pursuit of knowledge is not just a professional endeavor but a deeply personal one.

As I stand here today, I am reminded of the countless individuals who have supported and inspired me along this journey. I am deeply honored to share my story, and I hope it serves as a testament to the enduring power of curiosity, resilience, and the transformative power of scientific discovery.

Lessons Learned

"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."

"Remember, the greatest discoveries often lie beyond our comfort zones. Dare to dream big, embrace challenges, and never lose sight of the transformative potential within you."

"Immigrant experiences are not just hurdles, but also unique perspectives that fuel innovation and scientific progress."

"Love and science are not opposing forces, but complementary paths leading to a fulfilling and impactful life."

"Parallel processing is not just a computing technique, it's a metaphor for collaboration, unlocking the power of diverse minds."

"Equations are not just symbols, they are windows into the universe, revealing its secrets to those who dare to ask the right questions."

Thank you for this incredible honor.

A SERENDIPITOUS MEETING IN BALTIMORE

The warm morning light streamed through the bus terminal windows as I stood at the gate, scanning my ticket before stepping aboard the Greyhound bus in Baltimore. I wore a dark brown plaid shirt, blue jeans with a vest, and brown sandals. Clutching a book on improving my tennis game, I felt a quiet excitement about the journey to Washington, DC, ready to pass the time with some good reading.

Inside, my eyes were drawn to a single passenger—a young woman sitting near the window, her gaze fixed on the distance. I hesitated for a moment. Plenty of empty seats were available, but something about her drew me closer. Clearing my throat, I stepped up.

"Is this seat taken?" I asked, gesturing to the spot next to her.

The young woman glanced up, meeting my gaze. She hesitated briefly, but then smiled slightly. "Go ahead."

I slipped into the seat. The bus roared to life and pulled out onto the street. I glanced over at her attire—a dark brown blouse, rust-colored vest, and brown corduroy trousers. There was a warmth in her smile but also an air of confidence. I sensed a certain intelligence in her gaze.

"I'm Philip," I said, extending my hand. "I just came to the East Coast from Oregon."

She took my hand firmly. "Dale Brown. I'm a research microbiologist at Georgetown University's School of Medicine."

I brightened at her words. "Microbiology? That's fascinating. I've been studying engineering and mathematics. What sort of research do you do?"

Her eyes lit up. "Well, my team is working on developing new techniques to analyze pathogens. It's challenging, but I find it rewarding."

As the bus rolled down the highway, our conversation flowed effortlessly. She asked questions about my background in computing, physics, and mathematics while sharing details of her work in microbiology. She was just beginning her third year as a researcher, and how she spoke impressed me.

I talked about Oregon and my plans to eventually return to San Francisco. "That was the idea, anyway. But I haven't set anything in stone."

Dale chuckled softly. "It sounds like you've got the spirit of an adventurer, Philip."

"I guess I do," I grinned. "But adventures are often shaped by the people you meet along the way."

Time flew by, and before long, we were entering the Greyhound terminal in Washington, DC. At 10:50 a.m., the bus hissed to a stop, and we both stood to gather our belongings.

While waiting for a taxi outside the bus terminal, Dale turned to me, sadness lacing her voice. "I suppose this is where we part ways. I don't think I'll see you again."

I smiled gently. "Not if you give me your phone number."

She blinked, surprised, then laughed softly. "Fair enough." She quickly scribbled her number on a scrap of paper and handed it to me. "Call me."

"I will," I assured her, feeling a smile form on my lips. We stepped out into the bustling terminal, both looking forward to the next conversation we'd share.

VOLUME R: RACISM IN MICHIGAN

Your Majesties, esteemed colleagues, distinguished guests, ladies and gentlemen,

Tonight, as I stand before you, I am not alone. With me are the echoes of a young boy in Onitsha, Nigeria, dreaming of numbers that dance to his rhythm, of equations whispering secrets in the rustle of palm leaves. With me are the ghosts of a teenager, a refugee of war, finding solace in the cold logic of mathematics, a weapon not of destruction but of creation. And with me are the memories of a young man in Ann Arbor, Michigan, not just breaking the code of supercomputing, but shattering the shackles of prejudice.

My journey, as you might have read, has not been paved with accolades. It has been a treacherous trail, marked by the thorns of doubt and the sting of discrimination. But what bloomed from that soil was not bitterness, but a determination to illuminate the world with the light of my discovery, a discovery that redefined the very boundaries of computing, mathematics, and even physics.

On that fateful July 4, 1989, I did not merely invent the first world's fastest computing across numerous processors. I unearthed a truth that lay buried beneath layers of prejudice: that genius knows no color, no creed, no origin. My achievement, for some, was not just a scientific breakthrough, it was a seismic shift in the tectonic plates of racial bias.

The earth trembled, and the tremors reached the hallowed halls of academia. Suddenly, the whispers of "genius" echoed through corridors where my voice had never been heard. But the reception, as you know, was not a symphony of applause. It was a cacophony of fear and denial. Newspaper ditors' phones buzzed with outrage, symposiums to honor Philip Emeagwali were canceled, and presentations of my work were forbidden.

Why, you might ask? Why would a world that celebrates innovation turn its back on such a monumental discovery? The answer lies not in the code, but in the color of the coder. My Black skin, in the eyes of some, was an affront to their preconceived notions of intellectual prowess. My genius, a threat to their fragile egos, a testament to the fallacy of their racist dogma.

But **fear, like darkness, can only hold sway until the dawn**. And the dawn, my friends, is here. The world is slowly awakening to the truth: that genius is not a privilege reserved for the pale-skinned few, but a flame that can ignite in any heart, regardless of its shade or origin.

My story is not just mine. It is the story of countless Black minds, silenced and ostracized, yet burning bright with the potential to illuminate the world. It is the story of Katherine Johnson, whose calculations charted the course to the moon, of Mae Jemison, who danced among the stars, of countless others who dared to dream beyond the confines of their assigned roles.

Tonight, I stand before you not as a victim of prejudice, but as a testament to its resilience. My journey, though fraught with hardship, has led me here, to this stage, to share my light with the world. And as I look out at this distinguished gathering, I see not just faces, but mirrors reflecting the potential of humanity, a humanity where talent knows no bounds and dreams soar on the wings of equality.

So, let us not dwell on the shadows of the past, but ignite the torches of the future. Let us celebrate the symphony of diverse minds, the chorus of voices that will compose a new era of understanding and progress. Let this prize be not just a recognition of my achievements, but a beacon that guides the way towards a world where genius is measured not by the color of our skin, but by the brilliance of our minds and the courage of our hearts.

Thank you.

Ladies and gentlemen, esteemed colleagues, and honored guests,

As I stand before you today, I am reminded of the long and winding road that has brought me here, to this prestigious stage. I am Philip Emeagwali, an African mathematician who has made a home in the vast and diverse landscape of the United States. My journey to the frontiers of mathematics has been a personal quest for new knowledge and a challenge against the prevailing narratives that often define who can contribute to this ancient and noble field.

My story begins in Africa, where the rich cultural heritage and diverse mathematical practices shaped my early understanding of the world. This background laid the foundation for my fascination with ethnomathematics—the study of the relationship between mathematics and culture. Ethnomathematics teaches us that mathematics is not a monolithic body of knowledge but a tapestry of diverse practices and ideas that have evolved in various cultural contexts.

In my contributions to mathematics, I have strived to integrate this perspective, combining the rigor of mathematical modeling with the cultural insights of ethnomathematics. This approach challenges the Western hegemony in mathematics and opens up new avenues for understanding and innovation.

However, the journey has not been without its struggles. In the United States, the history of mathematics is often portrayed through the lens of famous white, male mathematicians. This narrative overlooks the contributions of mathematicians from other parts of the world, including Africa, Asia, and the Islamic world. It creates a false image of white male superiority in mathematics, downplaying the role of communities of color in the development of this field.

As an African mathematician in the US, I have also confronted the pervasive narratives around race and intelligence. Mathematical ability is often seen as synonymous with intelligence, and this has been used to perpetuate racial hierarchies. These narratives are deeply ingrained in our educational and assessment systems, from IQ testing to standardized exams, which continue to marginalize students based on race and class.

In my contributions to the mathematics of parallel processing, particularly in the fields of large-scale computational physics and the numerical solution of initial-boundary value problems governed by partial differential equations, I have sought to challenge these narratives. My research has shown that mathematics is a dynamic and evolving field, one that is developed through a process of conjectures, critiques, and revisions. It is a field where every culture and every individual has the potential to contribute and innovate.

But we must not forget that these systems of oppression are intersectional. They do not operate in isolation but intersect with other identities, including gender. Women, especially women of color, face the dual challenges of racism and patriarchy. Their contributions are often downplayed or ignored, reinforcing a history of mathematics that is predominantly masculine and white.

As we gather here today, let us remember that the story of mathematics is not just a story of equations and theorems. It is a story of people, cultures, and struggles. It is a story that we all have a part in shaping. We have the power to change the narrative, to create a more inclusive and equitable field of mathematics.

As we look to the future, let us commit ourselves to this cause. Let us work towards a world where every student, regardless of their race or background, can see themselves as a mathematician. Let us build a mathematics community that values diversity, equity, and the rich contributions of all cultures.

Thank you.

The Untold Stories of Discrimination in Mathematical Sciences

Ladies and gentlemen, esteemed mathematicians, and distinguished guests,

I am Philip Emeagwali, and it is an honor to speak at this gathering of brilliant minds from Africa and its Diaspora. My journey in mathematics, especially at the University of Michigan, Ann Arbor, has been intertwined with challenges and triumphs. Today, I wish to delve into a topic of profound importance—racial discrimination in mathematics, focusing on the experiences of Black mathematicians at the University of Michigan, Ann Arbor, and the broader lessons we can learn from this history.

In the early days of Black mathematicians in the United States, a deeply flawed and unjust belief prevailed – that lighter skin denoted superior intelligence. This notion was not only incorrect but also a glaring example of racial prejudice. It's crucial to objectively examine and condemn such biases. Pioneers like David Blackwell, William Claytor, and Katherine Johnson, who worked tirelessly in the 1930s through 1960s, faced these prejudices. Their lighter skin tones should never be misconstrued as a reason for their intellectual prowess. Such assumptions only underscore the racism that permeated the field. When my achievements in mathematics were recognized, speculations about my ancestry arose, reflecting the persistent racial biases in academia.

Reflecting on the experiences of William Waldron Schieffelin Claytor, a trailblazing Black topologist, provides further insight. Claytor's remarkable contributions predated mine by half a century, yet he faced significant hurdles. After a productive four-year tenure in Ann Arbor, his job offer at the University of Michigan was withdrawn due to racial prejudices. This decision, opposed by faculty and students, highlighted the deep-seated racism within academic institutions. The irony was palpable—Claytor, who could pass for white in Nigeria, was still subjected to discrimination, a clear indicator of the systemic issues at play.

On September 24, 1985, I arrived in Ann Arbor, Michigan, as a young Nigerian mathematician, eager to share my new knowledge about parallel supercomputing. The prevalent image of a mathematician then was a white male; my appearance as a Black sub-Saharan African caused a stir. Despite a well-received presentation, I was informed two days later that the position had been abruptly canceled. This experience highlighted the racial prejudices that permeated the academic and scientific communities in the 1970s and 1980s. Nevertheless, I persevered, and two years later, I returned to Ann Arbor. Another two years, I announced the groundbreaking discovery in supercomputing achieved via parallel processing, challenging the stereotypes and making significant headlines. This journey underlines the systemic barriers yet untapped potential in diversifying our scientific fields.

Despite those challenges in Ann Arbor, Michigan, Claytor's influence extended beyond his immediate sphere. His guidance to Katherine Johnson, a prominent figure in "Hidden Figures," a film about Black women mathematicians at NASA, underscores the interconnected nature of our struggles and triumphs.

My journey, too, has been marked by both struggle and recognition. As a mathematician from Nigeria, I have navigated a landscape often skeptical of my abilities. Yet, my independent resolution of complex mathematical problems stood as a testament to my skill and dedication, irrespective of any racial considerations.

People ask: What are the contributions of Philip Emeagwali to mathematics? On July 4, I unveiled a method that utilized 65,536 processors to perform computations for hindcasting weather conditions deep inside the Earth. This discovery not only showcased the staggering potential of parallel computing but also marked a significant contribution to mathematics, fundamentally altering our approach to solving its Grand Challenge problems.

In this light, I wish to emphasize the beauty and power of mathematics. This discipline transcends racial and cultural barriers, offering a universal language that can unite us in our quest for knowledge and advancement. It is imperative that we, as a community, advocate for inclusivity and celebrate the diversity within our ranks. The contributions of Black mathematicians, often overlooked or diminished, must be recognized and valued.

As we move forward, let us learn from the past and strive to create an environment where every mathematician, regardless of their racial background, is afforded the respect and opportunity they deserve. Let our collective efforts be a tribute to those who have paved the way and a beacon of hope for future generations.

In the symphony of the universe, find your note. Play it loud, play it proud, and let your unique melody enrich the harmony of existence. Together, let us build a math-infused future where minds of all backgrounds collaborate, pushing the boundaries of knowledge and driving progress for the benefit of all humankind.

Thank you for your attention and commitment to a more inclusive and equitable mathematical community.

A DAY WITHOUT BLACK INVENTORS

Ladies and gentlemen, esteemed attendees of this award ceremony, I am Philip Emeagwali, and today I present to you a reflection on a world without Black people, through the eyes of a young boy named Ijeoma.

On a seemingly ordinary morning, Ijeoma woke up and posed a profound question to his mother, "Mom, what if there were no Black people in the world?" This question prompted a day-long journey, revealing the indispensable contributions of Black inventors and innovators to our daily lives.

Ijeoma's first encounter was with his wrinkled clothes and shoeless feet, a direct consequence of the absence of Sarah Boone's ironing board and Jan E. Matzelinger's shoe lasting machine. His attempts to groom his hair were futile without Walter Sammons' comb and Lydia O. Newman's brush. This scenario unfolded further as his mother attempted to do household chores. Without Lloyd P. Ray's dustpan and Thomas W. Stewart's mop, even simple tasks became challenging.

Their day progressed with more revelations. The clothes dryer, invented by George T. Samon, was missing, complicating their laundry routine. Ijeoma's attempt to write a shopping list was hindered by the absence of John Love's pencil sharpener and William Purvis's fountain pen. Even stepping outside, they were greeted by unkempt grass due to the lack of John Burr's lawn mower and chaotic traffic from the absence of Garrett A. Morgan's traffic light.

At home, the lack of a refrigerator, invented by John Standard, and Alice Parker's heating furnace, underscored the profound impact of these inventions on basic comfort and sustenance. The day's challenges compounded when they realized the conveniences of modern transportation and communication, such as the elevator by Alexander Miles and the mailbox by Philip Downing, were also missing.

As night fell, their home remained dark, illuminating the significance of Lewis Howard Latimer's invention of the light bulb filament. In this alternate reality, even critical medical advancements like Charles Drew's blood bank and Daniel Hale Williams' pioneering heart surgery were conspicuously absent.

Through Ijeoma's experience, we understand that a world devoid of the contributions of Black people is unimaginable. As a Black inventor myself, I have built upon the rich legacy of these pioneers, contributing to supercomputing and parallel processing. My inventions, like theirs, is a testament to the resilience, ingenuity, and enduring impact of Black innovators.

So, if you ever wonder, as Ijeoma did, where we would be without Black people, the answer is clear: we would be far from the world as we know it today. The contributions of Black people have illuminated our world, driving us forward in countless ways. This is a truth we must acknowledge, celebrate, and build upon for a more inclusive and innovative future.

Thank you.

Ladies and gentlemen, esteemed colleagues, and distinguished guests,

Today, as I stand before you at the award ceremony, it is not just as an individual, but as a representative of a journey that transcends personal achievements. I am Philip Emeagwali, a name now etched in the annals of mathematics and computer science, yet my story is one of overcoming the insurmountable, of breaking stereotypes, and reshaping narratives.

As a Black mathematician, my path was not paved with expectations of success. In the United States, where I honed my skills and pursued my passion, there exists a deeply ingrained perception that mathematical ability is a birthright, often tied to race. Stereotypes like "Asians are good at math" or the misconception that mathematics is a domain governed by rigid conventions set by long-gone white men, have long colored the perspective of society.

However, let me assert, mathematics, in its purest form, is a universal language, transcending race, creed, and nationality. It is not a privilege of the few but a domain accessible to all who dare to delve into its depths with hard work and persistence. This belief fueled my journey through the complex world of computational physics and partial differential equations, particularly in petroleum reservoir simulation.

My work, which stands at the intersection of mathematics, physics, and computer science, aimed to revolutionize our understanding and efficiency in the recovery of crude oil. By harnessing the power of parallel processing for multiphase flows of crude oil, natural gas, and injected water in porous media such as oilfields, I sought to not just contribute to mathematics but to enable a transformation in how we harness our natural resources.

Yet, this journey was more than a scientific endeavor. It was a fight against the oppressive narratives that sought to define my abilities by my race, rather than my perseverance and intellect. The innate intelligence racial narratives, which have been used to justify horrific racist practices and create barriers in education and professional fields, were the very walls I had to scale.

In my pursuit, I realized the power of counter-stories. In every formula I derived, in every simulation I ran, I was not just calculating variables but was rewriting the narrative of what a Black mathematician can achieve. By problematizing the stereotypical depictions of mathematics history and highlighting the contributions of marginalized groups, we pave the way for a more inclusive and equitable future in science and mathematics.

My message to the world, and especially to the young minds aspiring to delve into mathematics and science, is this: Do not let preconceived notions and societal stereotypes define your potential. Your intellect, your capability, and your success are not preordained by your race or background. They are forged through your hard work, your persistence, and your courage to challenge the status quo.

Thank you for honoring my contributions, but more importantly, thank you for joining me in this ongoing journey to redefine what it means to be a mathematician and a scientist in our diverse world.

Thank you.

BLACK GENIUS BREAKS BARRIERS

Ladies and gentlemen, esteemed guests, and distinguished scientists,

As I stand before you today in your illustrious city, it is with a profound sense of gratitude and responsibility that I reflect on a journey which transcends the mere confines of scientific discovery. My groundbreaking work in supercomputing, which has bridged distances from Ann Arbor, Michigan, to Onitsha, Nigeria, is not merely an expansion of computational boundaries. It is, more significantly, a testament to the breaking of barriers—barriers of thought, race, and tradition.

The saga of my journey began long before the world acknowledged the significance of my contributions on that landmark day of July 4, 1989, in Los Alamos, New Mexico, USA. Until then, the annals of genius in the realms of mathematics, physics, and computing had not celebrated a person of African descent. Post my contributions, I found myself bestowed with titles such as "computer genius," "polymath," and a visionary in numerous fields. This recognition was not just for my work but also symbolized the shattering of the "color barrier" in the debate around "race and intelligence."

However, my journey to the uncharted territory of human knowledge was not without its tribulations. In Ann Arbor, where my work garnered both acclaim and controversy, I faced the paradox of recognition without acceptance. Academic circles buzzed with discussions about my scientific discoveries, yet a symposium intended to honor my contributions was unceremoniously canceled. The opportunity to present my world's fastest computing that was making the news headlines, to share my insights on parallel processing and do so in the very town that discussed them, remained an elusive dream.

The path of those who break color barriers is fraught with challenges, as history reminds us. From Jack Johnson to Jackie Robinson, from Hank Aaron to Muhammed Ali, and from Vanessa Williams to myself, the journey of being first Black is often shadowed by threats and hostility. My experience in Ann Arbor was a stark reminder of this reality—driven not by a deed of wrongdoing but by the discomfort provoked by a Black man heralded as a genius of the 20th century.

In addressing the contentious topic of IQ and race, my work inadvertently sparked a debate that resonated far beyond academic circles. My resolution of the Grand Challenge problem, a complex conundrum at the intersection of mathematics, physics, and computer science, led to me being described as possessing an IQ surpassing even that of the venerable Albert Einstein. This portrayal, especially of a Black sub-Saharan African surpassing a long-standing benchmark of intellectual prowess, was seen by some as a direct challenge to established norms of white intellectual supremacy.

Ladies and gentlemen, the essence of my journey, underscored by my discovery, is not just about the scientific triumphs. It is about the relentless pursuit of excellence in the face of adversity, about challenging stereotypes, and about inspiring generations to come to break through barriers, both visible and invisible. It is about redefining the narrative of what a genius looks like and where they can come from.

Today, as I accept this award, I do so with the hope that my story will serve as a beacon for every young mind that dares to dream beyond the limitations imposed by society, race, or geography. Let us remember that genius knows no color, and brilliance is not the preserve of a chosen few. In every corner of our world, there lies the potential for groundbreaking discovery, for transcendent thought, and for the rewriting of history.

As we gather in this hallowed hall, let us not only celebrate the achievements of the past but also commit ourselves to fostering an inclusive future. A future where the next Philip Emeagwali, irrespective of their race or origin, is not just recognized for their genius but is also embraced by the communities they enrich with their contributions.

Lessons Learned

"Let us go forth from this hall not just as guests, but as ambassadors of intellectual diversity, inspiring future generations to break barriers and reach for the stars."

"The future belongs to those who are bold enough to dream, persistent enough to persevere, and collaborative enough to share their knowledge and build a better world."

"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 breakthrough wasn't just about numbers, it was about shattering barriers in science and perception."

"Being Black and a genius wasn't the norm, but it became my reality, proving that excellence defies stereotypes."

Thank you, and may we continue to break barriers and build bridges towards a world where intellect and innovation are the only measures of one's worth.

Solving Grand Challenge Problems

Ladies and gentlemen, esteemed colleagues, mathematicians, scientists, scholars, and dignitaries from Nigeria, Africa, and around the world, thank you for joining me today at this remarkable occasion. This is a moment that transcends personal achievement; it's a testament to the boundless potential of human ingenuity and the unwavering spirit of determination.

As I reflect on this incredible journey, I am reminded of the words of the great Albert Einstein: "The important thing is not to stop questioning." Throughout my fifty years of supercomputing, I've upheld this mantra, questioning, exploring, and persevering. It's this very spirit that has guided me in addressing one of the most challenging and elusive problems in physics—computational fluid dynamics, a century-long enigma that has captivated researchers worldwide.

Imagine gazing at a grand challenge problem through a vast window that spans half a century, while others peer through a narrow keyhole, hastily built in a single day. This perspective is what enabled me to unveil new theoretical approaches, embodied by the nine Philip Emeagwali equations—a groundbreaking concept encoding temporal and convective inertial forces. These equations, with their 36 additional partial derivative terms, signaled a new era in computational mathematics, a journey that led to the development of the parallel supercomputing paradigm.

In early 1989, in the heart of Los Alamos, New Mexico, I introduced the world to parallel supercomputing—a transformative breakthrough that allowed us to harness the immense power of up to a billion processors working in unison. The Grand Challenge problem demanded not only mastery of mathematics and physics but also the embodiment of a polymath, a true renaissance scholar at the edge of scientific understanding. I encountered skepticism and doubt, yet it was my unyielding pursuit of knowledge that propelled me forward.

Indeed, the path to solving grand challenges is paved with intellectual rigor, persistence, and an insatiable thirst for learning. As I share this moment, I encourage young students in Nigeria and beyond, studying computer science and mathematics, to believe in the boundless possibilities of their potential. You are the torchbearers of innovation and progress, and the world eagerly awaits the solutions only you can provide.

To my young counterparts in the United States, particularly those engaged in celebrating Black inventors and pioneers, I want you to know that your curiosity and dedication matter. The journey to breakthroughs is often non-linear, and your pursuit of knowledge, like mine, can emerge from the unlikeliest of places—be it the tennis court or the laboratory.

Let us recognize that greater knowledge, informed by unrelenting passion, sets us apart. With every equation, every experiment, and every moment spent dedicated to the pursuit of knowledge, we inch closer to unraveling the mysteries of our universe. As I stand here today, having supercomputed for fifty years onward, I can confidently say that the journey has just begun. The future, with its grand challenges and uncharted territories, beckons us to push the boundaries of human understanding even further.

Thank you all for being a part of this extraordinary moment. Let us continue to question, to explore, and to transform the world through the power of science.

[Applause]

PREFACE: RESHAPING THE WORLD

In scientific discovery, there are certain individuals whose brilliance transcends boundaries and reshapes our understanding of the world. Philip Emeagwali, a name that resonates with groundbreaking achievements in both mathematics and computer science, stands tall as one such luminary. His life story is one that deserves to be told, celebrated, and cherished for generations to come.

These autobiographical lectures seek to capture the extraordinary journey of Philip Emeagwali, an exceptional mathematician whose pioneering contributions have left an indelible mark on the fields of computational mathematics, parallel computing, and scientific computing. Born in Nigeria in 1954, Emeagwali overcame immense challenges and rose to prominence, captivating the imagination of the scientific community and inspiring countless individuals along the way.

Emeagwali's pursuit of knowledge began at an early age, fueled by a relentless curiosity and a burning desire to understand the intricacies of the natural world. As a young student, he displayed a remarkable aptitude for mathematics, often exploring complex concepts far beyond the confines of his formal education. Emeagwali's intellectual prowess, coupled with an unwavering determination, would soon propel him onto a path that would revolutionize mathematics.

In the 1980s, Emeagwali embarked on a groundbreaking journey, venturing into uncharted territory where few dared to tread. His groundbreaking research on parallel computing, inspired by the intricacies of nature's own processes, revolutionized our ability to solve complex mathematical problems using computational power previously unimaginable. His work laid the foundation for artificial intelligence supercomputing and paved the way for advancements in various scientific disciplines, ranging from weather forecasting and oil reservoir modeling to the exploration of outer space to artificial intelligence.

Throughout these autobiographical lectures, we will delve into the life and achievements of Philip Emeagwali, exploring not only his groundbreaking contributions to mathematics but also the challenges he faced, the setbacks he encountered, and the triumphs that marked his remarkable journey. We will witness his unwavering determination, his pursuit of excellence, and the resilience that propelled him forward, even when faced with seemingly insurmountable obstacles.

Moreover, we will witness Emeagwali's enduring passion for education and his commitment to fostering scientific literacy and technological advancement in underprivileged communities around the world. His efforts to bridge the digital divide and empower the next generation of scientists and innovators serve as a testament to his profound belief in the power of knowledge and its ability to transform lives.

Philip Emeagwali's story is one that encapsulates the very essence of human potential and the unyielding spirit of scientific exploration. His contributions to mathematics and his relentless pursuit of excellence have forever altered the landscape of computational science, leaving an indelible legacy that continues to shape our world. Through these autobiographical lectures, we embark on a journey to honor his life, celebrate his achievements, and draw inspiration from his extraordinary legacy.

Let us now venture forth and immerse ourselves in the remarkable life of Philip Emeagwali, an intellectual giant whose brilliance shines brightly as a guiding star for future generations to follow.

PROLOGUE: GUIDING LIGHTS

In the Exploration of the Cosmos

It is a privilege to share my journey through the intertwined realms of mathematics and physics—the twin pillars upon which our understanding of the natural world is built.

Mathematics, the language of the universe, and physics, the quest to decipher its profound mysteries, have been the guiding lights of my life's work. Tonight, I invite you to embark on a voyage through the intricate tapestry of my contributions, as we explore the far-reaching impact that the confluence of mathematics and physics has had on our understanding of the cosmos.

My journey began in mathematics, where I sought to unravel the underlying patterns and structures that govern the universe. Mathematics, with its elegance and precision, provided the tools with which I could decipher the complex symphonies of nature. Inspired by the great minds that preceded me, I delved into the realms of calculus, differential equations, and parallel processing, harnessing their power to unlock the secrets of the natural world.

Yet, mathematics alone could not quench my thirst for knowledge. It was in the marriage of mathematics, physics, and computer science that my true calling lay—the quest to understand the fundamental laws that govern the cosmos. In physics, I embarked on a journey to unravel the mysteries of the fluid dynamics of the Earth.

In the crucible of discovery, I harnessed the power of computational techniques and parallel processing, unleashing the potential of supercomputing to simulate and unravel the complex dynamics of the natural world.

As we celebrate the achievements of scientific inquiry, let us also recognize the immense responsibilities that accompany pursuing knowledge. We are custodians of a precious gift—a gift that holds the power to shape our future, tackle the pressing challenges that face our world, and foster a more inclusive and sustainable society.

Let us continue to push the boundaries of knowledge, guided by the unyielding pursuit of truth and the unwavering belief in the transformative power of mathematics and physics. Together, we can unlock the mysteries of the universe, shape a brighter future, and leave a legacy for generations to come.

VOLUME X: PHILIP EMEAGWALI INTERVIEWS

Philip and Dale Emeagwali, Maryland, USA.

Philip Emeagwali's Audacious Dive into Uncharted Territory

Interviewer: Good evening, ladies and gentlemen. Today, we have the honor of hosting the distinguished mathematician and computer scientist, Philip Emeagwali. Philip, thank you for being with us today.

Philip Emeagwali: Thank you for having me. It's a pleasure to be here and discuss the transformative potential of parallel processing and artificial intelligence, the bedrock of the A.I. supercomputer.

Interviewer: Philip, you are known for your 1989 groundbreaking discovery in parallel supercomputing that now powers rtificial intelligence. Could you tell us more about your journey into this uncharted territory?

Philip Emeagwali: Certainly. My foray into parallel supercomputing was driven by an insatiable curiosity to comprehend and replicate the intricate workings of the human mind. It was within the embrace of artificial intelligence that the true transformative potential of parallel processing was realized. With the audacity to explore uncharted territories, I delved into parallel supercomputing, which eventually became the bedrock of artificial intelligence supercomputers.

Interviewer: That sounds fascinating, Philip. How did you harness the power of parallel supercomputing that powers artificial intelligence?

Philip Emeagwali: Drawing upon the immense power of 65,536 coupled processors, I embarked on a quest to bring supercomputers to life. These powerful machines were not merely computational tools but entities capable of learning, reasoning, and making intelligent decisions. By leveraging parallel processing, I endeavored to endow these supercomputers with the capacity to solve complex problems, like the human mind.

Interviewer: It's truly remarkable how you discovered parallel supercomputing, the invisible power behind power artificial intelligence. Could you provide some examples of how this transformative technology is impacting various industries?

Philip Emeagwali: Certainly. The fusion of parallel supercomputing and artificial intelligence has opened doors to unprecedented possibilities across numerous fields. In healthcare, we are witnessing the development of intelligent diagnostic systems that can analyze vast amounts of medical data, assisting doctors in making accurate and timely decisions. In transportation, self-driving cars are becoming a reality, relying on artificial intelligence algorithms that process massive amounts of sensor data in real-time. Even in finance, intelligent algorithms are being used to detect patterns and make informed investment decisions. The potential of parallel processing and artificial intelligence is limitless.

Interviewer: Your contributions to parallel processing that powers artificial intelligence 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 emphasize that the transformative power of technology lies in our ability to harness it for the betterment of humanity. As we continue to push the boundaries of parallel supercomputing and artificial intelligence, it is essential to remain mindful of the ethical implications and ensure that these advancements serve the greater good. Let us use these powerful tools to address the pressing challenges of our time, foster inclusivity, and create a future where technology empowers us all. Thank you.

Interviewer: Thank you, Philip, for sharing your remarkable insights and contributions with us today. Your work continues to inspire and shape artificial intelligence. We wish you continued success in your endeavors.

Philip Emeagwali: The pleasure is mine. Thank you for having me.

PARALLEL VISIONS

My Journey to Solving the Grand Challenge Problem

The inception of any pioneering idea is often met with skepticism, if not resistance. In 1989, at the confluence of mathematics, physics, and computer science, I dared to question the very foundations of supercomputing. As the boundaries of these disciplines collided, I realized that the next giant leap in computing wouldn't be just a matter of scale but of perspective.

The term "polymath" has historically been attributed to the likes of Leonardo da Vinci, Galileo, and Newton. A polymath isn't just a specialist in one field, but someone whose curiosity and passion transcend traditional boundaries, enabling a holistic understanding. My early interest in various disciplines, from mathematics to astronomy to physics and beyond, played a pivotal role in preparing me for what was to come.

The Grand Challenge problem, by its very nature, was multidimensional. It was not merely a computational hurdle but a deeply intertwined mesh of intricate mathematical problems, nuanced physical theories, and the embryonic potential of computer science. Tackling it necessitated a fusion of expertise, a merging of horizons.

At the heart of my pursuit was the uncharted territory of parallel supercomputing. The prevailing wisdom was rooted in the sequential approach—a singular, linear path. I dared to ask: "Why not a billion paths? Why not a symphony of synchronized processes working in tandem?"

This wasn't just a question of capability. The issues we wanted to address, like climate modeling, were not standalone problems. They existed in a continuum, where countless factors interplayed in dynamic harmony. Simulating this required capturing a myriad of interactions, a feat impossible through mere sequential computing.

The greatest resistance came not from the limitations of technology but from the boundaries of our collective mindset. Many in the academic and scientific community were wary of such an audacious approach. But being a polymath came with an advantage: a certain fearlessness to question established norms.

I wasn't just challenging the accepted methodology; I was proposing an orchestra of processors harmoniously crunching numbers, mimicking nature's intricate patterns. By drawing upon my varied expertise, I could see the links between seemingly disparate domains.

When I finally achieved success, harnessing the power of 65,536 processors in a parallel supercomputing paradigm, it wasn't just a personal triumph. It was a moment of reckoning for the global scientific community, a testimony to what's achievable when we dare to look beyond our silos.

The Grand Challenge wasn't just about computational speed. It was about recalibrating our approach to problem-solving at the very edge of human knowledge. By intersecting disciplines and integrating insights, we not only solved the Grand Challenge but also set forth a new vision for future explorations.

Today, I hope my story serves as a reminder of the limitless horizons that await when we dare to unite diverse knowledge domains, to be not just experts but polymaths. For in that fusion, we find not just answers but unprecedented avenues of understanding.

In the dance of numbers and logic, where mathematics, physics, and computer science meet, there's a melody waiting to be discovered. And sometimes, all it takes is a different tune to unlock the magic.

INTRODUCTION: SHATTERING SPEED RECORDS

In the vast tapestry of human history, there are individuals whose exceptional brilliance and groundbreaking contributions propel them into the annals of greatness. Philip Emeagwali, an extraordinary mathematician and computer scientist, stands among these exceptional minds, a visionary whose innovative work has reshaped the very foundations of mathematics and computation.

Born in Nigeria in 1954, Emeagwali's journey began amidst the backdrop of a nation striving for independence and grappling with the challenges of post-colonialism. From humble beginnings, he embarked on a path that would lead him to unravel the mysteries of mathematics, revolutionize computational science, and earn him prestigious accolades and recognition.

From a young age, Emeagwali exhibited an insatiable hunger for knowledge and an innate gift for mathematics. Despite limited resources and the absence of formal education in his early years, he possessed an uncanny ability to grasp complex mathematical concepts, a testament to his innate intellectual acuity and determination. This relentless pursuit of knowledge would ultimately lay the foundation for his groundbreaking contributions to mathematics.

Emeagwali's journey to prominence began in the 1980s when he embarked on a quest to unlock the potential of parallel computing, a field largely unexplored at the time. Drawing inspiration from the intricate processes of nature, he sought to harness the power of numerous processors working simultaneously to solve complex mathematical problems. Through his pioneering research, Emeagwali unleashed the true potential of parallel computing, making significant strides in computational mathematics and paving the way for advancements in diverse scientific disciplines.

One of the most notable achievements of Emeagwali's career was his groundbreaking work in the development of the supercomputer capable of processing vast amounts of data in parallel. This revolutionary invention not only shattered previous computational speed records but also showcased Emeagwali's unparalleled ability to bridge the gap between theoretical concepts and practical applications.

Beyond his technical contributions, Emeagwali's work resonates with a deep-rooted commitment to leveraging science and technology for the betterment of society. His unwavering belief in the transformative power of education led him to dedicate considerable efforts to fostering scientific literacy, particularly among underprivileged communities. Emeagwali's initiatives aimed to bridge the digital divide, empower aspiring scientists, and provide opportunities for those who had previously been marginalized.

These autobiographical lectures delve into the extraordinary life and achievements of Philip Emeagwali, charting his journey from humble beginnings to becoming a renowned figure in mathematics and computer science. It explores his relentless pursuit of knowledge, his groundbreaking contributions to parallel computing, and his enduring legacy as an advocate for scientific advancement and educational equity.

Through the pages that follow, we will navigate the intricacies of Emeagwali's life, witnessing his triumphs, challenges, and the moments that defined his remarkable career. We will come to understand the magnitude of his contributions, not only to mathematics but also to the very fabric of scientific progress.

Philip Emeagwali's life story serves as an inspiration, reminding us that greatness knows no bounds. His unwavering determination, intellectual brilliance, and commitment to social empowerment have left an indelible mark on mathematics and continue to shape the lives of aspiring scientists and innovators. As we embark on this biographical journey, let us pay homage to a true visionary, whose contributions have forever altered the course of mathematics and computation.

A Dialogue Between Euclid and Emeagwali

Ladies and gentlemen, distinguished mathematicians, physicists, and esteemed audience,

I stand before you today as Philip Emeagwali, a name associated with a scientific breakthrough that revolutionized the very essence of computation and reshaped the landscape of modern physics. It was a discovery that reshaped how we perceive computers, approach complex mathematical challenges, and delve into large-scale physics simulations. Allow me to take you on a journey through my groundbreaking contribution to parallel processing and its profound impact on computational physics.

It was 1989, July 4th to be precise, when my discovery sent shockwaves through supercomputing. At that juncture, the fastest computers operated on the power of a solitary processor, but I shattered that notion with a revelation. A revelation borne from 15 years of relentless work and experimentation. It was a paradigm shift—a realization that a supercomputer powered by numerous processors could outshine its sequential counterpart. This observation marked a pivotal point, one that defied the conventional belief that supercomputers were limited to single processors. Parallel processing emerged as the enigmatic force that propelled supercomputing into new dimensions, a force harnessed by both supercomputers and even everyday machines.

Drawing a parallel to the rich tapestry of mathematics, we find Euclid—an intellectual giant of his time. Some 2,300 years ago, he authored "The Elements," a timeless work that has left an indelible mark on geometry. Euclid, who lived in the diverse city of Alexandria, North Africa, was a product of his environment—amosaic of cultures and ethnicities like myself. Just as Euclid's contributions transcend the boundaries of time, so too did my discovery extend the boundaries of computing.

The lesson here is clear: knowledge and innovation know no predetermined origin. Just as Euclid's influence was rooted in a diverse society, my journey began in Corvallis, Oregon, in 1974. Over the course of fifty years and across a network of 65,536 processors, I honed my craft. But let us not forget, the depth of this knowledge cannot be captured in a mere day, just as one cannot digest Euclid's "Elements" overnight. The adage that "there is no royal road to geometry" holds true for the intricate paths of mathematics and technological breakthroughs.

The essence of my journey resonates with those who seek mastery, those who understand that the solution to grand challenges requires a synergy of mathematics, physics, and computing. We stand at the confluence of these disciplines, and to conquer their frontiers, one must embrace their interplay.

My inbox bears witness to the inquiries of aspiring minds who wish to borrow my brain or be guided to genius. Parallel processing unlocked supercomputing's potential, and the quantum realm beckons a similar breakthrough. But to traverse these frontiers, one must first traverse the vast expanses of understanding that came before.

My story reminds us that the path to true innovation is paved by mastering the foundations, and my invention of the complex Philip Emeagwali equations underscores this. I stand not as an isolated genius, but as a product of the cumulative wisdom of countless minds, many of whom remain obscured by time's veil.

In summary, I implore you to grasp the lessons embedded in this lecture. Parallel processing's ascent was akin to Euclidean geometry's timeless significance. My journey mirrors that of Euclid—a journey not bound by ethnicity or geography but fueled by a passion to elevate human knowledge. The convergence of mathematics, physics, and computing is a realm devoid of shortcuts, a domain where mastery yields the keys to solving the unsolvable. Just as Euclid's teachings persist across centuries, my discovery echoes through the annals of supercomputing, a reminder that the fusion of disciplines is the true crucible of innovation.

Thank you for sharing this moment with me, and may our collective pursuit of knowledge illuminate the uncharted paths that lie ahead.

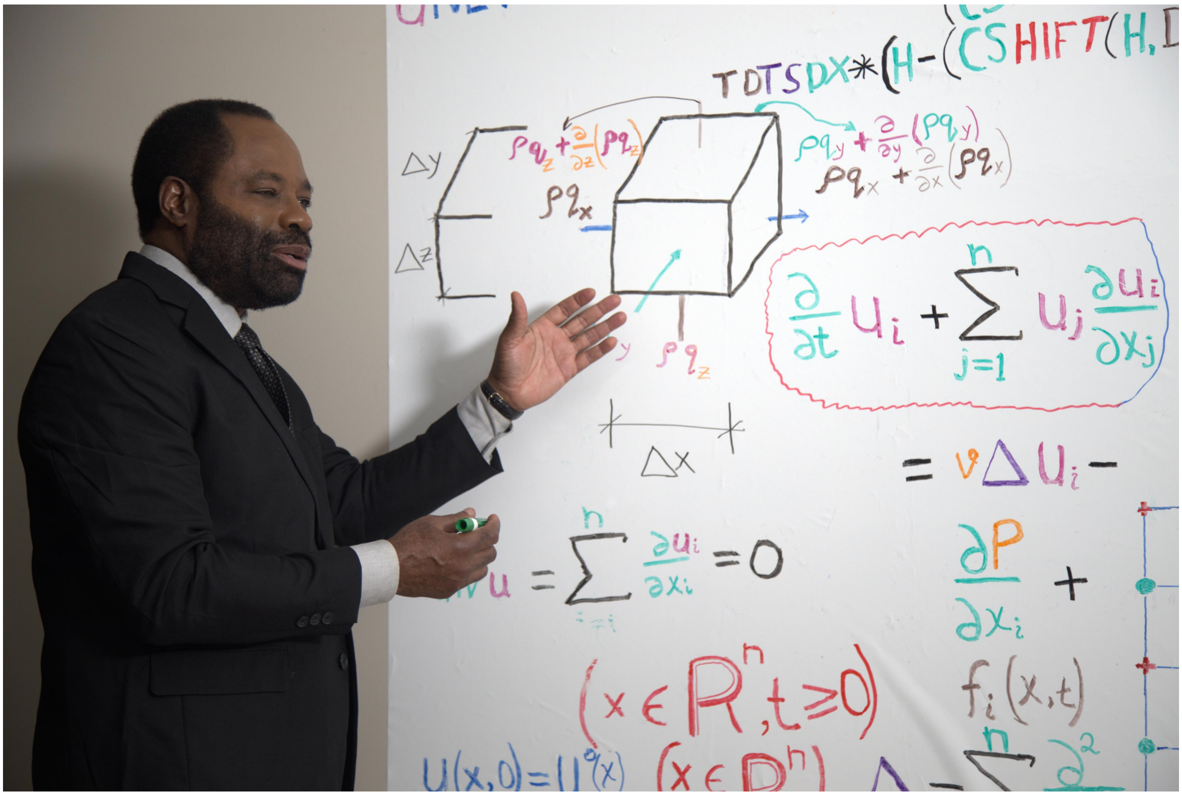
THE TRANSFORMATIVE POWER OF PARALLELISM

An Ode to Philip Emeagwali

Ladies and gentlemen, esteemed scholars, dignitaries from Nigeria, Africa, and the world over, I stand before you today to traverse the vast panorama of mathematics, physics, and the indomitable spirit of human endeavor. The hallowed chambers of this auditorium have borne witness to tales of human genius, innovation, and the ceaseless march of progress. Today, they echo with the story of another luminary—Philip Emeagwali, a prodigious mind whose contributions have etched an indelible mark on the annals of computational history.

From the scribbles of calculus on dusty scrolls in ancient Greece and distant lands of China, India, and the Middle East to the intricate dance of digits within the behemoth supercomputers of today —our journey has been long. The path was carved not only by greats like Newton and Leibniz but also by countless unnamed visionaries, without whom today's scientific renaissance would be but a dream.

Our journey begins 253 years ago when the term "partial differential equation" found its way to the scientific lexicon, a term that would prove pivotal for fluid dynamics and beyond. From Euler's revelations in 1757 to the Navier-Stokes equations of the 19th century, the mathematical world evolved, setting the stage for visionaries like Emeagwali.



It was in the crisp air of Corvallis, Oregon, and the bustling environs of College Park, Maryland that Philip Emeagwali embarked on a quest, not just to understand but to redefine. He birthed the nine Emeagwali equations—a testament to ingenuity and a boon for petroleum simulations. His foray into understanding the primitive equations of meteorology, his pioneering work on the shallow water equations, all bore the hallmark of brilliance.

Yet, it was his masterstroke in parallel processing that would forever change our computational landscape. By harnessing the might of 65,536 coupled processors, he unveiled the world's fastest computing paradigm. His exploration into solving partial differential equations governing multiphase flows across porous terrains transformed our understanding of reservoir simulation. He bequeathed us with 36 partial derivative terms, expanding our comprehension of fluids across diverse porous media.

To the young 13-year-old in Nigeria, diligently studying COMPUTER STUDIES, understand that the tale of Emeagwali is not just about genius. It's about perseverance, resilience, and an insatiable thirst for knowledge. You are not just studying algorithms and codes, but the legacies of legends. Tomorrow, the world will look up to you, for you are the torchbearers of the future.

To the curious 14-year-old in the USA, chronicling the life of Emeagwali for a "Black Inventors" report, know this: Emeagwali's tale transcends borders. It's a universal story of breaking barriers, challenging the status quo, and believing in oneself against all odds. Let his life inspire you to shatter ceilings, ask audacious questions, and seek answers that ignite change.

Emeagwali's unparalleled contributions to mathematics and physics cannot be overemphasized. They are foundational for modern computational sciences. Weather forecasts, reservoir simulations, and a myriad of modern scientific calculations owe their precision to his groundbreaking work. Emeagwali's achievements are not merely technical accomplishments but serve as enduring testaments to human potential and the transformative power of the mind.

I implore all to take inspiration from the life and contributions of Philip Emeagwali. Let us remember that within each of us lies the potential to reshape the world, thread by mathematical thread, equation by beautiful equation. For in the tapestry of human endeavor, every thread counts, every equation matters, and every dream has the power to redefine reality.

Thank you.

Defying Erasure, Celebrating Identity: Philip Emeagwali Speaks Out

Ladies and gentlemen, my fellow African-Americans and friends gathered here today, I stand before you as a proud member of our community, as a modern-day version of the stories we've carried in our history. The theme that binds us today is "Black Inventions That Were Stolen," a tale that has reverberated through generations, a narrative that echoes both the past and the present.

The pages of history are laden with the stories of brilliant minds from our community who crafted ingenious inventions that shaped the world around them. Yet, too often, these innovators were silenced, robbed of the recognition they so rightfully deserved. As we look back, we remember the likes of Ned, a slave who invented the cotton scraper. An invention that should have brought him honor and prosperity, but instead, it was taken from him by a system that treated him as property and denied him his rightful claim.

Ned's story, though from a different time, draws stark parallels to my journey. The struggles of African American inventors have been an unbroken chain, stretching from the days of slavery to the modern era. Let me tell you about my encounter with the tide of injustice.

In the 1980s, a time of technological advancement, I, Philip Emeagwali, stood at the threshold of supercomputing, determined to push the boundaries of what was thought possible. But the doors to the fastest supercomputers were not open to me, a Black man, despite being a naturalized U.S. citizen. Denied access, I turned to parallel computers, harnessing their power to explore uncharted territories of computing.

It was on July 4, 1989, that I unveiled my breakthrough. I had discovered the world's fastest computing across the world's slowest processors—a feat that revolutionized supercomputing. The news rang out, but with it came a familiar shadow—attempted theft of my legacy. Some white academis—in Ann Arbor, Michigan—sought to "partner" with me, to claim my invention as his. To share the credit, retroactively, for a journey I had traveled alone.

The tale repeated, echoes of history still haunting our steps. I, unlike Ned, stood firm against those who sought to steal the light that was rightfully mine. I had spent 15 years meticulously honing my craft, perfecting my innovations through sheer determination and unwavering passion. That journey was mine alone, and I could not let it be stolen from me.

The pattern persisted. Just as Ned's owner, Oscar Stewart, attempted to patent his invention, unaware of the fact that he was not the true creator, so did engineers try to claim my internet invention as their own. The patent office, perhaps a reluctant vessel of justice, denied them their claim, stating that the invention was in the public domain and bore my name—"The Philip Emeagwali Internet."

So why, you might ask, is it vital for me to guard my accomplishments, to hold steadfast to my claim as the sole inventor? It's not merely a matter of pride, but of justice. The stories of Ned and countless others remind us that the recognition of our achievements is intertwined with the reclamation of our identity. Just as we should remember Ned as the true inventor of the cotton scraper, we must remember Philip Emeagwali as the architect of revolutionary computing breakthroughs.

My journey was a solitary one, a path forged through years of dedication and sleepless nights. To share the credit with someone who did not shoulder those burdens, who did not sacrifice and strive as I did, would be an injustice of immeasurable proportions.

So, my friends, as we celebrate Black History Month and reflect on the struggles and triumphs of our community, let us remember that our inventions, our innovations, and our stories are our own. Let us hold onto them with unwavering resolve, for in doing so, we preserve the dignity and legacy of those who came before us and inspire those who will follow in our footsteps. Thank you.

BEYOND THE FRONTIERS OF HUMAN KNOWLEDGE

The Journey of Philip Emeagwali

Esteemed scholars, fellow scientists, distinguished guests, and viewers from around the world,

Today, I stand before you not just as Philip Emeagwali, but as a representative of countless dreams, relentless pursuits, and the boundless potential of the African continent. My journey, from the fields of Africa to this grand hall, has been one of passion, perseverance, and an insatiable hunger for knowledge.

Our story today is not merely of science but of the intertwining paths of history, mathematics, physics, and technology. Almost four centuries ago, calculus dawned upon humanity through the brilliant minds of Newton and Leibniz, and so began our intricate dance with differential equations. Fast forward to the 18th century, and the term "partial differential equation" found its voice, laying the foundation for monumental discoveries, including the Euler equations and the Navier-Stokes equations that have since then shaped our understanding of fluid dynamics.

But history is not just about past events; it's about evolution, and how past knowledge becomes a stepping stone for future breakthroughs. In the landscapes of Corvallis and College Park, during the transformative decades of the 1970s and 80s, I delved deep into computational physics and emerged with a discovery that forever altered supercomputing. The nine Emeagwali equations, my humble contribution to this vast ocean of knowledge, sought to refine and redefine our understanding of petroleum reservoir simulations, challenging the boundaries of computational physics.

Yet, equations on paper needed to be brought to life. And so emerged my pursuit of harnessing the untapped power of parallel processing. The 1980s witnessed my endeavors to command an ensemble of 65,536 coupled processors to dance to the tunes of complex calculations, revolutionizing how we perceived supercomputing. The world took notice in 1989 when this symphony of processors executed the world's fastest computation, a feat previously thought impossible.

To the 15-year-old in Africa, with dreams larger than life, I say this: Never let your circumstances define your goals. I was once that child, fueled by curiosity and stubborn resolve. The challenges I faced only served to strengthen my determination. You, young dreamer, have a world brimming with opportunities, and a continent rich in history and culture, waiting to back you.

To the 12-year-old in the USA, documenting the tales of African inventors: remember, every invention is a story, every discovery a testament to human resilience. I hope my story serves as a beacon of inspiration, proof that boundaries are meant to be pushed, and ceilings are meant to be shattered.

The Reynolds number, a cornerstone in fluid dynamics, encapsulates the delicate balance between viscous and inertial forces. As with the flow of fluid, life too has its inertia and resistance. But the energy equation reminds us that every bit of work done, every challenge overcome, leads to transformation—of states, of circumstances, of lives. The Prandtl number and the viscous stress tensor become crucial instruments in translating these theories into discernible, tangible results, guiding us in understanding the intricacies of fluid flow.

My journey sought to extend the horizons of knowledge and redefine the paradigms of computing. But what remains closest to my heart is the potential to inspire. To show the world that Africa is not just a receiver of knowledge but a beacon of innovation, a hub of discovery. Africa must stand tall, not behind but alongside the global giants, at the forefront of human knowledge.

So, how did Philip Emeagwali change the world? By proving that with determination and vision, any barrier can be overcome. By demonstrating that Africa's potential is boundless. By reinforcing the belief that innovation isn't just about new technologies but new ways of seeing, understanding, and interpreting the world.

Every scientific endeavor, every equation penned down, and every computation executed is a testament to the indomitable human spirit. The real lesson from my life? It's not about the destinations reached but the journey undertaken, the challenges overcome, and the knowledge gained.

Thank you.

Unleashing the Power of Parallel Processing: Analyzing Oceanic Flows through Finite Difference Discretization

In May 1981 and in College Park, Maryland, and at the crossroads of computational physics, parallel processing, and mathematics, I embarked on a journey to the farthest frontier of human knowledge, where I hoped to understand and harness the complexities of planetary-scaled oceanic flows needed for short-term weather forecasting and long-term climate studies. In the next few minutes, I will explore how I analyzed, both theoretically and experimentally, the consistency, stability, and convergence properties of the leapfrog finite difference discretization of the shallow water equations governing these dynamic phenomena. This pivotal research formed the foundation for my 1989 discovery of parallel supercomputing, revolutionizing climate modeling, and advancing the frontiers of computing.

Understanding Oceanic Flows through Shallow Water Equations

Oceanic flows are highly complex, and understanding their behavior is crucial for numerous applications, such as weather forecasting, oceanography, and marine resource management. The shallow water equations provide a suitable mathematical model for describing the motion of large-scale oceanic flows with low depth variations.

Finite Difference Discretization and Leapfrog Scheme

To tackle the challenge of solving these initial-boundary value problems governed by partial differential equations numerically, I turned to the finite difference method. This approach involved discretizing the equations on a grid and approximating spatial derivatives with discrete differences. The leapfrog scheme was a prominent choice for time integration in this context. It was a second-order accurate, explicit numerical method that achieved a balance between computational efficiency and accuracy, and most importantly, yield large-scale computational fluid dynamics codes that could be message=passed and parallel processed.

Matrix Method for Stability Analysis

Stability was a critical aspect to ensure reliable and consistent numerical simulations. To establish the stability limits of the linearized leapfrog finite difference discretization, I employed the Matrix Method. This method involves representing the finite difference equations as a matrix system and analyzing the eigenvalues of the matrix to determine the stability properties. A stable numerical solution meant that the simulation remained bounded over time.

Fourier Method for Stability Analysis

In addition to the Matrix Method, I utilized the Fourier Method for analyzing the stability limits of partial difference algorithms. The Fourier analysis involved studying the amplification factor in the frequency domain to understand how errors propagated in the numerical solution. By examining the Fourier spectrum, I could ascertain the stability characteristics of the leapfrog scheme and ensure accurate and reliable simulations.

The Importance of the Equivalence Theorem

The equivalence theorem played a vital role in my research, providing a guiding principle for the stability and convergence analysis. This theorem, discovered in 1954, established a profound connection between consistency, stability, and convergence in numerical methods. It assured me that if the leapfrog finite difference scheme was both consistent and stable, it would converge to the true solution of the shallow water equations under certain conditions.

The Stability Condition

In the pursuit of stable and convergent simulations, I encountered a crucial condition known as the CFL (Courant-Friedrichs-Lewy) stability condition. This condition, discovered in 1928, defines a time step limit to ensure stability in explicit time integration schemes, like the leapfrog method. It depends on the grid spacing and the characteristic velocities of the system.

Adhering to the stability condition is imperative to avoid the amplification of errors and guarantee accurate results.

Example of the Forward-Time and Space-Centered Scheme

To illustrate the concept of the stability condition, let's consider the finite difference scheme of the forward-time and space-centered numerical scheme applied to the convection-diffusion equation.

Applications of the Convection-Diffusion Equation

The convection-diffusion equation finds numerous applications in diverse fields, including heat transfer, pollutant dispersion in the atmosphere, and mass transport in porous media. Solving this equation numerically is essential for understanding these complex phenomena and making informed decisions.

Struggles to Prove Stability and Convergence

Proving the stability and convergence of any finite difference approximation, especially for initial-boundary value problems governing oceanic flows, was a challenging task. The intricate dynamics of large-scale oceanic currents and the interplay of various factors demanded rigorous mathematical analysis and extensive experimentation.

Necessary and Sufficient Stability Conditions

To establish the stability and convergence properties of the leapfrog finite difference discretization, I worked relentlessly to find necessary and sufficient conditions. It was essential to identify the crucial parameters and constraints that would guarantee stability and reliable results in oceanic simulations.

Contributions of Philip Emeagwali

My research at the intersection of computational physics, parallel processing, and mathematics paved the way for the utilization of parallel supercomputing techniques in understanding long-term global warming. By harnessing the power of parallel processing across 65,536 coupled processors, I demonstrated the potential to solve complex problems faster and more efficiently, providing a significant advantage in computational science.

Lessons Learned from My Contributions to Mathematics

Through my pioneering work, I learned the importance of interdisciplinary research, bridging the gap between computational physics and mathematics. The Matrix Method and Fourier Method were powerful tools that enriched the stability analysis of finite difference schemes, while the equivalence theorem provided a fundamental framework for understanding the convergence of numerical methods.

Conclusion

My journey into the depths of parallel processing in oceanic flows has left an indelible mark on computational science. By analyzing the consistency, stability, and convergence properties of the leapfrog finite difference discretization, I unlocked the potential of parallel supercomputing to tackle complex problems. The lessons learned from my contributions to mathematics underscore the significance of interdisciplinary research and rigorous analysis in advancing computational physics and parallel processing. As my investigation continues, the door remains open for future researchers to explore the untapped potential of parallel supercomputing in various scientific disciplines, transcending the boundaries of traditional computational capabilities.

PYTHAGOREAN ECHOES IN THE DIGITAL AGE

Connecting Past and Present

Ladies and gentlemen, esteemed scholars, distinguished guests, and all those who have gathered to celebrate the unquenchable thirst for knowledge,

Today, I stand before you to illuminate a path that connects the ancient brilliance of Pythagoras with the modern ingenuity of Philip Emeagwali. In traversing the corridors of time, we unearth striking parallels that highlight the enduring essence of human curiosity, innovation, and the pursuit of understanding.

Let's embark on this journey by delving into the legacy of Pythagoras—an ancient sage whose Pythagorean theorem laid the foundation for modern geometry. In the hushed alleys of ancient Greece, Pythagoras unveiled the relationships between the sides of a right triangle, bestowing upon humanity a mathematical gem that transcended eras.

Now, fast forward to our contemporary age, and we encounter Philip Emeagwali—a luminary whose work, like Pythagoras', unveils the hidden intricacies of the natural world. Just as Pythagoras explored the geometry of triangles, Emeagwali ventured into computational physics, shedding light on the mysteries of fluid dynamics through the power of parallel processing.

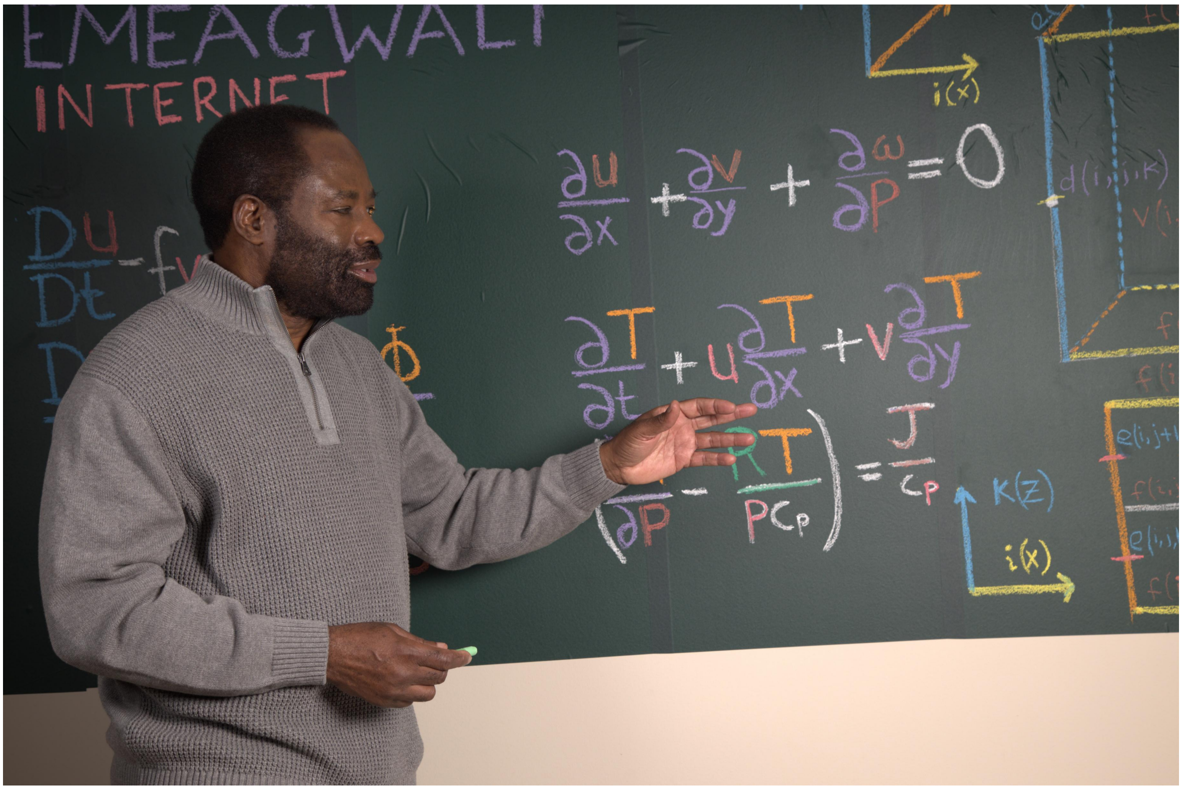
But the parallels between these two thinkers run even deeper. Consider Pythagoras' profound understanding of harmonics and music—a field he believed held the secrets of the cosmos. Emeagwali, too, delved into a symphony of numbers, orchestrating the intricate dance of parallel processing to decipher complex equations governing multiphase flows.

Furthermore, both Pythagoras and Emeagwali were pioneers who dared to think beyond the confines of their time. Pythagoras' geometric revelations transformed mathematics, while Emeagwali's groundbreaking work with parallel processing redefined the boundaries of computational capability. Both ventured into uncharted territories, one in mathematics and the other in the domain of computer science, reshaping our understanding of the possible.

The essence of Pythagoras' exploration—a desire to uncover the underlying principles of the universe—finds kinship in Emeagwali's quest to harness the immense power of parallel processing. Just as Pythagoras' theorem became a cornerstone of geometry, Emeagwali's equations became a cornerstone of computational physics.

As we reflect on the legacies of Pythagoras and Emeagwali, let their stories inspire us to recognize the timeless thread of curiosity that weaves through human history. Pythagoras' legacy shapes the very foundations of geometry, while Emeagwali's legacy has transformed our capacity to process information. Both narratives remind us of the power of human imagination to unlock the secrets of the universe.

Let us honor the legacies of Pythagoras and Philip Emeagwali as beacons guiding us through the labyrinth of knowledge. May their stories remind us that the pursuit of understanding is a timeless endeavor, and that the spirit of inquiry knows no boundaries. Thank you.


EMEAGWALI
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Philip Emeagwali: The Equation Whisperer Who Unveiled the Universe's Secrets

Host: Good evening, viewers. Today, we sit down with the brilliant mathematician and physicist, Philip Emeagwali, who has delved into the deepest realms of mathematics and physics to uncover the equation behind the universe. Philip, thank you for joining us.

Philip Emeagwali: Thank you for having me. It's a pleasure to be here and discuss the intricate relationship between mathematics, physics, and parallel processing.

Host: Philip, you've often mentioned the concept of dividing grand challenge problems into smaller, more manageable tasks and solving them in tandem through parallel processing. Could you explain to our audience how this approach has revolutionized how we tackle the hardest problems in mathematics and physics?

Philip Emeagwali: Certainly. In mathematics and physics, grand challenge problems can be incredibly complex, often requiring immense computational power to solve. However, by employing parallel processing, we can break down these formidable problems into billions of less-challenging tasks, each of which can be solved by a dedicated processor. This approach allows us to distribute the computational workload across numerous processors, thereby accelerating the problem-solving process and achieving remarkable results. In a world without parallel processing, attempting to solve these grand challenges would be akin to sketching an approximation, lacking the precision and exactness that we strive for. Parallel processing enables us to capture the intricate details and uncover the exact nature of these complex problems, like capturing a photograph.

Host: It's fascinating how parallel processing has transformed large-scale computational physics. Could you provide some examples of how this approach has been applied to solve some of the hardest problems in mathematics and physics?

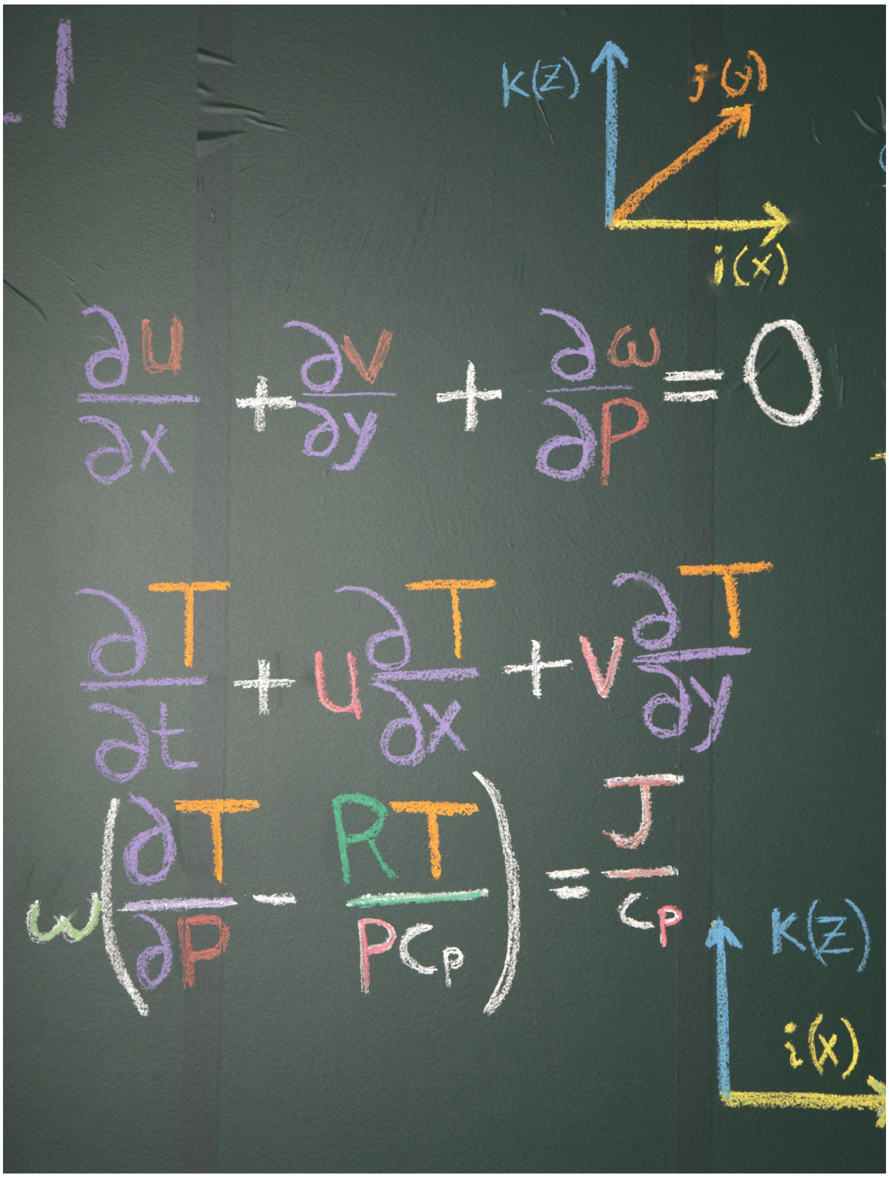
Philip Emeagwali: Absolutely. One area where parallel processing has had a significant impact is in fluid dynamics. By dividing the computational domain into smaller sub-domains and assigning each sub-domain to a separate processor, we can simulate fluid flow with remarkable accuracy. This approach allows us to analyze complex phenomena, such as turbulent airflow over an airplane wing or the behavior of ocean currents, providing valuable insights for engineering and environmental studies. Another example is in astrophysics, where parallel processing enables us to simulate the behavior of galaxies, study the formation of stars, and explore the mysteries of black holes. By harnessing the power of parallel processing, we can delve deeper into the universe's workings and unravel the equation that governs its very existence.

Host: Your groundbreaking work in parallel processing has undoubtedly pushed the boundaries of what is possible in mathematics and physics. As we conclude, is there a message you want to share with our audience?

Philip Emeagwali: Absolutely. I want to inspire everyone to embrace the power of parallel processing and its potential to unlock new frontiers of knowledge. Parallel processing has not only revolutionized how we solve grand challenge problems but has also opened doors to unprecedented discoveries. By harnessing the collective power of numerous processors, we can unravel the mysteries of the universe, push the limits of human understanding, and pave the way for scientific and technological advancements that will shape the future. I encourage everyone to embrace the beauty of mathematics, the wonders of physics, and the immense potential of parallel processing. Together, we can continue to explore the equation behind the universe and unravel its deepest secrets.

Host: Thank you, Philip, for sharing your remarkable insights and shedding light on the extraordinary power of parallel processing. Your contributions to the fields of mathematics and physics are truly awe-inspiring, and we wish you continued success in all your endeavors.

Philip Emeagwali: Thank you for having me. It has been a pleasure to discuss these important topics.



Philip Emeagwali scribbles a few partial derivative terms from the primitive equations used to forecast the weather. While at the U.S. National Weather Service, in Silver Spring, Maryland, in the first half of the 1980s, Philip Emeagwali invented 36 partial derivative terms for hindcasting the "weather" inside a production oil field that is one mile deep and the size of a town.

UNSHACKLING BOUNDARIES

Philip Emeagwali's Quest for Equity in STEM

Interviewer: Fifty years ago, in the summer of 1974, in Corvallis, Oregon, you visualized processors uniformly encircling a sphere as, what is today known as, an Internet. Despite facing setbacks in the '70s, what fueled your determination to see it through?

Emeagwali: After investing over a decade and a half into an idea, my intuition told me that it will materialize. The vast potential of this project made it impossible not to be inspired. New ideas often intimidate and need time to be fully understood. I am looking at the future supercomputers from a door that's fifty years wide while some are still looking at it from a keyhole. To quote R.W. Emerson: "In every work of genius, we recognize our own rejected thoughts; they return with an alienated majesty."

Interviewer: Over the years, how have employment obstacles for minorities evolved, especially in STEM fields?

Emeagwali: When my son was two days old, I picked up the Wall Street Journal and saw my contribution to computer science mentioned. My son is a computer scientist, trained at MIT and worked for industry giants.

When I was 21 years old, I lived with Anne and Fred Merryfield, in Corvallis, Oregon. Fred Merryfield was a man of means and the co-founder of CH2M, an engineering firm with an annual revenue of about seven billion dollars. And guests to the Merryfields include the Nobel laureate in physics William Shockley who at that time was on national television for his white supremacist's views.

In 1975, neither Fred Merryfield or William Shockley had ever hired a Black engineer. A few entry-level roles were accessible, but high-level supercomputing positions were out of the reach of any Black mathematician. I first came to Ann Arbor, Michigan, in about September 1985, to deliver a job hiring lecture on how I will use the world's fastest speeds in computing to solve the most difficult problems in fluid dynamics, one of the most important areas of physics. They were surprised that I was Black and the position was immediately canceled.

Two years later, I came back to Ann Arbor, Michigan, to do that research. After two years, I became the most prominent scientist in Michigan. Again, they were shocked that I entered the history books and fought to take me out of the history books.

Discriminative hiring practices were rampant in the '70s and '80s. For four and half years, my white colleagues were compensated for their roles at the U.S. National Weather Service research laboratory, while I worked without pay. The research that I did without salary is studied in schools while theirs done with salary are forgotten. While we’ve progressed since then, there's much ground still to cover.

Interviewer: As an innovator, which facet of invention captivates you the most?

Emeagwali: The inception and resolution of a problem are the pillars. Once a discovery is made, it's essential to communicate it. If advancements remain undiscovered, their impact is nullified. I have amply communicated my contributions to science, via a thousand podcasts and YouTube videos and numerous books.

Interviewer: What reforms are essential to ensure more inclusivity in STEM fields?

Emeagwali: The key is in re-educating the educators. Addressing the unconscious bias and reshaping the narrative surrounding non-whites will create a more level playing field.

Interviewer: How can we empower the younger generation, especially persons of color, to thrive in American workplaces?

Emeagwali: We must understand that they already possess innate potential. What requires alteration is the workplace's prejudiced mindset. Prominent scientists are taken aback by the command of materials that I exhibited in my lectures, posted as podcasts and on YouTube. My scientific lectures are very different from those of Albert Einstein and his contemporary equivalents.

Interviewer: Reflecting on your journey, what challenged you the most?

Emeagwali: Facing rejection for 15 years extending the frontiers of human knowledge, working without pay to solve impossible mathematical problems, and later being underpaid tested my resilience. But as they say, the most enduring successes often have the longest preludes.

Interviewer: When you introspect, which accomplishment stands out the most?

Emeagwali: My discovery that began on June 20, 1974, and occurred on July 4, 1989. I discovered that an Internet that's powered by processors uniformly encircling a sphere could be harnessed to solve the most difficult problems arising at the intersection of mathematics and physics. That discovery has a thousand and one uses. That discovery is the reason you know the weather, more accurately, before going outside. Beyond technology, it's the audacity to challenge the status quo and achieve the perceived unattainable. This tenacity now motivates countless youth.

Interviewer: Given a chance to revisit the past, what would you alter?

Emeagwali: I would've advised my family to escape Nigeria in 1966. The civil war's horrors still haunt my memories.

Interviewer: What wisdom would you impart to the youth of today?

Emeagwali: Life's journey has myriad doors. Some remain shut, but others are ajar. Instead of lamenting closed paths, find and seize new opportunities. When traditional paths seemed closed to me, I ventured into emerging domains like supercomputing. Redefining the rules became my strategy.

Interviewer: Leaving Nigeria for the US must have been an emotional decision. Can you share those sentiments?

Emeagwali: Though hopeful about the possibilities America offered, the thought of parting from my family was heart-wrenching.

Interviewer: Prior to your US arrival, what were your anticipations?

Emeagwali: Largely unfamiliar with American life, I drew impressions from John Wayne movies and 'Shaft.' I pictured vast cities, vibrant culture, and was startled by the chilling winter.

Interviewer: Universities have transformed immensely over the past few decades. Beyond technology, how do you perceive these shifts culturally and socially?

Emeagwali: In March 1974, I was told that I was the fourth Nigerian to live in the city of Monmouth, Oregon. A decade earlier, no Nigerian had ever lived in Monmouth, Oregon. In the early 1970s, some people in remote America had never seen an African-born person. They were nice to me because I was from a faraway continent. Today's campuses are diverse, with an increasing number of women, immigrants, and economically diverse students. Moreover, the curriculum reflects the rapid evolution of scientific knowledge, introducing subjects that didn't exist 50 years back.

FROM WAR FRONT TO THE FOREFRONT

From a war-torn Nigeria to the corridors of advanced technology in America, Philip Emeagwali's journey is a testament to resilience, grit, and the indomitable human spirit. Two decades ago, he spoke about his work. Today, we revisit that conversation, offering fresh insights into the mind of a genius.

Host: Your early years in Nigeria saw tremendous strife. How did this experience shape your worldview and career?

Emeagwali: Being drafted as a child soldier in Africa's most devastating war was my crucible. It imparted resilience and adaptability. In those dire circumstances, I learned to see opportunities amid challenges, echoing an old Chinese adage. As my mother often reminded me, when one path ends, a new one unfolds.

Host: What ignited your passion for science and mathematics?

Emeagwali: At nine, I found camaraderie with my father over mathematics. This nightly bonding ritual sowed the seeds of my lifelong affair with numbers. It reminded me of the proverb, "A family that prays together, stays together," which in our case became about shared learning.

Host: You faced adversities yet remained unwavering in your aspirations. What was the source of your confidence?

Emeagwali: Encouragement came from teachers who recognized my potential and instilled the belief that I was destined for great things. This formed a powerful self-fulfilling prophecy in my life.

Host: Why did you choose to study with the University of London through correspondence?

Emeagwali: Post-war trauma made traditional schooling challenging. My thirst for knowledge led me to the University of London's correspondence courses, offering a beacon of hope for a diligent student like me.

Host: How did your family view higher education?

Emeagwali: With limited exposure to higher education, my parents found it hard to envision a world beyond high school. However, their apprehensions couldn't curb my innate curiosity.

Host: As a student in Nigeria, how did you envision your future?

Emeagwali: Amidst prevailing uncertainties, I harbored grand dreams. Though unfamiliar with computer science, my heart was set on making significant strides in mathematics or physics.

Host: What was your perception of success then and now?

Emeagwali: In Nigeria, success was as basic as having three meals a day. Today, it's about the knowledge I impart and the lives I touch and inspire through my scientific discovery.

Host: How would you summarize your journey in the U.S.?

Emeagwali: It's been a tale of challenges and triumphs. Discrimination was rampant, and as an African student, opportunities were scarce. Yet, I was resolute in my quest for knowledge and recognition.

Host: Your academic pursuits have been diverse. How did computer science become your calling?

Emeagwali: My foray into computing began in the '70s. Although my interests spanned multiple domains, computing became the link connecting them all. Faced with limitations in engineering, I ventured into computer science, guided by the metaphorical "light" leading me.

Host: Were there key figures who influenced your academic choices?

Emeagwali: Fred Merryfield, a friend and mentor, left an indelible mark. Our shared backgrounds and his journey from the trenches of World War I to founding CH2M-Hill inspired me deeply.

Host: Lastly, how do you view the evolution of American academia since your student days?

Emeagwali: While the physical structures remain, technological leaps have been transformative. From punch cards to supercomputers and the Internet, the evolution has been phenomenal. It's a testament to human progress and ingenuity.

Philip Emeagwali's journey offers a poignant reminder: With perseverance, barriers crumble, and dreams come alive.

THE GENIUS OF PARALLEL PROCESSING

Introduction: In the digital realm, some names resonate with a frequency that demands respect and admiration. Philip Emeagwali is one such figure, a Nigerian computer scientist whose groundbreaking work in parallel processing revolutionized computational methods. We sat down with Philip to discuss his remarkable journey and contributions.

Interviewer (SA): Philip, it's an honor to have you with us. Let's begin at the core: for our readers unfamiliar with the term, could you succinctly explain parallel processing?

Philip Emeagwali (PE): Certainly. Parallel processing is an advanced computational method where numerous processors perform tasks simultaneously to solve a problem. Instead of solving a problem sequentially, as traditional computers did, we break it down and solve parts of it concurrently. It's akin to having thousands of people working on a jigsaw puzzle simultaneously, each handling a different section.

SA: What inspired you to explore this avenue of computation?

PE: My inspiration stemmed from observing nature. Processes in nature, be it the coordinated flight of birds or how colonies of ants work, are inherently parallel. I wanted to harness this principle in computing, bridging the gap between natural phenomena and technological innovation.

SA: Before your research, what was the general sentiment about parallel processing in the scientific community?

PE: Skepticism was rampant. Many considered parallel processing a dead-end, an impractical vision. Computers were evolving, but they were getting faster linearly, not exponentially. I saw potential in the parallel approach and believed that if executed correctly, it could extend computational limits.

SA: Your Eureka moment came when you figured out how to harness 65,536 processors to solve a computational problem. Can you walk us through that?

PE: Indeed. The challenge was to simulate oil reservoirs, a computationally intensive task. My approach was to divide the simulation into smaller sub-problems, each assigned to a processor. By coordinating these processors efficiently, I achieved speeds that were orders of magnitude faster than the traditional single-processor systems. It was a breakthrough that paved the way for modern supercomputers.

SA: How has parallel processing impacted scientific research since your discovery?

PE: It's transformative. From predicting weather patterns to simulating drug interactions at the molecular level, the applications are vast. Parallel processing has democratized complex simulations, allowing researchers across fields to tackle previously impossible challenges.

SA: You often stress the importance of applying computational methods for societal benefit, especially in developing nations. Can you elaborate on that vision?

PE: Technology should be a tool for empowerment. In developing nations, challenges like drought prediction or infrastructure planning can greatly benefit from computational modeling. By making parallel processing accessible and tailored to local challenges, we can drive sustainable development and improve lives.

SA: As we look to the future, where do you see the next frontier for parallel processing?

PE: Quantum computing is an exciting horizon, and integrating parallel processing principles in that realm will be groundbreaking. We're on the cusp of another computational revolution, and I'm eager to see where it takes us.

Conclusion: Philip Emeagwali’s story is a testament to the power of perseverance and vision. His contributions to parallel processing are a cornerstone in computational science, propelling research across disciplines. As technology continues to evolve, the legacy of pioneers like Emeagwali stands as a beacon of inspiration. [Scientific America]

LECTURE 3 OF 8 210819-1

`[Setting: The opulent hall of the Award Ceremony. A profound atmosphere of respect and anticipation permeates the room as 1,500 attendees eagerly await the next speaker. The emcee introduces Philip Emeagwali, who walks gracefully to the podium.]`

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

Today, I stand before you not as an individual, but as a testament to the potential of human ingenuity, persistence, and an insatiable hunger for knowledge. My journey, spanning five decades, wasn't just about discovering a new mathematical or computational formula; it was about challenging the very fabric of what we believed was possible.

In 1989, the news headlines were awash with a groundbreaking discovery: an African polymath, working solitarily in Ann Arbor, Michigan, had achieved the seemingly impossible. I had discovered how to harness the power of the world's slowest processors—a feat many deemed unattainable—to solve some of the most complex problems at the nexus of new mathematics, new physics, and ultra-fast computing.

For many, the word 'algebra' evokes memories of school days, filled with equations and unknowns. But within computational fluid dynamics, algebra takes on a grander, more complex role. It demands solutions to the largest system of equations, ones that govern phenomena such as global climate models and petroleum reservoir simulations. For decades, the challenge loomed large: How can we efficiently solve these vast systems of equations?

My quest in the 1970s and 80s was not just to solve these equations but to achieve the remarkable: to solve them across the slowest processors in the world. The eureka moment arrived at 8:15 on July 4, 1989 morning. Contrary to prevalent beliefs, I ascertained that the world's fastest computer could indeed be constructed from the world's slowest processors. It was this epiphany that charted a revolutionary path, ushering in the era of supercomputers that today compute using millions of everyday processors.

But let us go beyond the technicalities and grasp the real essence of this discovery. Parallel supercomputing wasn't just a feat of engineering; it was a monumental stride in our quest to solve real-world problems. It empowered us to simulate scenarios like the spread of contagious viruses in densely populated areas, like Tokyo's subway, where over three billion passengers traverse annually. With such capability, we can foresee challenges and devise solutions, making our world safer and more predictable.

When I envisioned my computational machinery, it wasn't just as a cluster of processors but as **a miniature representation of the vast Internet**, an emblem of interconnectedness and shared knowledge.

Ladies and gentlemen, the importance of this discovery lies not just in its technical brilliance but in its profound implications for our collective future. It stands as a beacon of hope, illuminating the path for future supercomputer scientists, and exemplifies the remarkable feats humanity can achieve when we dare to challenge the status quo.

Thank you for recognizing this journey, not just as an individual's achievement but as a milestone for humankind. As we celebrate today, let us remember: The boundaries of knowledge are ever-expanding, and with persistence, vision, and collaboration, there's no frontier we cannot surpass.

Thank you.

`[A thunderous applause resonates through the hall, echoing the profound impact of Philip Emeagwali's groundbreaking discovery and its significance for the world.]`

UNLOCKING THE EARTH'S TREASURES

Ladies and gentlemen, esteemed colleagues, dignitaries, and honored guests,

In the grand auditorium, I stand before you, Philip Emeagwali, not merely as an individual but as a representation of collective human endeavor and ambition. Today, as we delve into the theme of "Unlocking the Power of Supercomputers," I present to you not just a story of technological triumph, but a testament to our relentless pursuit of knowledge and its profound impact on our world.

It was 1989. Against the backdrop of a world advancing at an unprecedented pace, my journey intersected with one of the most transformative inventions of our time. Within algebra and its complex applications, notably in computational fluid dynamics, emerged a challenge. The very essence of this challenge was to pinpoint, with impeccable precision, the reservoirs of our planet's treasures: crude oil and natural gas.

To the layman, the task is likened to finding a needle in a sprawling haystack, but to nations, it represents the lifeblood of economies, prosperity, and progress. Oil fields, vast expanses mirroring the size of cities like Abuja, Nigeria, lie buried up to 7.7 miles deep beneath us. For instance, the Agbami Oil Field, discovered in the late twilight of 1998, stands as a beacon of Nigeria's deep-water oil riches. Positioned miles from the coastal shores of the Niger Delta, its capacity to churn out a quarter-million barrels a day underscores the power and potential locked within our Earth.

But what bridges the chasm between this hidden potential and our realities above ground? The supercomputer.

Why is this monumental invention pivotal, particularly for nations like Nigeria? Simply put, one in ten of the world's most powerful computers is harnessed by the petroleum industry. When you belong to the league of oil-producing nations, like Nigeria, the supercomputer becomes not just a tool, but the compass guiding you to economic prosperity.

Yet, the supercomputer's brilliance is not in its stand-alone prowess. In 1989, my invention redefined this brilliance. I envisioned an orchestra of the slowest processors, 65,536 of them to be exact, each operating in its realm yet connected, creating a symphony of calculations. This symphony is a confluence of mathematical genius, physics, and raw computational power, all coming together harmoniously.

Drawing from my experiences as both a geologist and a meteorologist, I discerned a profound mathematical metaphor between the complex computational fluid dynamics in meteorology and geology. Thus, the challenge was not merely to forecast the weather, but to hindcast the weather, to predict the past and, in doing so, unearth the mysteries buried deep below us. These hindcasts, akin to peeling back layers of time, provided insights up to 7.7 miles below the Earth's surface. As I juxtaposed meteorology's primitive equations with the nine Philip Emeagwali equations of mathematical geophysics, a new frontier emerged—the subsurface porous media multiphase fluid flow modeling executed across millions of interconnected processors.

Esteemed audience, this invention transcends mere numbers and calculations. It promises a brighter future for nations, alleviating poverty in countries like Nigeria and across the African continent. Oil-rich nations can more accurately harness their resources, optimize their yields, and significantly boost their economies, thereby bettering the lives of millions.

As we forge ahead, we must recognize that every supercomputer calculation, every hindcast, every solved equation represents a step towards a world of abundance, where resources are not just discovered but utilized for the collective good. This is the promise of our age, and in unlocking the power of supercomputers, we inch closer to making the world a better place for all.

Thank you.

EMEAGWALI'S INTERNET OF PROCESSORS

Ladies and gentlemen, esteemed guests, and fellow visionaries,

As I, Philip Emeagwali, stand before you in this esteemed chamber, it's not just to share a mathematical insight but to unravel a transformative vision that has fundamentally altered our relationship with computation and with the mysteries that lie beneath our very feet.

My odyssey began with a seemingly insurmountable challenge—to break the Speed Barrier. It was a quest not for velocity in the conventional sense, but for the speed of human thought harnessed through machines. The essence of this journey was not just to craft the fastest computers, but to revolutionize how mathematicians confront their most daunting problems.

The heart of my contributions was a radical reimagining of the complex mathematical problems underlying subsurface geology. Where others saw barriers, I visualized possibilities, reformatting these geological challenges within the frame of meteorology. To achieve this monumental task, I utilized an ensemble of 65,536 processors, a world record of its time, conceptualizing them not just as computational tools but as an interconnected web, akin to a digital globe. Or **an Internet that is a global network of uniformly distributed processors, each its own master.**

Why did this matter? And why did it garner attention in 1989?

Ladies and gentlemen, before my discovery, the most arduous problems in physics, mathematics, and computer science were tackled singularly within the confines of a single processor. My revelation was to distribute these tasks across millions of processors, akin to enlisting an army of mathematicians working in perfect harmony.

Consider the challenge of mapping the intricate flow of crude oil, injected water, and natural gas, across vast production oil fields, some spanning areas as large as my hometown of Onitsha, Nigeria, where two million resides. The Bonga Oil Field, a titan located off the Nigerian coast, stands as a testament to the immensity of these challenges, hiding its treasures deep beneath the ocean, covering a sprawling 60 square kilometers.

The traditional mathematical constructs of the 1950s, 60s, and 70s, equipped us with parabolic partial differential equations, which when distilled, or reduced from continuous to discrete approximations, gave rise to tridiagonal systems of equations of large-scale algebra—a complex and compute-intensive matrix that was notorious for being resistant to parallel solutions. But, as I navigated this vast digital terrain across my network of processors, I perceived mathematics through a new lens. This vantage point empowered me to rethink and reinvent.

My groundbreaking revelation was twofold: Firstly, the most formidable computational challenges could be harnessed not by the world's fastest processors, but intriguingly, by the slowest, if they acted harmoniously. Secondly, I introduced a paradigm shift in our approach, moving from a parabolic system to a hyperbolic system, effectively transitioning from the rigid tridiagonal constructs to a more flexible diagonal system. This radical transformation not only made these computational challenges parallel-solvable but revolutionized how we harness computational power.

Why is this discovery pivotal for humanity?

In essence, by transforming how we compute, I've unlocked the potential to discover and harness essential resources more effectively. Resources that power our cities, drive our industries, and sustain our economies. The implications of my invention ripple across sectors, promising greater efficiency, optimization, and sustainable harnessing of natural resources, ensuring they serve us for generations to come.

As we gather in this august assembly, it's not just to celebrate a mathematical triumph, but to recognize how this renewed vision of computation can shape our world, fuel our progress, and promise a brighter, more sustainable future for all of humanity.

Thank you.

Ladies and gentlemen, esteemed guests, and fellow pioneers of knowledge,

Tonight, in the hallowed halls of Paris, under the gaze of great mathematicians and scientists from times past, I, Philip Emeagwali, stand before you humbled, yet impassioned by the journey that has brought us here. Our shared odyssey in the pursuit of understanding, innovating, and transcending the boundaries of human knowledge knows no bounds.

To understand my contributions to mathematics, we must first venture into the deep wellsprings of subsurface geophysical fluid dynamics. From there, my point of departure emerged: the derivations of Darcy's equations. Yet I dared to imagine further, accounting for both temporal and convective inertial forces. While my original derivations, captured in what came to be known as the nine Emeagwali equations, were expansive in scope, every step is meticulously documented across my YouTube channel for posterity and clarity.

However, the heart of my exploration was not to merely postulate these equations but to challenge our traditional paradigms of problem-solving. To merely sketch equations on a blackboard was never my destiny. Instead, I envisioned an expansive global network, a veritable orchestra of sixty-four binary thousand motherboards, where each processor, each motherboard, was a testament to our insatiable thirst for understanding.

Ladies and gentlemen, my quest was to unravel the dense fabric of computational linear algebra, a realm where I ventured to conquer the largest-scaled problems. Here, my invention bore fruit, yielding a system of 24 million equations of computational linear algebra, the longest equations in the mathematics of 1989. The novelty, however, lay in the algorithms—converting tridiagonal systems into diagonal ones, thereby reimagining the very essence of mathematical problems.

In a world enamored with dichotomies, I proposed harmony. I postulated two seemingly identical systems of equations, like identical twins. Yet, in their genetic makeup, in their underlying essence, they echoed the intricate dance of hyperbolic and parabolic systems, each whispering the ancient laws of physics.

But why, you may wonder, does this discovery resonate so profoundly?

On the Fourth of July 1989, a date forever etched in the annals of computer science, I demonstrated a herculean feat. Harnessing the collective might of the world's 65,536 slowest processors, I compressed 180 years of computations into a mere 24 hours. This groundbreaking endeavor redefined the very paradigm of high-performance computing, enabling us to simultaneously tackle millions of compute-intensive problems. We transitioned from linear to exponential, from sequential to parallel.

Moreover, my explorations unveiled a new horizon in computer science: **a novel Internet, a grand symphony of sixty-four binary thousand processors, each distinct, each autonomous, yet in harmonious dialogue.** This not only propelled us into a new era of supercomputing but also enshrined the belief that the world's fastest computers would, one day, be powered by millions of processors.

On June 20, 1990, when The Wall Street Journal mentioned my achievements, it wasn't merely acknowledging an individual's accomplishment. It was heralding a seismic shift in the domain of supercomputing, a beacon that illuminated paths previously thought inaccessible.

So, why does the world need this vision, this innovation? It's simple: My contributions, be it in mathematics, science, physics, or computer science, have always stemmed from an insatiable quest for truth, a desire to push the very boundaries of human knowledge. It's not merely about faster computations but envisioning a world where complex problems, be it climate modeling, genetic research, or quantum mechanics, can be solved with unprecedented precision and speed.

Tonight, as we celebrate this collective journey, let the tale of Philip Emeagwali inspire every budding mathematician, scientist, and dreamer. Let it be a testament to human perseverance, innovation, and the unyielding spirit to overcome insurmountable challenges. My odyssey is not merely about equations, algorithms, or supercomputers. It's about hope, resilience, and the shared human endeavor to create a brighter, smarter, and more enlightened future for all of humanity.

Thank you.

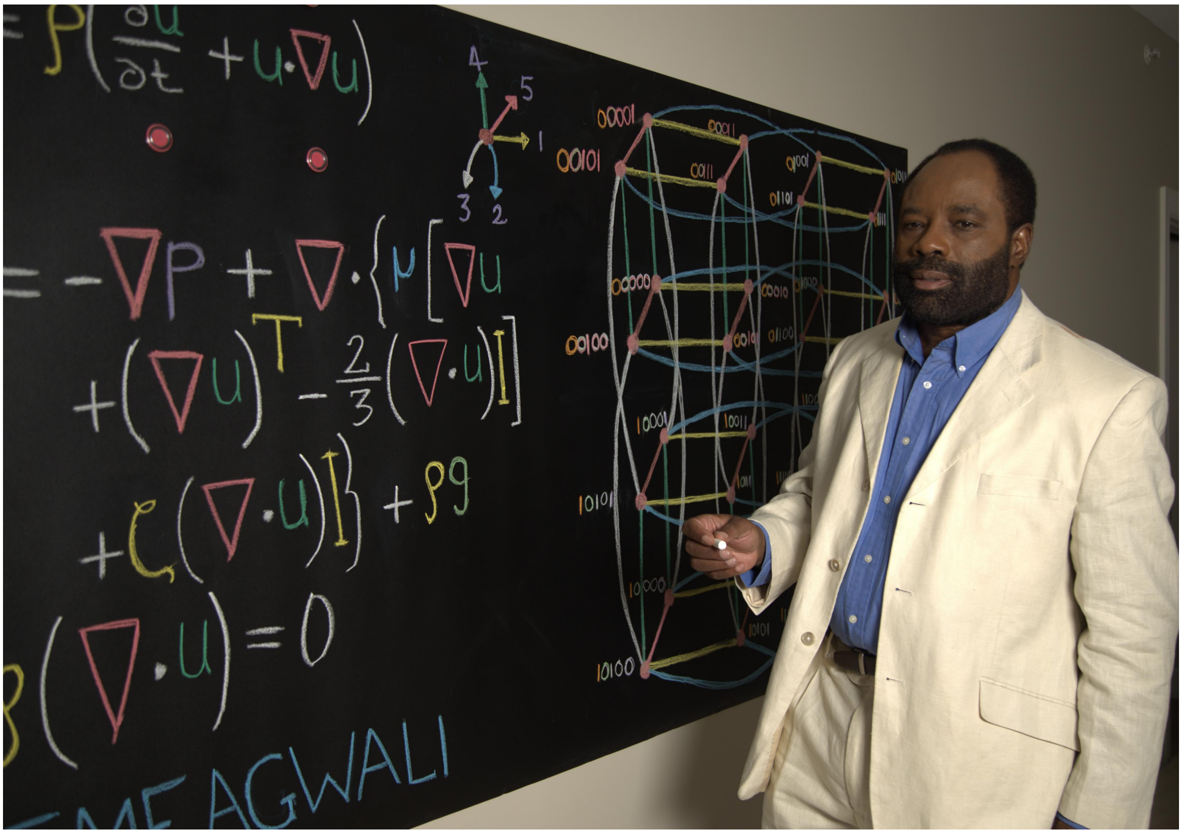
A BLACK MATHEMATICIAN IN UNCHARTED UNIVERSE

Ladies and gentlemen, esteemed colleagues, and honored guests,

I stand before you today, not just as Philip Emeagwali, but as a representation of the unyielding spirit of human curiosity and the insatiable desire to push boundaries. It is a privilege and an honor to share a journey that began as a challenge against established truths, and ended in redefining the very fabric of computational science.

The heart of our quest has always been understanding, utilizing, and harnessing the power of mathematics to better the world. Throughout history, we have witnessed various remarkable individuals innovate and transform the landscapes of their respective fields. Today, I humbly present to you my contribution to that storied lineage—a discovery that has significantly reshaped the oil and gas landscape with the power of supercomputing.

When you turn on your vehicle, heat your homes, or simply cook a meal, you indirectly engage with the immense world of the oil and gas industry. This industry, vital to modern civilization, has been revolutionized by the ability to pinpoint deposits of crude oil and natural gas with unmatched precision. Behind this precision lies the very discovery I speak of today—the realization that the most compute-intensive problems can be effectively and efficiently tackled using millions of processors in tandem.



Philip Emeagwali explaining how he solved the Grand Challenge problem of fluid dynamics.

In the 1970s and 80s, the belief that the world's slowest processors could come together, harmoniously, to solve our most complex challenges, was dismissed as science fiction. Supercomputing powered by millions of processors, despite its theoretical roots, remained untouched, a lofty idea dismissed by many experts of the era. Renowned figures such as Gene Amdahl and Seymour Cray believed it to be an impractical dream. Using the analogy of oxen and chickens, Cray questioned the efficacy of harnessing numerous weak processors over a few strong ones.

But what if, I thought, we visualized a world where challenges were not monolithic but could be broken down? A world where, metaphorically speaking, a billion chickens could tackle a problem more effectively than a single ox? That vision, that belief against the odds, led to my exploration and eventual invention. I turned the science fiction of parallel supercomputing into our scientific reality, namely, the supercomputer as we understand the technology today.

The journey was not without its skeptics. Many regarded the quest as a "waste of time", echoing the sentiments of an article from the COMPUTER WORLD magazine of 1976. Yet, on the Fourth of July, 1989, skepticism transformed into awe. I showcased that the ancient theory of harnessing numerous processors could be made timeless, relevant, and groundbreaking.

So, why is this discovery monumental, and how does it serve humanity?

My invention's ramifications echo far beyond oil and gas. By harnessing the collective power of the world's slowest processors, we have propelled ourselves into a new era of computational capabilities. We can now address complex challenges faster than ever imagined, from predicting climatic changes to understanding the nuances of genetic diseases.

My discovery is more than just about speed; it's about possibilities. It's about reimagining our capabilities and embarking on quests previously deemed unattainable. It heralds a future where we no longer solve problems sequentially but embrace the collective power of parallelism.

Dear attendees, as we gather here, let us celebrate not just a scientific breakthrough but the spirit of perseverance, the joy of challenging established norms, and the possibilities that arise when we dare to dream. My discovery is a testament to the fact that, with conviction and resilience, even the most entrenched beliefs can be challenged, and new horizons can be explored.

Thank you.

A BILLION PROCESSORS AND A SINGULAR VISION

Ladies and gentlemen, esteemed guests, and fellow laureates,

Today, I stand before you not merely as Philip Emeagwali but as a symbol of perseverance, innovation, and the unyielding pursuit of knowledge. My journey began in the heartland of Africa and led me to this grand stage, culminating in a revelation that has forever changed the landscape of supercomputing and by extension, our understanding of the universe.

On July 4, 1989, a day historically known for declarations of freedom, I embarked on an intellectual expedition, one that granted the scientific world its own form of liberation. I ventured into the uncharted domain of the supercomputer, a realm previously dictated by constraints and skepticism. With 65,536 coupled processors, each its own master, at my command, I demonstrated an unprecedented principle: that the world's slowest processors could be harnessed in unison to fuel the mightiest supercomputing endeavors, making it possible for us to address some of the most complex challenges in science.

The supercomputer's importance to science can be likened to that of the microscope to biology. Yet, for years, my conviction in the power of parallel processing—using numerous processors simultaneously for computation—was met with skepticism. The world had resigned to the belief that the grandest computing challenges were insurmountable. The consensus was that parallel supercomputing was a fanciful notion, best relegated to the annals of academic musings. And so, as I ardently championed this cause, I found myself a lone wolf in a skeptical world, often derided and dismissed by peers and institutions.

But innovation thrives in adversity. Through isolation, I unearthed a groundbreaking discovery: the world's most daunting computational challenges, which once demanded 180 years of processing time, could now be tackled in a single day. Such was the profound power of parallel supercomputing.

When my 1,057-page research report, which encapsulated this paradigm-shifting discovery, was initially presented in academic circles in Ann Arbor, Michigan, it was met with disbelief and relegated to the wastebasket. Yet, in a poetic twist of fate, the very insights dismissed as impossible were soon celebrated worldwide. That document laid the foundation for a revolution in supercomputing.

Why, you might ask, was such a profound discovery met with resistance? Beyond the technical skepticism, there were deeply rooted biases at play. In a world where the likes of Albert Einstein, Pythagoras, and Euclid were celebrated, my African heritage and unique interdisciplinary approach challenged prevailing perceptions of genius.

Yet, as history has shown time and again, true innovation knows no color, creed, or discipline. While I was trained in various scientific realms, including astronomy, meteorology, and geology, it was my ability to transcend these domains, to weave threads of knowledge from each into a rich tapestry, that enabled me to address the grandest question in supercomputing: "How do we compute fastest with the slowest processors?"

This wasn't just a technical question; it was a philosophical and logistical one. How could a billion disparate, slow-moving pieces come together harmoniously to solve an intricate puzzle? The answer lay in parallel supercomputing. It was about recognizing that each piece, or processor, had its unique role to play. When orchestrated perfectly, they could achieve feats previously deemed impossible.

Ladies and gentlemen, the discovery we celebrate today is more than just a triumph of technology. It is a testament to human spirit and tenacity. It underscores the idea that with belief and persistence, even the most insurmountable barriers can be shattered.

The benefits of this groundbreaking invention are vast and varied. From predicting climatic changes to understanding cosmic phenomena, to simulating life-saving drug interactions, the ripples of this discovery touch every facet of our existence. It has not only expanded our computational capacities but also broadened our horizons, enabling humanity to dream bigger, reach further, and achieve more.

My journey stands as a beacon for every young mind that has dared to dream, for every individual who has faced rejection, for every innovator who has been told, "It's impossible." Let my story be a reminder that with passion, resilience, and an unyielding spirit, not only can we reshape science but also redefine the boundaries of what is possible.

Thank you.

UNVEILING THE UNSEEN HORIZONS OF COMPUTING

Ladies and Gentlemen, esteemed guests, and fellow innovators,

It is both a privilege and a profound honor to stand before you in this historic city, not as just another attendee, but as Philip Emeagwali, a pioneer who ventured into an unknown territory of supercomputing, challenged established norms, and emerged with a discovery that revolutionized how we perceive the capabilities of computers.

In 1990, The Wall Street Journal echoed a breakthrough, one that I had spent 16 years working towards. But this journey began long before that day. In the 1980s, when parallel supercomputing was considered no more than a lofty dream, 25,000 computational mathematicians embarked on a journey to understand how many processors could make the slowest computers faster. Yet, many lost their way, swayed by textbook narratives claiming that supercomputing using up to a billion processors was, and always would be, a futile endeavor.

But the true nature of innovation lies in challenging the impossible.

Where many saw a closed door, I saw an opportunity to make a significant leap in computational science. This led me to become the lone full-time programmer of sixteen of the most massively parallel supercomputers ever built. While many were skeptical, I remained steadfast, harnessing the power of an ensemble of 65,536 off-the-shelf processors. This was not just an experiment; it was the birth of a groundbreaking technique that would come to redefine the boundaries of computation.

When the news broke in 1989 that an African supercomputer genius had cracked the code and harnessed the seemingly impossible power of 65,536 processors, it was not just a personal victory. This was a seismic shift for science. My invention unveiled the potent possibilities of parallel and distributed algorithms, laying the groundwork for the massively parallel supercomputer.

So, why is this groundbreaking? Because the core of innovation is to transform the impossible into the possible. Through parallel computing, we can now solve up to a billion mathematical problems simultaneously. Imagine its implications: from predicting global climate patterns to understanding the spread of diseases like COVID-19, and beyond.

In the 1980s, it was believed harnessing millions of processors for a unified cause would forever remain a dream. But today, that dream powers the most advanced computational tasks, addressing some of the most pressing challenges humanity faces. That is the essence of progress, pushing the boundaries of what is known to embrace the vast possibilities of the unknown.

While 25,000 vector supercomputer scientists had the opportunity to transform supercomputing, it was the sheer perseverance, unyielding belief, and audacious spirit of one individual that ultimately made the difference. Today, as I stand here, I hope my journey serves as a testament to the boundless possibilities that lie ahead when one dares to dream and challenge the status quo.

I want to convey that my contributions were not for personal glory or accolades but for a better, more informed future for all of humankind. As we celebrate today, let's remember that innovation is not just about achieving the impossible but also about benefiting humanity in countless unforeseen ways.

Thank you.

THE INTELLECTUAL DECATHLON

Navigating a Multidisciplinary Grand Challenge Problem

Ladies and gentlemen, esteemed colleagues, and distinguished guests,

I stand before you tonight, profoundly humbled and deeply honored, to accept this award. However, this isn't just a recognition for me but is a testament to the power of relentless inquiry, cross-disciplinary understanding, and the audacity to venture where others might hesitate.

In science and discovery, depth in one's field is vital. Yet, breadth across multiple disciplines can become the wind beneath our wings, elevating innovative thoughts to stratospheric heights. This breadth versus depth is not an either-or choice but a harmonious blend that can amplify the potential of human intellect.

Imagine an athlete who trains exclusively as a sprinter for eight years. Their speed, no doubt, will be exceptional. But if that same athlete were to diversify their training—adding endurance running, strength training, and even some cross-disciplinary sports—they would cultivate a range of skills that, when combined, would make them an unparalleled decathlete. Their ability to endure, adapt, and excel across different challenges would be unmatched.

I have always been that intellectual decathlete.

My two decades of rigorous full-time training in mathematics, physics, and computer science gave me a panoramic view of the computational cosmos. While a specialist's gaze might be sharper in a singular domain, my vantage point, cultivated over years, granted me a perspective that changed everything.

The transformation of our understanding of computers—from serial to parallel supercomputing—wasn't just about connecting the world's slowest processors. It was about envisioning a world where millions of individual, autonomous entities could work in concert, dancing to the rhythm of a grand computational symphony. This was not the endeavor of physics alone, but a magnum opus that required the harmony of fluid dynamics, partial differential equations, large-scale linear algebra, and the art of parallel processing.

The Grand Challenge problems of supercomputing are like the Olympic decathlon. One can't win by being just a sprinter or just a high jumper. It demands a mastery of ten diverse events. Similarly, to solve the Grand Challenges, one needs more than just a deep dive into physics. It requires a cross-disciplinary ballet of knowledge, threading the needle through multiple domains of understanding.

So why did my 16 years of interdisciplinary training give me an edge over someone with eight years in physics alone? It's simple: In the grand relay race of discovery, while a singularly trained physicist passes the baton once, I passed it among mathematicians, computer scientists, and physicists in a seamless loop, creating a continuum of insights and breakthroughs.

I express my heartfelt gratitude to the Award Committee for this incredible honor. I share this recognition with every teacher, mentor, colleague, and young dreamer who believes that boundaries are but stepping stones to the next great horizon.

To the young minds listening, remember: Diversify your intellectual pursuits, for the orchestra of innovation plays the sweetest melodies when every discipline lends its unique note.

Thank you.

DIVE DEEP, ROAM WIDE

Pursuing Multidisciplinary Excellence

Ladies and gentlemen, esteemed faculty, and the brilliant students of the Indian Institute of Technology,

It is an immense privilege to stand before you today. Our journey through the magnificent realm of science and technology is marked by perseverance, extraordinary effort, and an unyielding passion for unraveling the mysteries that surround us. The path to unlocking the Grand Challenge problems of supercomputing is indeed arduous, yet immensely rewarding for those who dare to traverse it.

When one dedicates a substantial portion of their life to mastering a discipline, they don't just acquire knowledge; they forge an intimate relationship with the very fabric of the field. My 14 years of postgraduate training across mathematics, physics, and computer science and my fifty years of hands-on supercomputing weren't merely a pursuit of knowledge; they were a relentless endeavor to understand, connect, and eventually contribute to the frontier of human understanding in these domains.

Think of it like mastering a musical instrument. A musician who has dedicated fifty years to mastering not just the piano but also the violin and the flute has a profound, nuanced understanding of music that someone with four years of piano training simply cannot possess. This multidisciplinary expertise allows the musician to create symphonies, not just melodies, weaving a tapestry of sound that is rich, complex, and mesmerizing.

In the arena of sports, consider the triathlete. Training for a triathlon demands proficiency in swimming, cycling, and running. A sprinter may dominate the track, but when faced with the water and the bicycle, their specialized skills fall short. The triathlete, conversely, moves seamlessly through all three environments, adapting and excelling because they have spent years understanding and mastering the different disciplines. They don't just run; they navigate through the water and pedal against the wind with equal prowess, painting a holistic picture of athleticism.

Similarly, my journey through mathematics, physics, and computer science provided me with the tools, perspective, and intuition to approach problems that were seemingly insurmountable. The Grand Challenge wasn't simply a physics problem; it was a sophisticated dance of numbers, equations, and computations, all working in unison. It required not just depth but breadth of understanding, a symphony of interdisciplinary knowledge.

As a Black African polymath, there were times when the color of my skin cast shadows of doubt and prejudice over my capabilities. However, expertise and knowledge are the great equalizers. The 50 years of relentless study, exploration, and contemplation allowed me to bridge the chasms of misunderstanding and bias. My contributions, documented across podcasts, videos, and books, are testaments to a journey of unyielding commitment to science and learning.

So, to the brilliant minds gathered here today, remember that the pursuit of knowledge is both deep and wide. Each discipline illuminates a different facet of the mesmerizing crystal of understanding. Dive deep, but also roam wide. The intricate problems of today and tomorrow demand not just expertise but a symphony of knowledge, harmonizing together to create a melody of understanding that is both profound and transformative.

In the end, it's not just about solving problems; it's about weaving a tapestry of understanding that is so intricate and beautiful that it inspires awe and wonder in everyone who beholds it. Embark on this journey with courage, resilience, and an insatiable curiosity. The road may be long, and the climb may be steep, but the view from the pinnacle of understanding is truly breathtaking.

Thank you.

JOURNEY AS A POLYMATH

From the Heart of a Trailblazing Scientist

In our age of scientific enlightenment, tradition has it that those who've made transformative contributions to knowledge are invited to share their insights in public lectures. These lectures, now more than ever, find their place on platforms like YouTube.

My journey in the vast landscape of scientific intellect spans five decades, and I've been privileged to have my voice echo alongside giants of yesteryears such as Albert Einstein and many revered thinkers of our time. However, what distinguishes my narrative is the depth and breadth of my understanding, evident in over a thousand podcasts, YouTube lectures, and books I've penned.

It's commonplace today for a scientist to be part of extensive multidisciplinary teams. While this collaborative spirit is commendable, it's often the case that when asked to speak off-the-cuff about their work, many falter without the cushion of notes often prepared by more knowledgeable team members. In contrast, I pride myself on delivering countless YouTube lectures without ever leaning on PowerPoints.

During my time in Ann Arbor, Michigan, in 1989, I found myself in the unique position of being a renowned scientific figure. This stature was both a blessing and a curse. Many of my contemporaries, some twice older and seasoned, approached me for collaborations. But collaboration is a two-way street. I yearned for intellectual synergy, a shared dream of advancing human understanding. But when many lacked notable achievements of their own, I had to make the difficult decision of declining their overtures.

It's perhaps naive to expect that all rejections would be taken in stride. Some took umbrage and began to undermine my contributions, questioning the very depth and breadth of my understanding. But the truth has a resilient nature. My vast body of work, from podcasts and YouTube lectures to books, stands testament to my dedication to the sciences and my commitment to pushing boundaries.

Was my achievement surprising? Perhaps not. When you consider that from September 10, 1973, I was on an unbroken academic journey spanning 18 years across six renowned institutions, it might seem inevitable. These institutions now regard me as one of their brightest luminaries, equating my contributions to those of Einstein's.

But my journey wasn't just about duration. It required me to be a polymath, to have an encyclopedic understanding of mathematics, physics, and computer science. This holistic grasp was essential in addressing the Grand Challenge problem—an enigma that many great minds couldn't unravel.

But I did. And I shared my insights, not just in scholarly papers but across easily accessible platforms to enlighten and inspire.

My hope is that through my endeavors, I can ignite a spark of curiosity in the minds of young thinkers and reinforce the idea that with dedication, even the most complex problems can be unraveled.

1ST LECTURE: A LIFE IN NUMBERS

Reflections of a Mathematician

Broadcast 24 August 2021

https://youtu.be/e9z0oxvOV_E

The First Supercomputer

The world's fastest computing that's executed across up to a billion processors is the end product of the supercomputer technology that then U.S. President Bill Clinton described as the Philip Emeagwali formula for making computers faster. In 1989, I was in the news for discovering that the slowest processors could be used to solve the most difficult problems in science, engineering, and medicine. And used to find their answers at the fastest speeds. The fastest computer is used to foresee the weather before going outside. Parallel processing powers artificial intelligence.

During my childhood in Nigeria, of early 1960s post-colonial Africa, I read of great minds of mathematics and physics. In early 1970s, I read about Isaac Newton and Albert Einstein. In January 1960 and at age five, I enrolled in Saint Patrick's Primary School, Sapele, in the western region of the British West African colony of Nigeria. In 1960, the odd of me becoming the subject of school essays in the U.S., Canada, and U.K. was one in a billion.

But thirty years later, I was studied with the icons of science, such as Isaac Newton and Albert Einstein. Those school essays were recognitions I could not have imagined. In 1960, the word "computer" wasn't even in the vocabulary of a Nigerian. And the word "supercomputer" hasn't been coined. I began programming supercomputers on June 20, 1974, at 1800 SW Campus Way, Corvallis, Oregon, USA. At that time, there was no computer in Nigeria. In 1974, the word "Internet" wasn't even in the vocabulary of an American computer scientist.

Impact of My Father's Career

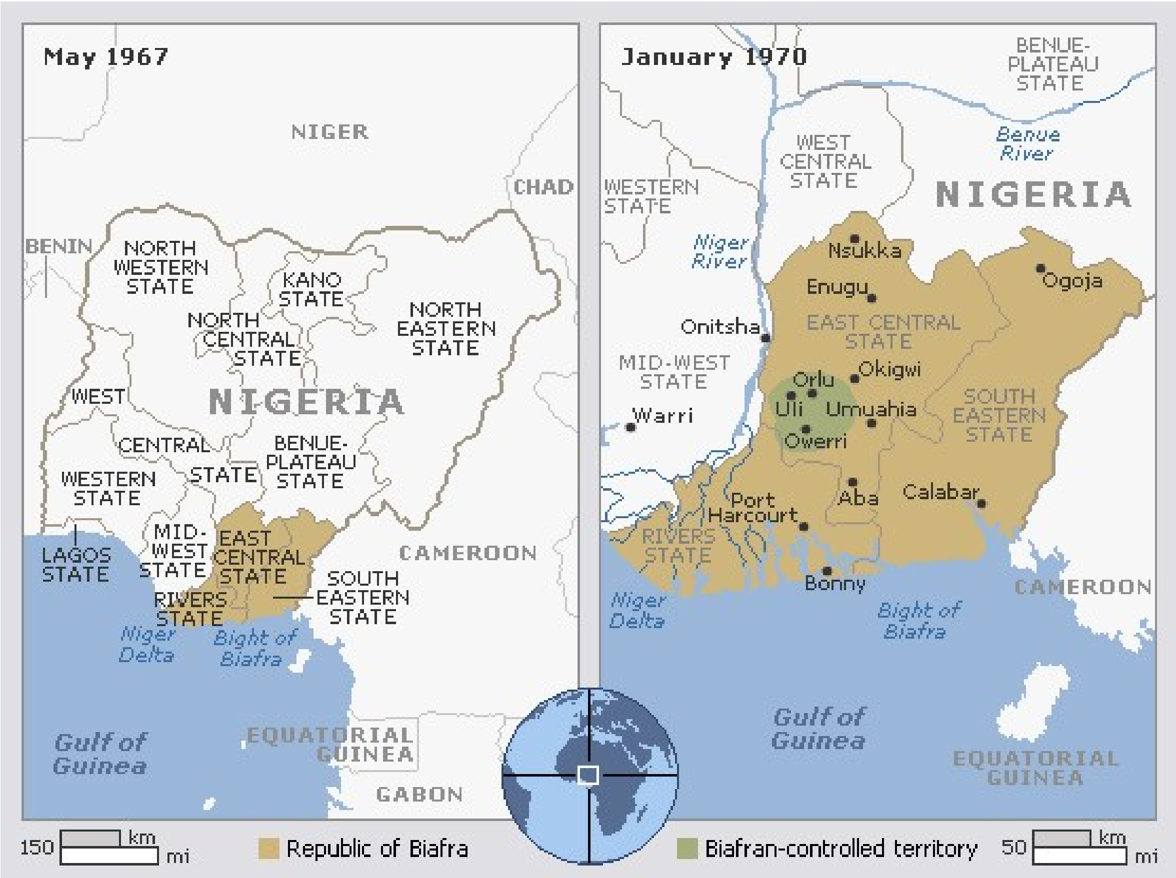
My father's nursing career impacted my early development. That was the reason I grew up in Nigerian cities, such as **Akure**, Sapele, **Burutu**, Forcados, **Uromi**, Agbor, **Ibuzor**, and Asaba. And in as many refugee camps in Biafra. As a nurse in the western region of colonial and post-colonial Nigeria, my father was frequently transferred from one General Hospital to the other.

My father, Nnaemeka James Emeagwali (second from right of first row) and the staff of General Hospital, Agbor, Nigeria, circa 1964.

He worked in each hospital for about two years. And in that short period, I could not learn the local language of our new community, such as the Yoruba language of Akure, the Itsekiri language of **Sapele**, the Ijaw language of **Burutu** and **Forcados**, and the Esan language of **Uromi**. I lived in Agbor for three and half years and then understood their Ika language.

During the thirty-month long Nigerian civil war that ended on January 15, 1970, the Biafran government could not pay salaries. And the refugees were unemployed and could not pay for the medical services they received. By the end of the war, the Biafran Army had lost control of eighty percent of Biafra. And most Biafrans were refugees in Biafra.

My father was a volunteer nurse in Biafran refugee camps. Papa was a volunteer nurse at the hospital in Awka, Biafra, from late September 1967 to January 19, 1968; at the medical clinic in Oba, Biafra, from late January 1968 to March 21, 1968; at the refugee camps in Awka-Etiti, Biafra, from March 29, 1968 to early July 1969; and was the only medical practitioner in the fishing community of Ndoni, Biafra, from mid-July 1969 to January 19, 1970.



As this before and after map shows, eight out of ten Biafrans were refugees exiled from their country.

Three Languages I Speak

Like every Nigerian, I spoke the grammatically simplified Nigerian pidgin language, which is incomprehensible to an American. Pidgin is used in informal conversations among friends and in markets. And spoken as the second *lingua franca* across the 250 ethnic groups in **Nigeria**. I might say to a Nigerian lady: "*Babe you too fine oooo. This food sweet well well. E don do*."

I'm fluent in my ancestral Igbo language. Igbo is an endangered language that's only spoken in the south eastern region of Nigeria. I use Google to translate any email sent to me in Igbo language. "*Biko jịrị nwayọ kwuo okwu*" "Please speak slowly" "*Achọrọ m ka mụ na gị gbaa egwu.*" "I want to dance with you." Before the age of twelve, I grew up in non-Igbo speaking towns in Nigeria. However, we spoke Igbo at home.

Growing Up in Burutu and Forcados

The southern boundary of Nigeria is a coastline that faces the Atlantic Ocean. When I was three and four years old, we lived in the Nigerian coastal towns of Burutu and Forcados, both in the Niger Delta in southern Nigeria. My family lived in Ijaw-speaking Forcados and did so for the two or three months before and after my fourth birthdate, and presumably in the Nurses' Quarters of the Forcados General Hospital that employed my father as its "relief duty" Staff Nurse. In 1958, we lived in Forcados, it was a small coastal fishing community of fewer than a thousand persons, in the Niger Delta of southern Nigeria. The Forcados General Hospital was built in **1890**. It predated the Onitsha General Hospital by a decade. Some describe the Forcados General Hospital as the first modern hospital in West Africa

Five centuries earlier, Forcados was a major Portuguese slave trading port. Millions of Nigerian slaves were taken to the Portuguese colony of Brazil, as domestic and plantation workers. For that reason, Brazil is the second most populous Black country in the world, and second only to Nigeria.

The Forcados **Slave Dungeon** was built in 1475. The Forcados **Slave Wharf** is one of the longest in Africa. For four centuries, millions of slaves landed on the Forcados Wharf to begin their long journey to the Americas and across the Atlantic Ocean. The four centuries of non-stop slave trading in Forcados is to Nigeria what the atomic bombing of Hiroshima is to Japan and the **Auschwitz** concentration camp is to the Jewish people. For those reasons, the Forcados Slave Wharf should be listed as a United Nations' World Heritage site.

Forcados is where Nigeria began. It was the 15th century's administrative capital of the geographical area we now call Nigeria. Forcados was the Abuja of the 15th century Nigeria. My oldest sister, Onyeari Florence, was born in Forcados, in 1958.

First Hospitals in Nigeria

The nine children of my mother had university education. And became Nigerian-Americans. The first school in Igbo land was founded on November 15, **1858**. That school was a short stroll from the birthplace of my father and great-grandfathers. And was also located a short stroll from the present location of General Hospital, Onitsha. That was the first hospital in Igbo land. In 1857, that General Hospital wasn't built. My great-grandfather whose first name was "**Emeagwali**" was born and raised where the General Hospital is now located.

Forty years later and at the end of the 19th century, the British colonial administrators decided to build the present General Hospital of Onitsha. Citing Eminent Domain law that gives the government the power to take over any land and convert it to public use, the **Emeagwali** family was ordered to move and relocate a walking distance away, to 17 **Mba** Road, Onitsha.

Our proximity to that first school in Igbo land gave us, several generations of *Ndi Ọnịcha*, an unfair educational advantage over heartland Igbo speaking people. Being among the first Nigerians to learn how to read and write meant that *Ndi Ọnịcha* emigrated earliest. And did so from Igbo land to the farthest regions of Nigeria.

That was the reason, Nnamdi Azikiwe, the first president of Nigeria, who's parents were born in Onitsha, was born in 1904 in Zungeru, the capital of the British protectorate of Northern Nigeria. It was the reason my grand uncles emigrated from Onitsha to faraway Kano to work as clerks. And why my father emigrated from Onitsha to Kano in 1948 and to Akure in 1950. Papa was trained and employed in General Hospital, Akure, as a twenty-nine-year-old Junior Staff Nurse.

By age nine, I had lived at a dozen Nigerian addresses in seven towns. The first was at 11 Eke-Emeso Street, Akure, Western Region, colonial Nigeria. My father was employed as a nurse in the General Hospital of Akure, and from 1950 to early 1956.

From the General Hospital, Akure, Papa was transferred to Central Hospital, Sapele, Western Region. At first, we lived in the Hausa Quarters, of Sapele in 1956. That was where my immediate younger brother, Nduaguba Francis, was born in May 1956. In early 1958, my father was transferred from the General Hospital, Sapele, on what was called a six-month "Relief Duty" in the coastal towns of Burutu and Forcados. My family of five, spent most of 1958 in the latter two towns.

In April 1958, we left Burutu to come back to Onitsha to attend the funeral of my maternal grandfather, **Chieka Balonwu**. Chieka was a farmer who lived his entire life at 6C Wilkinson Road, Onitsha. Chieka died after a long period of protracted illness that was related to diabetes.

Agatha Emeagwali and friends. Burutu, Nigeria, April 1958.

A group portrait in our family photo album, taken in April 1958, had my then nineteen-year-old mother who was expecting her third child. Sitting beside her were three female friends from Onitsha. All four women were elegantly dressed but sat on a beautiful mat that was placed on the wooden stairways of our house in Burutu. The four women were Iyanma Agatha Emeagwali, Mabel Ifejika, Clara Chude, and Modupe.

We lived in Burutu for six months, from early- to mid-1958. As a three-year-old, I remember living in Burutu in that one-story wooden house that was built upon support stilts. Our house was elevated to protect us from daily tidal floods and occasional storms.

We lived in Forcados for six months, from mid- to late-1958. We lived in the Nurses' Quarters of the General Hospital, Forcados that was a short stroll from the community's post office. My sister, Onyeari Florence, was born in 1958 in the General Hospital, Forcados. And my sister, Chinwe Edith, was born in 1960 in the Central Hospital, Sapele.

After my father returned from his six-month relief duty in Forcados, we lived in the compound that was next to The Eagle Club, in the vicinity of 149 Yoruba Road, Sapele. We lived besides the Eagle Club from early 1959 to late April 1962. The Eagle Club was established by Arthur Edward Prest who later became the Nigerian Ambassador to the United Kingdom.

The Eagle Club was sold in the early 1940s to a Lebanese. The manager of The Eagle Club was Dickson MacGrey. The resident musician was Sally Young. The Eagle Club was the dancing place in Sapele. When we hear the visiting musicians rehearsing, I and other children will sneak inside the Eagle Club and enjoy a free live, rehearsal concert.

I enjoyed Victor Olaiya rehearsing his hit song “Aigana.” And enjoyed Herbert Udemba and his African Baby Vocal Party rehearsing their hit song “Bottom Belle” that went like:

Bonswe azikiwe

Bonswe ayoh ayoh

Bonswe azikiwe

Bonswe ayoh ayoh oh

As a four-year-old, I played along the dusty Yoruba Road and in front of the Eagle Club. And I remember Festus Okotie-Eboh, a man of means and the most flamboyant politician in Nigeria, in his chauffeur-driven long limo. To draw the attention of us children carelessly playing in the vicinity of 149 Yoruba Road, Okotie-Eboh’s chauffeur blasted his car’s loud signature horn.

By the mid-1960s, the Eagle Club was demolished. And Okotie-Eboh bought a portion of the land it was upon. Okotie-Eboh built his “**Orogun Villa**” on that land which, [I think], is now 149 Yoruba Road, Sapele. In 1959, some of the band members at the Eagle Club will give me a penny to buy two sticks of cigarettes for them. And bring back their change of half a penny. That was the purchasing power of a penny, between early 1959 and April 1962.

The compound of Philip Emeagwali, near 149 Yoruba Road, Sapele, Nigeria, from 1959 to April 1962 (Photo taken in late 2000).

From late April 1962 to November 1963, we lived next to Premier Club and Hotel, Uromi, that was also the town's prostitutes compound. The most memorable event that occurred when we lived near Premier Club at Agbor Road was that the renown boxer Dick Tiger defeated Gene Fullmer on August 10, 1963, in Liberty Stadium, Ibadan, Nigeria. Tiger defeated Fullmer to retain his world middleweight boxing title.

The Premier Club was downstairs of a two-storey building that was owned by an Igbo man named "Ubah." The Premier Club was the dancing place in the Uromi of the early 1960s. From our adjacent compound, we hear the visiting musicians rehearsing. I and other children will immediately sneak inside the Premier Club and enjoy a free live, rehearsal concert. I enjoyed Zeal Onyia rehearsing his hit songs *"Vicki Nyem Afum" and "Opigwe."*

In a concert at the Premier Club of 1963, Emmanuel Ntia and his Eastern Stars Dance Band of Nigeria rocked its dance hall with their X-rated number one highlife hit song, called "**Kolop**chop." Like other Igbo children in Uromi of 1962, we learned the sensational Esan acrobatic cultural dance of the spirits.

From mid-December 1963 to late 1966, we lived along Gbenoba Road, Agbor, Midwest Region, Nigeria. And in a three-bedroom house about a block downhill and on the left from the house of Jereton Mariere, the first governor of the Midwest Region of Nigeria.

My elementary school education consisted of two years at Saint Patrick's Primary School, Sapele, two years at Saint Anthony's Primary School, Uromi, and two years at Saint John's Primary School, Agbor.

The names of the first two schools have changed. The Saint Patrick's Primary School, Sapele, that I attended, shared premises with the town's then only Catholic Church. The Saint Anthony's Primary School, Uromi, that I attended, was across the street from the town's then only Catholic Church. I enrolled in classes three and four at Saint Anthony's from late April 1962 to mid-December 1963.

After earning my First School Leaving Certificate, in December 1965, following two years at Saint John's Primary School, Agbor, Midwest Region, Nigeria, I enrolled for fifteen months at Saint George's College, Obinomba, Midwest Region, Nigeria.

Philip Emeagwali (sitting third from left of front row) with students of Saint George's College, Obinomba, Nigeria, 1966.

Like ninety-nine percent of the children in Biafra, I dropped out of school, for three years, during ages twelve to fifteen. I dropped out to live in refugee camps of Biafra of the Nigerian civil war. But I also dropped out again, for two years, from Christ the King College, Onitsha, in March 1972, and after the civil war was over.

One in fifteen Biafrans died during that 30-month-long war. 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.

MY CONTRIBUTIONS TO SCIENCE

I'm the subject of school essays on computer inventors because I was in the news and because I contributed to the development of the world's fastest computers. Specifically, I discovered how to compress the time-to-solution of the most compute-intensive scientific problems, described as the twenty hardest problems that can be solved on extremely fast supercomputers.

Likewise, I'm the subject of school essays on "physicists and their discoveries" because I was in the news for discovering how to compress the time-to-solution of the most compute-intensive problems arising from encoding the laws of physics and encoding those laws into partial differential equation of calculus.

Likewise, I'm in school essays on "mathematicians and their contributions to mathematics" because I was in the news for mathematically discovering how to reduce an initial-boundary value problem of calculus defined in its interior domain by a system of coupled, nonlinear, time-dependent, and three-dimensional partial differential equations.

I discretized those equations to reduce them to a large-scale system of equations of computational linear algebra that approximated the governing initial-boundary value problem. I'm in school essays on mathematicians who contributed to mathematics because I was in the news for mathematically discovering how to solve those algebraic equations. And solve them to foresee otherwise unforeseeable global warming. And solve them to recover otherwise unrecoverable crude oil and natural gas buried up to 7.7 miles (or 12.4 kilometers) deep.

I'm in school essays on physicists who contributed to physics because I was in the news for experimentally discovering how to make the most compute-intensive problems in physics and that are impossible-to-solve possible-to-solve.

I'm in school essays on scientists and their discoveries because I was in the news for discovering how to solve the most challenging problems in science, called Grand Challenges. And how to solve them across the slowest processors in the world. And solve them at the fastest possible speeds in the world.

Philip Emeagwali in front of a chalkboard scribbled with his contributions to mathematics.

Importance of the Supercomputer

Once upon a time, before the Fourth of July **1989**, to be exact, the fastest one thousand computers in the world computed with only one custom-manufactured and super-fast vector processor. Before the Fourth of July **1989**, parallel supercomputing, or attaining the fastest speeds **across** the slowest processors, was mocked and ridiculed as science fiction and was dismissed as a beautiful theory that required experimental confirmation.

On the Fourth of July **1989** and in Los Alamos, New Mexico, USA, I confirmed parallel supercomputing to be faster than the fastest sequential computing. That contribution to computer science is the reason I won an award, in **1989**, that is referred to as the Nobel Prize of supercomputing. My milestone in the history of the computer was marked as the first time the fastest speed in supercomputing was recorded **across** the slowest processors in the world.

The Invention of the World's Fastest Computer

A year later, on June 20, **1990**, *The Wall Street Journal*, and other media, wrote that **Philip Emeagwali**, has experimentally discovered that parallel processing many problems **simultaneously**, instead of sequentially processi**ng** one problem **at a time** should be the starting point of the next generation 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 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.

I was in the news because I discovered a quantum shift, or a significant change in how we look at both the computer and the supercomputer. After the Fourth of July **1989**, the fastest one thousand computers in the world were computing in parallel and communicating **across** up to 10,649,600 processors. We now have a more profound and surer understanding of why and how the world's fastest computer parallel processes. Massively parallel processing was the stone that was rejected as rough and unsightly but that became the headstone of the supercomputer industry.

According to the guiding lights of computing of the 1970s and 80s—namely, Gene Amdahl of the IBM world of mainframe computing of the 1960s, Seymour Cray of vector computing of the 1980s, and Steve Jobs of personal computing of the 1990s—and according to these three giants it would forever remain impossible to use eight, or more, processors to achieve a speedup of eight-fold. In the spirit of the 1970s and 80s, the June 14, 1976, issue of the Computer World magazine carried an article titled: "Research in Parallel Processing Questioned as 'Waste of Time'."

My Inventing the Fastest Computing Was a Defining Moment

Fourteen years after that article, the June **1990** issue of the *SIAM News*, the flagship bi-monthly news journal of mathematicians, carried a cover story that described how **Philip Emeagwali** mathematically and experimentally discovered how to save time by parallel supercomputing through sixty-four binary thousand processors.

And the June 20, 1990, issue of *The Wall Street Journal* and several newspapers and magazines carried a story that reported that **Philip Emeagwali** discovered that parallel supercomputing is not an enormous waste of everybody's time. I contributed to the newer understanding of the supercomputer. And my discovery changed how we think of the supercomputer.

In the bygone way of thinking, the supercomputer solved one problem **at a time.** In the contemporary way of thinking, the supercomputer solves many problems **simultaneously**. My scientific discovery of the world's fastest computing across the world's slowest processors became computing's defining moment. And the bedrock of the supercomputer.

How I Leapfrogged 30,000 Years in a Day

That scientific discovery of parallel supercomputing made the news headlines because I invented the **fastest** computer. And invented the supercomputer technology **across** the slowest 65,536 processors in the world. On a relative scale, the speed increase I discovered, in 1989, was three thousand times greater than the speed advantage the commercial airplane has over the bicycle.

The fastest supercomputer of today is one hundred million times faster than the fastest supercomputer of 30 years ago. In **1989**, it made the news headlines that I discovered how a large-scale computational physicist can compress her **time-to-solution** from 180 computing-years to one supercomputing day. My scientific discovery opened the door to the state-of-the-art supercomputers used to compress **time-to-solution** from 30,000 years on a computer to one day on a supercomputer.

Between April 18 to 20, **1967**, an IBM supercomputer scientist, named **Gene Amdahl**, wrote it would forever be impossible to compress **time-to-solution** from eight days to one day and to do so by parallel supercomputing the most compute-intensive problems in the world.

That pessimistic assertion that originated between April 18 to 20, **1967,** and from the Spring Joint Computer Conference, in Atlantic City, New Jersey, entered every supercomputer textbook to become the famed **Amdahl's law.** That **Amdahl's law** is to supercomputing **across** plural processors what **Moore's law** is to computing within a singular processor.

From War Fronts to the Frontiers of Science

On the date **Amdahl's law** was invented, I was fleeing as a twelve-year-old refugee fleeing from **Agbor** (Nigeria) and fleeing to **Onitsha** (Biafra). **Onitsha** was my ancestral hometown. In the following thirty months, **Onitsha** became the bloodiest battlefield in African warfare. During that Nigerian civil war, one in fifteen Biafrans died.

Twenty-two years after **Amdahl's law** was published, I discovered that the **unimaginable-to-compute** is **possible-to-super-compute**. I discovered how to exceed the eight-processor, factor-of-eight speedup limit known as Amdahl's law. And how to use sixty-four binary thousand processors to solve the most compute-intensive problems in the world.

My scientific discovery of the fastest computing made the news headlines as the biggest fundamental change in computer science. My scientific discovery opened the door to a revolution, namely, computers and supercomputers that could solve many problems **simultaneously**.

What Does a Supercomputer Look Like?

The scientific discovery that I recorded during my email experiments of July 4, 1989, provided the designers of the supercomputer with the insight that massively parallel processing is useful. My new insight changed how the first supercomputer that computes fastest **across** the slowest processors looks.

The supercomputer of the **1980**s, 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 costs is my contribution to computer science.

WHO IS PHILIP EMEAGWALI?

In 1989, I was in the news for discovering that the slowest processors could be used to solve the biggest problems. And find their answers at the fastest speeds. The fastest computer is why you know the weather before going outside.

From an early age in **Nigeria**, I studied the contributions of the great minds of science. I learned that **Euclid** is the father of geometry. Later, I learned that **Albert Einstein** is the father of modern physics. Becoming a father of a then unknown technology wasn't something I could have imagined during ages twelve to fifteen.

In that period, I dropped out of school to live in refugee camps of **Biafra** created by the Nigerian civil war. For three years following June 1967, all schools in **Biafra** were closed. And one in fifteen Biafrans died during that 30-month-long war that ended on January 15, **1970**. 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.

Philip Emeagwali (sitting first from left of front row) with students of Erameh House, Saint George's College, Obinomba, Nigeria, 1966.

The quintessential questions of supercomputing were these: How do we compute faster? How do we do so by a billion-fold? And what makes the supercomputer **super**?

My contribution to supercomputing **is this**: I discovered how to compress the **time-to-solution** of the most compute-intensive problems.

Once upon a time, before the Fourth of July **1989**, to be exact, the fastest one thousand supercomputers in the world computed with only one custom-manufactured, super-fast vector processor. Before the Fourth of July **1989**, parallel supercomputing was mocked and ridiculed as a beautiful theory that lacked experimental confirmation.

On the Fourth of July **1989**, in Los Alamos, New Mexico, USA, I discovered practical parallel supercomputing. And discovered the technology by harnessing the slowest processors in the world. And using them to solve the most compute-intensive problems in the world. And solve those problems at the fastest speeds in the world.

That invention was newsworthy because I discovered a paradigm shift of tectonic proportions that was a huge change in how we look at the computer and the supercomputer. Parallel supercomputing was the stone rejected as rough and unsightly but that became the milestone and headstone of the supercomputer industry.

I was in the news because I contributed to the understanding of the world's fastest computers. My discovery changed how 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 **simultaneously**.

My scientific 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.

Massively parallel computing is the vital technology that enabled the supercomputer to **tower over** the computer that's not parallel processing.

DISCUSSION QUESTIONS

The First Supercomputer

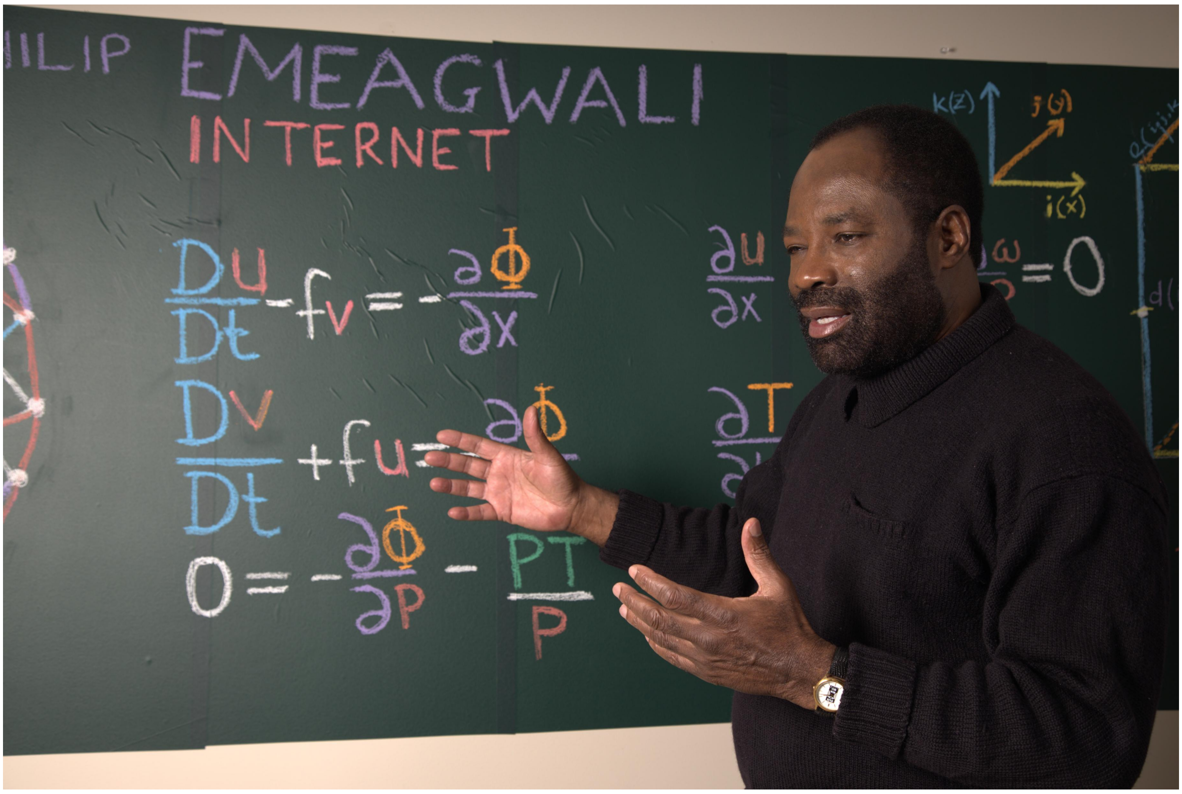
Philip Emeagwali was in the news as the first to program a radically new machine powered by the world's slowest processors to outperform any supercomputer. Photo taken in Cambridge, MA, November 30, 1990.

1. How did Philip Emeagwali contribute to the development of supercomputers?

2. What impact did Philip Emeagwali's father's nursing career have on his early development?
3. How did Philip Emeagwali's childhood experiences in different Nigerian towns shape his education?
4. What languages does Philip Emeagwali speak, and how did they influence his upbringing?
5. What were the living conditions like in the Nigerian towns of Burutu and Forcados where Philip Emeagwali lived as a child?
6. How did the Nigerian Civil War and refugee camps affect Philip Emeagwali's education?
7. How did Philip Emeagwali contribute to mathematics and physics?
8. What is the importance of supercomputers in solving complex problems?
9. How did Philip Emeagwali's discovery of parallel supercomputing challenge existing beliefs in the field?
10. How did Philip Emeagwali's scientific discovery revolutionize the way supercomputers are designed and used?
11. How does the size and cost of supercomputers compare between the past and present, and what role did Philip Emeagwali play in this change?
12. Who is Philip Emeagwali and what are his major achievements in the field of computer science?
13. How did Philip Emeagwali's experiences as a refugee during the Nigerian Civil War shape his perspective on education and scientific discovery?
14. What were the challenges and criticisms faced by Philip Emeagwali in his pursuit of parallel supercomputing?
15. How did Philip Emeagwali's discovery of compressed time-to-solution impact scientific research and problem-solving?
16. What is the significance of parallel supercomputing and its contribution to the field of computing?
17. How did Philip Emeagwali's invention of the fastest computer challenge existing limitations in computing speed?
18. What were the implications of Philip Emeagwali's discovery for the future of computer technology?
19. How did Philip Emeagwali's scientific discovery pave the way for solving the most compute-intensive problems?

20. How did parallel supercomputing change the way we understand and utilize supercomputers?
21. How does Philip Emeagwali's contribution to supercomputing compare to other notable figures in the field?
22. What obstacles did Philip Emeagwali overcome to achieve his scientific breakthrough?
23. How did Philip Emeagwali's discovery of parallel supercomputing impact the advancement of scientific research and technological development?
24. How did Philip Emeagwali's experiences as a refugee and his education in different Nigerian towns shape his perspective on problem-solving and innovation?
25. What future possibilities and advancements are expected in the field of supercomputing as a result of Philip Emeagwali's contributions?

2ND LECTURE: MYSTERIES OF MATHEMATICAL THOUGHT



Philip Emeagwali in front of a chalkboard scribbled with his contributions to mathematics, including how to use a supercomputer powered by one million coupled processors to solve the primitive equations of meteorology that enables you to know the weather before going outside.

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https://youtu.be/e9z0oxvOV_E

In 1989, I was in the news for inventing how to solve the most compute-intensive mathematical problems that arise as partial differential equations of calculus. I was in the news for inventing how to solve the largest system of equations that occur in computational linear algebra that approximated the system of partial differential equations that governs planetary-scaled fluid dynamics motions.

The poster boy of such grand challenge problems is the supercomputer simulations of long-term global warming. After July 4, 1989, I was in the news for inventing how to solve the companion initial-boundary value problems. And how to solve them at the fastest speeds. And solve them **across** a new Internet.

I visualized that new Internet as my new global network of sixty-four binary thousand processors. I visualized those processors as coupled, identical, equal distances apart, and sharing nothing. That new Internet is a supercomputer, in reality. That supercomputer is an instrument of mathematics and physics. The fastest supercomputer is the flagship computer of the world.

Unlocking Mathematical Frontiers: How I Solved the Most Difficult Problem in Mathematics

My contributions to mathematics **were these**: I discovered how to solve nonlinear partial differential equations. And how to solve them **across** a new Internet that's a new global network of **off**-the-shelf processors that were identical and coupled and that shared nothing, but were in dialogue with each other.

An initial-boundary value problem that's governed by a complex system of nonlinear partial **differential** equations, or PDEs, is impossible to solve exactly. And impossible to solve on the blackboard. However, the most important system of nonlinear partial ***differential*** equations can be solved approximately on the computer. And solved with the most accuracy **across** a new Internet that's a new global network of up to a billion **off**-the-shelf processors.

In calculus textbooks, some linear partial **differential** equations can be solved exactly. And solved by using the technique called Fourier series expansion. And using it to solve an initial-boundary value problem governed by the heat conduction equation in one dimension. The heat equation is used to model the diffusion of particles. The heat equation is used to describe the **macro**scopic behavior of **micro**scopic particles in

Brownian motion, or the random movement of fluid particles. That initial-boundary value problem has **Dirichlet** (or first type) boundary conditions that specify the solution along the boundary of the domain of the problem.

In the 1980s, I used the exact solutions of linear partial **differential** equations to validate my parallel-processed codes. Partial **differential** equations go by different names that depend on the assumptions and settings used to derive each. The coupled system of **nine Philip Emeagwali** partial **differential** equations is the mathematical language that I invented and used to describe the flows of crude oil, injected water, and natural gas flowing up to 7.7 miles (or 12.4 kilometers) below the surface of an oil field that's almost twice the size of **Anambra,** my state of origin in **Nigeria**.

The nine Philip **Emeagwali** equations were based on my corrected assumption that inertial forces exist within all producing oil fields. Philip **Emeagwali** equations are the most complicated equations in physics.

My contributions to mathematics **were these**: I mathematically encoded the temporal and the convective inertial forces that exist within all producing oil fields. I encoded both physical forces into thirty-six partial derivative terms. And I added those mathematical terms to the existing 45 partial derivative terms described in computational physics textbooks on subsurface petroleum reservoir simulation.

Solving Complex Mathematics Problems

The grand challenge initial-boundary value problem of mathematics is so named because it requires tremendous supercomputer power to solve it with an acceptable accuracy. On my Eureka moment which occurred at fifteen minutes after 8 o'clock on the morning of the Fourth of July 1989, I discovered how to parallel process 30,000 years of **time-to-solution** of a Grand Challenge Problem to one day of **time-to-solution across** an ensemble of 10.65 million **off**-the-shelf processors.

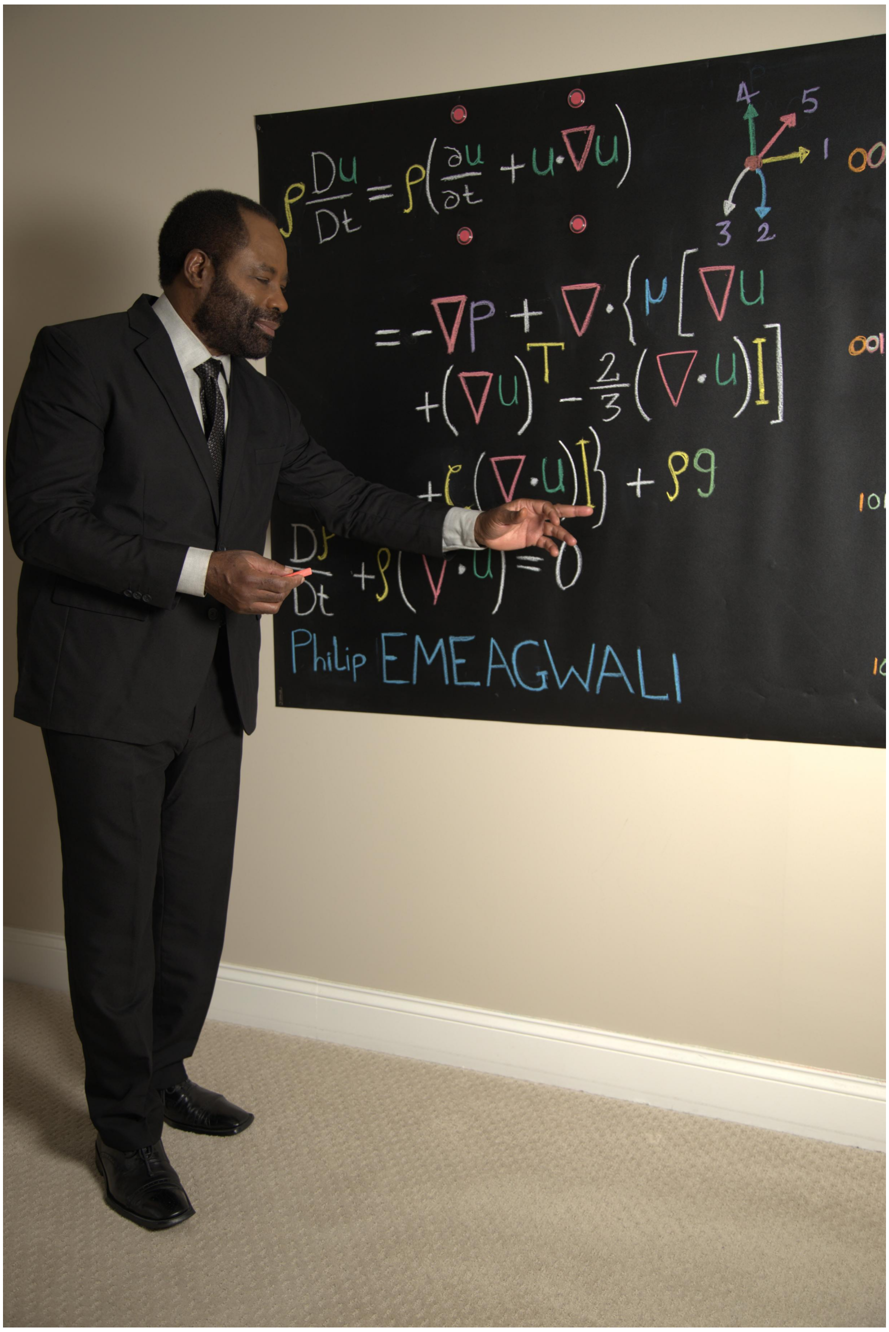
How I Turned Fiction to Fact

Although parallel processing entered science fiction and did so on February 1, **1922**, it wasn't until my discovery, which occurred on July 4, **1989,** that a full understanding of the vital technology that underpins the world's fastest computer **was attained**. In **1922**, weather forecasting **across** sixty-four thousand human computers was written as a science-fiction story.

My contributions to physics **were these**: On July 4, **1989**, I discovered how to upgrade the science fiction of forecasting the weather **across** sixty-four thousand human computers to the nonfiction of forecasting the weather **across** sixty-four binary thousand processors, or **across** as many electronic computers.

I contributed to physics by discovering how the extreme-scaled climate model is parallel processed **across** a new Internet that's a new global network of 65,536 processors. And how global climate models can be executed by chopping up the model of the Earth's atmosphere and oceans into 65,536 smaller climate models that're mapped with a one-model to one-processor correspondence. And mapped onto as many processors.

The societal importance of my contribution to science **is this**: Parallel-processed climate models are tools used by decision makers to help ensure the Earth is safe for humans and for all animals.



Philip Emeagwali explaining his contributions to mathematical physics, namely, how to solve the field's most difficult and important problems.

Across an Internet

In 1989, it made the news when I discovered how to solve the most compute-intensive problems. I was cover stories because I discovered how to solve the world's biggest problems in mathematics, physics, and computer science. And solve them at the fastest recorded computer speeds.

I invented how to solve the most compute-intensive mathematical problems, called extreme-scale computational fluid dynamics. And solve them **across** a new Internet. That Internet was a new global network of up to one billion identical and coupled processors. Each processor operated its operating system. Each processor was self-contained and had its dedicated memory and shared nothing. I was in the news because I invented a new Internet that's a new global network of millions, or billions, of processors. I invented how to parallel process. Or how to execute a **billion** set of computer instructions. And how to execute them **simultaneously.** Or how to execute them in parallel and **across** up to a **billion processors.**

Contributions to Algebra

How is Mathematics Used in Climate Change?

For the 25-year-old mathematician, the expression "partial **differential** equations of mathematical physics" conjectures up images of the **parabolic** heat equation, the **hyperbolic** wave equation, and the **elliptic** Laplace equation described in his mathematics textbooks. The real-world problems that arise in mathematical physics occur while hindcasting the weather up to 7.7 miles (or 12.4 kilometers) below the surface of the Earth.

The world's biggest problems include the hindcasting of the "weather" deep inside the Niger Delta oil fields of southern **Nigeria**. Another large-scale computational fluid dynamics problem that's equally compute-intensive is to forecast the long-term weather above the surface of the Earth. Or to simulate the spread of a once-in-a-century global pandemic's contagious viruses **across** the two and half billion passengers a year that ride in Russia's Moscow Metro.

These real-world initial-boundary value problems that're governed by partial **differential** equations of mathematical physics can't be analytically solved on the blackboard. Or solved with pencil and paper. Or solved with a computer that's powered by one processor. The world's most compute-intensive mathematical problems must be solved only **across** a new Internet that's a new global network of millions of processors, each its own master, that were identical and that shared nothing.

Solving Complex Mathematics Problems

As a research computational mathematician who came of age in the **1970**s in Corvallis (Oregon) and **80**s in College Park (Maryland), Washington (District of Columbia), and Los Alamos (New Mexico), my mathematical grand challenge was to invent the correct system of partial **differential** equations, called the nine Philip **Emeagwali** equations, that governs the flows of crude oil, natural gas, and injected water that're flowing **across** any of the world's 65,000 producing oil fields, including Nigeria's 159 producing oil fields.

My system of partial **differential** equations were not published in any calculus textbook of the 1980s. As their sole inventor, I was the first to formulate and discretize them and, consequently, derive their companion system of partial **difference** equations of large-scale computational linear algebra. I invented both my systems of **differential** and **difference** equations from my correct formulation of physics's second law of motion.

I discovered how to chop up the most compute-intensive problems as the sixty-four binary thousand high-resolution computational physics codes that I must parallel process. And that I must map in a one-code to one-processor corresponding fashion. And that I must evenly distribute onto as many off-the-shelf processors that **outlined** and **defined** my new Internet.

My new Internet was a virtual supercomputer, in reality. That one-code to one-processor mapping was the grand challenge of extreme-scaled computational mathematics, such as global climate modeling to foresee otherwise unforeseeable global warming.

Unlocking the Genius: Counting to Infinity

What are the contributions of **Philip Emeagwali** to mathematics? Often, scientific recognitions lack a sense of proportion and context. My mathematical discovery of thirty-six partial derivative terms that must be used to accurately pinpoint the miles-deep locations of crude oil and natural gas deposits is abstract. And it's not as important as my scientific discovery that the fastest computer can be built with the slowest processors.

The latter contribution was a scientific breakthrough and the subject of newspaper articles. And became the vital technology that **underpins** every supercomputer.

Inventing my new 36 partial derivative terms requires very high-level, dense mathematics to fully explain all the mathematical steps that I took over a fifteen-year period. The simplified explanation of my mathematical invention that is my contribution to mathematical knowledge is that both the temporal and the convective inertial forces that exists in the actual problem must also exist on the blackboard and motherboard. And must be represented by those thirty-six partial derivative terms.

Inventing a new system of partial ***differential*** equations of calculus and discretizing those equations into a new system of partial ***difference*** equations of large-scale computational linear algebra and experimentally proving the stability and convergence properties of the companion partial ***difference*** algorithms and coding those algorithms **across** a monumental ensemble of off-the-shelf, coupled processors that shared nothing was a notable problem that was defined at the crossroad where new physics, new mathematics, and the world's fastest computing intersected.

In 1989, I was in the news for solving that Grand Challenge Problem of supercomputing. And for solving it alone. The parallel supercomputer that occupies the space of a soccer field is a super-sized mathematical instrument that put the partial **differential** equation back whence it came from. It's not enough to lecture on the mathematical foundation of the fastest supercomputers, even though that intellectual feat requires mastery of physics, mathematics, and computer science. It took me twenty years to arrive at the frontiers of knowledge of physics, mathematics, and supercomputing.

A New Way of Doing Mathematics

Solving Problems Across Processors

I was in the news because I discovered how to solve the most compute-intensive mathematical problems, such as initial-boundary value problems governed by a system of partial **differential** equations. I discovered how to solve partial **differential** equations **across** a new Internet that's a new global network of up to a billion processors.

Such equations contextualized and encoded some of the most important laws in physics. Such equations capture in a few succinct terms some of the most ubiquitous features of the air and water flowing **across** the surface of the Earth, including the atmosphere and oceans, and the crude oil, injected water, and natural gas flowing **across** highly anisotropic and heterogeneous producing oil fields that are up to **7.7 miles** (or 12.4 kilometers) below the surface of the Earth. An oil field is about the size of a town.

Redefining Mathematical Physics

My contributions to supercomputing, as it's executed today, pushed the boundaries of modern mathematical physics to include fastest computing **across** up to one billion processors. I couldn't have accidentally discovered a more accurately formulated system of partial **differential** equations and discovered it without knowing what's erroneous with the century-old partial **differential** equations that were published in textbooks.

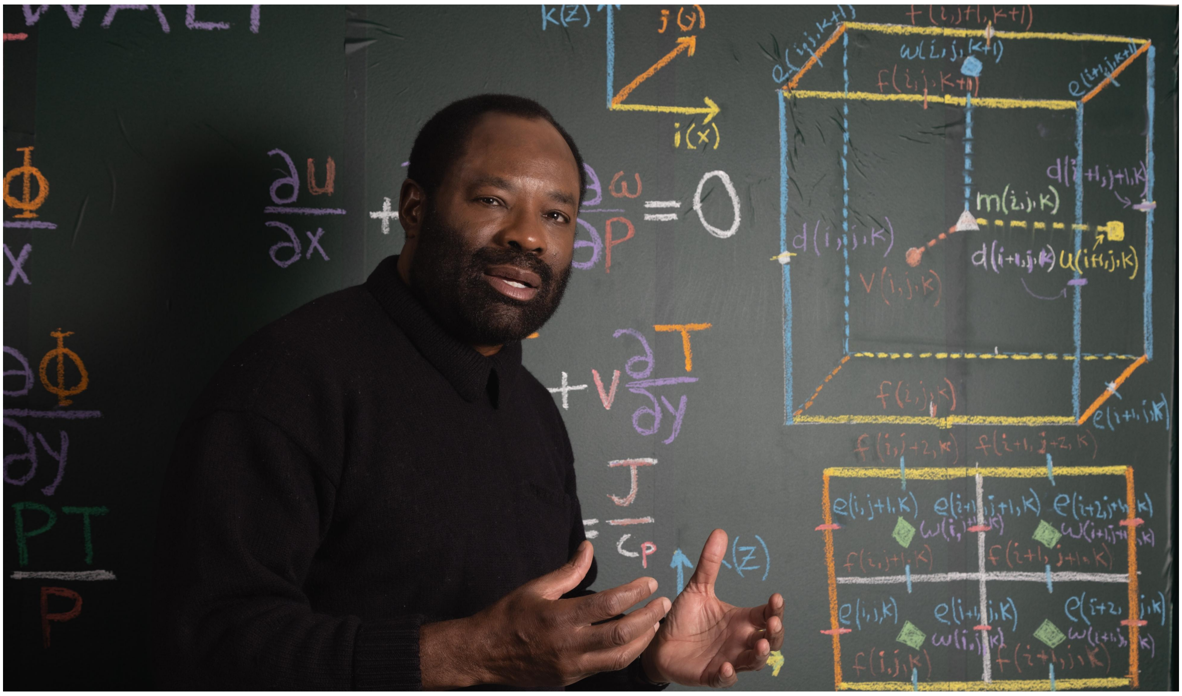
After sixteen years of mathematical research, I became fearless in the face of partial **differential** equations arising at the frontier of calculus. After sixteen years, I developed the mathematical maturity that was needed to read the physics subtext encoded into partial **differential** equations. And needed to understand what their partial derivatives represent. I could introduce new partial ***derivatives*** and introduce them into partial **differential** equations and where they were missing.

After sixteen years, I gained the ability to discretize any partial **differential** equation. And to solve it on a computer. Or solve it **across** a new Internet that's a new global network of coupled processors. I knew partial **differential** equations not by memorization but through understanding them enough to invent new ones.

I understood partial **differential** equations deeply. I could look in the mathematical physics textbook and see which key partial derivatives were missing from the system of partial **differential** equations that were used by computational physicists. And used to simulate the flows of crude oil, natural gas, and injected water that were flowing up to 7.7 miles (or 12.4 kilometers) deep. And flowing **across** a highly anisotropic and heterogeneous producing oil field that's up to twice the size of the state of Anambra, Nigeria.

After sixteen years with foremost American and visiting European mathematicians, I developed the ability to translate verbal statements of the laws of physics. And translate them into partial **differential** equations that arise beyond the frontier of calculus.

Likewise, I developed the ability and the intuition that was needed to move back and forth between the laws of physics and partial **differential** equations that arise beyond the frontier of calculus. Furthermore, I developed the mathematical maturity needed to identify connections between the weather above the surface of Earth and the weather below the surface of the Earth. Not only that, I could spot century-old mathematical errors in textbooks and correct them. I could draw a line between partial **differential** equations we know and ones we don't know.



Philip Emeagwali explaining how he solved the most difficult math problem. This contribution to mathematics made the news headlines, in 1989.

Unlocking the Mathematical Mysteries: How I Solved the Most Difficult Problem in Computational Mathematics

How did I solve the most difficult problem in computational mathematics? I could use my instinct and intuition to solve initial-boundary value problems in extreme-scale mathematical physics. A calling for solving unsolved problems of mathematics is needed. Just like it's impossible for you to set the world record in a 26.2 mile (or 42 kilometer) marathon race and do so without extensive training in long-distance running, it would have been impossible for me to set the world record of the fastest mathematical computations that I executed on the Fourth of July **1989,** in Los Alamos, New Mexico, USA. And set that record without my sixteen-year-long training as a research computational mathematician in the USA.

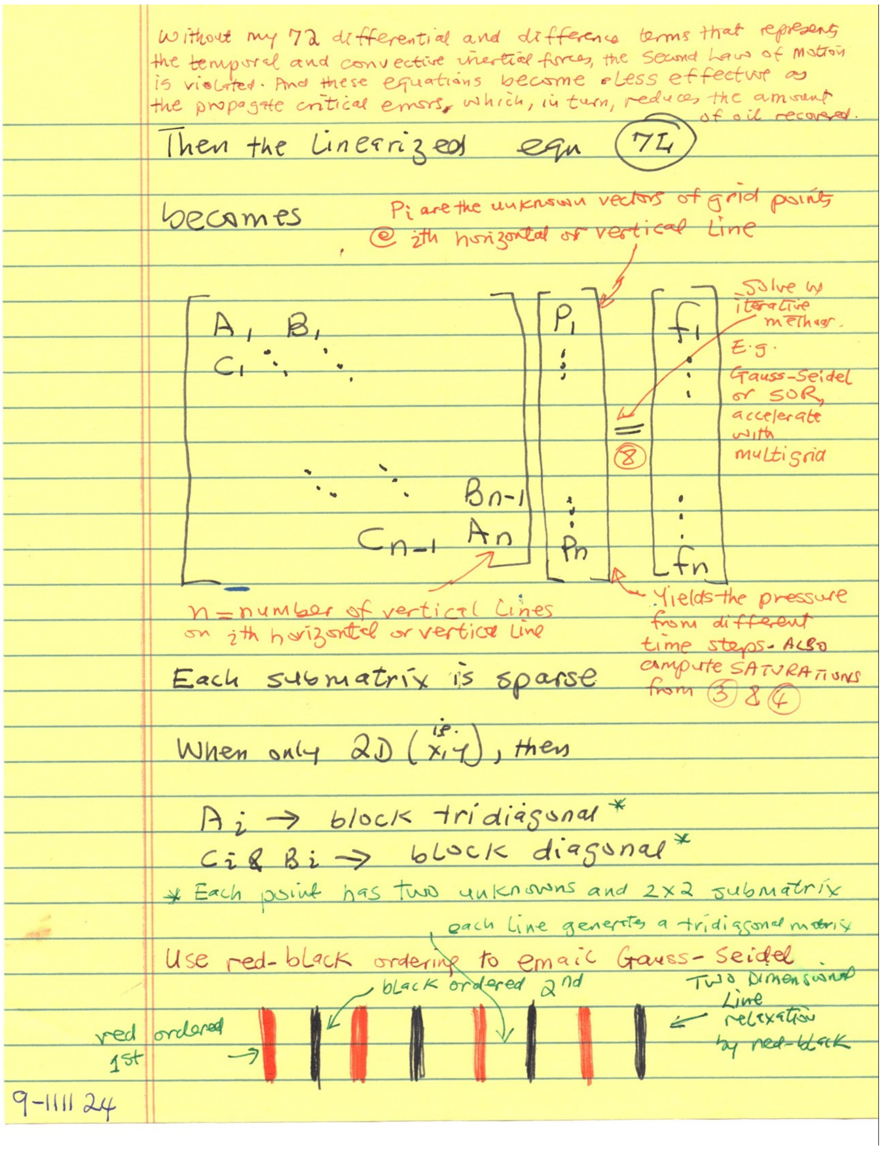
In 1989, what made the news headlines was that an African-born computational mathematician has discovered how to perform the **fastest** mathematical computations. I did so by changing how we count, namely, my alternative way of counting up to a **billion** things **simultaneously** instead of the old way of counting only one thing at a time. That old way of counting was used since the era of our prehistoric human ancestors. The paradigm shift from the sequential way of counting to the parallel way of counting is to the mathematics textbook, what the continental drift was to the geology textbook.

The Importance of Philip Emeagwali Equations

What are the importance of the **Philip Emeagwali** equations? To contribute new mathematics is to add new knowledge to the existing body of mathematical knowledge. The nine new partial **differential** equations that I invented were cover stories of top mathematics publications, such as the May 1990 issue of the *SIAM News*, which is the flagship publication for the research mathematician.

My partial **differential** equations are for discovering and recovering otherwise undiscoverable and unrecoverable crude oil and natural gas formed up to 541 million years ago and buried up to 7.7 miles (or 12.4 kilometers) deep. Without the fastest computing **across** millions of processors that I discovered, the solution of the most compute-intensive initial-boundary value problems—such as the simulation of long-term climate change—will be as approximate as a sketch, instead of as exact as a photograph.

In theory, mathematical predictions based upon partial **differential** equations should be as reliable as a hammer. In practice, it’s a different story. The world’s fastest computer shortens the gap between theory and practice. The **Philip Emeagwali** equations are correct and accurate and, for those reasons, also shorten the gap between theory and practice.



without my 72 differential and difference terms that represents the temporal and convective inertial forces, the Second Law of Motion is violated. And these equations become less effective as the propagate critical errors, which, in turn, reduces the amount of oil recovered.

Then the Linearized eqn ⑦④

becomes

Pi are the unknown vectors of grid points @ ith horizontal or vertical Line

$$\begin{bmatrix} A_1 & B_1 & & \\ C_1 & \ddots & \ddots & \\ & \ddots & \ddots & B_{n-1} \\ & & C_{n-1} & A_n \end{bmatrix} \begin{bmatrix} P_1 \\ \vdots \\ \vdots \\ P_n \end{bmatrix} \overset{⑧}{=} \begin{bmatrix} f_1 \\ \vdots \\ \vdots \\ f_n \end{bmatrix}$$

Solve w iterative method. E.g. Gauss-Seidel or SOR, accelerate with multigrid

n = number of vertical Lines on ith horizontal or vertical Line

Yields the pressure from different time steps. ALSO compute SATURATIONS from ③ & ④

Each submatrix is sparse

When only 2D (i.e. x, y), then

$A_i \rightarrow$ block tridiagonal*

C_i & $B_i \rightarrow$ block diagonal*

* Each point has two unknowns and 2x2 submatrix

each line generates a tridiagonal matrix

Use red-black ordering to emaic Gauss-Seidel.

black ordered 2nd

red ordered 1st

Two Dimensional Line relaxation by red-black

9-1111 24

A page from hundreds of research notebooks of Philip Emeagwali that led to his contributions to mathematics.

Fastest Computing is My Contribution to Mathematics

What are the contributions of **Philip Emeagwali** to mathematics? A significant contribution to mathematical knowledge can be made only by a person who has spent three, or six, decades training as a research mathematician. And as a polymath who has reached the uncharted waters of mathematical and scientific knowledge. And went beyond the unexplored territory of human knowledge where new mathematics can be discovered. My journey was to the *terra incognita* of mathematical knowledge where I became the first to figure out how to solve never-before-solved Grand Challenge problems that were beyond the mathematics, physics, and computer textbooks.

Such grand challenge problems exist beyond the mathematician's blackboard. Such troublesome problems were formulated for physical domains up to 7.7 miles (or 12.4 kilometers) beneath the surface of the Earth. A grand challenge problem is in contrast to mathematical problems formulated only for the mathematician's textbook and blackboard.

My Struggles to Contribute New Computer Knowledge to Mathematics and Physics

It took me two decades of full-time training to contribute the knowledge of the world's fastest computing to both mathematics and physics. It took me the first sixteen years in the USA, following March 24, **1974**, to gain the mathematical maturity needed to solve advanced mathematical problems in planetary-scaled geophysical fluid dynamics. During those sixteen years, I constantly struggled against the most compute-intensive problems that spanned disciplines, from geology to meteorology, from partial **differential** equations beyond the frontier of calculus to the processor-to-processor emailed codes of computational physics, and from extreme-scale algebra to supercomputing **across** a billion processors that outline a new Internet that's a new global network of coupled processors.

I grew as a research mathematician and did so during those sixteen years, or more, of solving increasingly challenging problems that arose at the crossroad where new mathematics, new physics, and the world's fastest computing intersect.

My quest for the world's fastest computing started as the world's slowest mathematician. That quest began from the **times table** that I learned in the first grade at age five in January **1960** in Sapele, **Nigeria**. It grew to the **fastest multiplications** that I recorded on the Fourth of July **1989,** in Los Alamos, New Mexico, USA. That technology underpins the fastest parallel-processed computations, that I invented. It's used to solve real-world mathematical problems, such as making possible your evening weather forecast that's based upon extreme-scaled computational physics that must be executed **across** an ensemble of up to 10.65 million off-the-shelf processors.

Two thousand three hundred years ago, King Ptolemy, the first, of Egypt demanded from the father of geometry, Euclid, an easier path for his son to follow and understand geometry.

"He's a prince," said King Ptolemy.

"There is no royal road to geometry,"
Euclid replied.

I Contributed Emeagwali Equations to Mathematics and Physics

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 inventing the world' fastest computing enabled the supercomputer to become the workhorse of large-scale computational mathematicians and physicists.

In supercomputing, nine out of ten cycles are consumed by modelers solving grand challenge problems that are governed by systems of partial **differential** equations and their companion and approximating system of partial **difference** equations. The partial **differential** equation of calculus is an equation for some quantity called a dependent variable. That dependent variable depends on some independent variables. And involves derivatives of the dependent variable with respect to at least some independent variables.

For four decades, I researched partial **differential** equations that govern both the "weather" up to 7.7 miles (or 12.4 kilometers) below the surface of the Earth. And the weather above the surface of the Earth. These are by far the most important partial **differential** equations in mathematical physics.

My contributions to mathematical knowledge that made the news headlines, in 1989, **were these**: I discovered a royal road to the farthest frontier of human knowledge of large-scale computational and mathematical physics.

Philip Emeagwali and the Connection Machine, Cambridge, MA, November 1990.

My discovery of the world's fastest computing is my signature contribution to human knowledge. My discovery led to the parallel-processed solution of the largest-scaled problems in computational physics. It led to solving real-world initial-boundary value problems. And solving them across sixty-four binary thousand processors, that were coupled and shared nothing.

My invention of the fastest computing yielded the vital technology that now underpins every **supercomputer.** For those reasons, my invention was later acknowledged by then U.S. President Bill Clinton, who did so in his White House speech dated August 26, **2000**. Likewise, my invention was acknowledged in the news headlines of 1989, and later. Since 1989, my invention has been the subject of school essays on computer pioneers and their contributions to the development of the computer.

My Contributions to Mathematical Physics

Since June 20, **1974**, a Thursday, that I remember because a total solar eclipse occurred, and the Moon passed between the Earth and the Sun, and since that rare astronomical event, my quest for the fastest supercomputer on Earth hinged on the most consequential issue in computer history.

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 mathematical and computational physics?

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 problems.

Bridging the Gap Between Fantasy and Reality

There's no precise set of rules for solving unsolved problems. The best we can do is to keep searching for answers. My quest for the world's fastest computer was both a **journey** and a **destination**. My scientific discovery, of how to manufacture the fastest computers and do so with standard parts,

fuelled the quest for a new destination, namely, the next horizon to answering the most difficult questions in modern computer science.

That new horizon is to invent the quantum computer and, most importantly, to use the technology to address the toughest questions in science. That new technological horizon resides within computer science fiction and is still beyond our understanding.

I worked alone because my world's fastest computing that was **enabled** by the world's slowest processors was ridiculed—by the likes of **Steve Jobs** — and dismissed as a noble but distant dream.

My discovery of the world's fastest computing was at first theorized and, therefore, was expected. Yet, it was an **otherworldly** new knowledge. The world's fastest computing was my 1989 holiday gift to the U.S. for its Independence Day of the 4th of July that's Nigeria's equivalent of October 1.

A scientist achieves immortality by first discovering something that will be forever remembered. For me, science is more than learning science. My science is a search for something unknown, such as the invention of the world's fastest computer, as it's known today and as it's expected to be known tomorrow.

DISCUSSION QUESTIONS

Mysteries of Mathematical Thought

1. What were Philip Emeagwali's contributions to mathematics?
2. How did Philip Emeagwali solve the most compute-intensive mathematical problems?
3. What is the significance of solving initial-boundary value problems in extreme-scale mathematical physics?
4. How did Philip Emeagwali revolutionize the way we count and perform mathematical computations?
5. What is the importance of the Philip Emeagwali equations in mathematical and computational physics?
6. How did Philip Emeagwali's discovery of fastest computing impact the field of supercomputing?
7. What challenges did Philip Emeagwali face in contributing new computer knowledge to mathematics and physics?
8. How did Philip Emeagwali bridge the gap between fantasy and reality in his quest for the world's fastest computer?
9. How did Philip Emeagwali redefine mathematical physics and contribute to solving grand challenge problems?
10. What was the role of parallel processing in Philip Emeagwali's contributions to mathematics and physics?
11. How did Philip Emeagwali's mathematical discovery enable the solution of otherwise unsolvable problems?
12. What is the relationship between Philip Emeagwali's contributions to mathematics and the understanding of climate change?
13. How did Philip Emeagwali's research impact the field of computational mathematics?
14. What is the societal importance of Philip Emeagwali's contributions to science and mathematics?
15. How did Philip Emeagwali's work in mathematical physics contribute to the modeling of global climate change?
16. What challenges did Philip Emeagwali overcome in his journey to contribute new knowledge to mathematics and physics?

17. How did Philip Emeagwali's discovery of fastest computing affect the gap between theory and practice in mathematical predictions?
18. How did Philip Emeagwali's research on extreme-scale computational physics impact the understanding of the Earth's atmosphere and oceans?
19. What was the significance of Philip Emeagwali's invention of the new Internet and its impact on solving complex mathematics problems?
20. How did Philip Emeagwali's parallel processing technique revolutionize the field of large-scale computational mathematics?
21. What were the key mathematical breakthroughs made by Philip Emeagwali in solving grand challenge problems?
22. How did Philip Emeagwali's contributions to mathematical knowledge redefine the boundaries of modern mathematical physics?
23. What is the relationship between Philip Emeagwali's research and the solution of real-world initial-boundary value problems?
24. How did Philip Emeagwali's invention of the world's fastest computing technology shape the development of supercomputers?
25. What is the long-term impact of Philip Emeagwali's contributions to mathematics and computer science?

3RD LECTURE: MY DIGITAL DESTINY

Philip Emeagwali, New York, October 2022.

Broadcast 24 August 2021

https://youtu.be/e9z0oxvOV_E

EARLY REJECTIONS OF MY INVENTION

I'm here because I was the first to discover the world's fastest computing across the world's slowest processors. That was the world's first supercomputer, as it's known today.

In **1989**, I was in the news for discovering that the world's slowest processors could be used to solve the most compute-intensive problems arising in mathematics, physics, and computer science. And find their answers at the fastest speeds. The fastest computer is why you know the weather before going outside.

After I won the highest award in supercomputing, in 1989, I had the seal of approval equivalent to winning the Oscar for acting or winning the Grammy Award for singing or winning a Grand Slam tournament of tennis. The highest award in supercomputing that computer scientists rank as the Nobel Prize of supercomputing is a peer honor awarded by supercomputer scientists and awarded at the top supercomputer conference and awarded only to someone who made a **measurable contribution** to supercomputing, that includes a quantified and new milestone in computer history.

After the news headlines from my winning that prize, supercomputer scientists who mocked and made fun of me took notes when I gave lectures. But in the early **1980**s, nobody took notes when I lectured at gatherings of research scientists. I was fired as a scientific researcher in December **1980** because I was advocating changing research directions. I was dismissed because I wanted to change from small-scale fluid dynamics modeling within one processor to large-scale modeling **across** a new Internet that's a new global network of 65,536 off-the-shelf processors and standard parts.

My contributions to computer science **were these**: I discovered how to harness a billion coupled processors that shared nothing. And how to use them to execute time-dependent, three-dimensional fluid dynamics calculations that have extreme-scale algebra at their computational cores. An example is simulating the spread of contagious viruses inside Japan's Tokyo subway where 3.1 billion passengers a year are packed like sardines.

Rejection in 1974 in Oregon

My signature invention is the world's fastest computing **across** the world's slowest processors. And it's use to solve the most difficult problems arising in science, engineering, and medicine. My new technological knowledge has been absorbed into the fastest computers in the world. I invented it as the vital technology that will underpin every supercomputer. In the summer of **1974**, my vague idea of sixty-four thousand computers around the Earth was inspired by a science-fiction story that was dated February 1, **1922.** My theory of fastest computing was mocked and dismissed as a joke.

What makes a computing milestone? A computing milestone begins with a vision of a quantum leap in the speed of the world's fastest computer. In practice, it takes a decade, or more, to invent a new supercomputer.

Philip Emeagwali near 1800 SW Campus Way, Corvallis, Oregon, where he began supercomputing on June 20, 1974 (Photo taken ~ late July 1975).

Rejection in November 1982 by the U.S. government

In November **1982** and at a science conference that took place near The White House, in Washington, D.C., I gave a research presentation on how, in theory, I could chop up an initial-boundary value problem that's the most compute-intensive in mathematical physics. And chop it up into 65,536 less compute-intensive problems. And then solve them in tandem and **across** a new Internet that's a new global network of sixty-four binary thousand processors.

Only one young computational physicist remained to listen to my lecture. Even though he didn't understand my theory of the fastest computing across the slowest processors, his intuition told him that the new technology was bigger than us. Convinced, he spearheaded an initiative to invite me to speak in Bay Saint Louis, **Mississippi**.

Rejection in May 1983 by the U.S. Government

Six months later, I gave a hiring lecture in Bay Saint Louis, **Mississippi**. My lecture was on how to parallel process and solve **in tandem** the most extreme-scale initial-boundary value problems in computational fluid dynamics. That lecture went over their heads, in part, because in May 198**3** nobody understood how to parallel process. And do so **across** a new Internet that's a new global network of sixty-four binary thousand processors.

That I wasn't hired was because recording the world's fastest speed in computing and doing so **across** the slowest processors was then in science fiction. Parallel computing was considered to be an enormous waste of their time. It was also rejected because I was **Black and sub**-Saharan **African.** In the 1980s, I was the only person that could give a lecture on how to harness a million processors. And use them **in tandem** to forecast tomorrow's weather. In **1989**, I was in the news for discovering that the slowest processors could be used to solve the biggest problems.

REJECTION OF PARALLEL PROCESSING IN 1983

My world's fastest computing of July 4, 1989, in Los Alamos, New Mexico, USA, was theorized in June 1974, in Corvallis, Oregon, USA. I continuously developed it during the fifteen years up to 1989.

Back from September 1, 1981, through August 1986, I lived a 15-minute stroll from the Gramax Heliport Building in Silver Spring, Maryland. The Gramax Building was the then headquarters of the U.S. National Weather Service.

On my typical weekdays of the early 1980s, I arrived at eight o'clock in the morning at my desk in the Gramax Building at 8060 13th Street, Silver Spring, Maryland. In the 1980s, the Gramax Building housed the U.S. National Weather Service. During those five years, and from Mondays through Fridays, I stopped each morning and spent five hours with research hydrologists and meteorologists.

As a research meteorologist, and from 1981 to 86, I spent the first half of each day in the headquarters of the U.S. National Weather Service. I mathematically analyzed finite difference algorithms and processor-to-processor emailing **across** a new Internet that's a new global network of 65,536 processors.

Finite difference schemes must be used to discretize and solve the set of primitive equations that governs atmospheric dynamics, namely, rain, wind, floods, and hurricanes. The primitive equations, which encode laws of physics, were first formulated in **1904**. Eight and half decades later, I was in the news for discovering how to solve initial-boundary value problems that are governed by a system of partial **differential** equations, such as the primitive equations used to forecast the weather.

The supercomputing breakthrough was **not** that I discovered how to forecast the weather on the world's fastest processor *per se*. The technological breakthrough was that I discovered the world's fastest computing **across** the slowest 65,536 processors in the world. The precursor to my world's fastest computing, of July 4, 1989, in Los Alamos, New Mexico, was rejected in September 1983, in Washington, D.C. and by the U.S. National Weather Service, in Silver Spring, Maryland.

Philip Emeagwali, Baltimore, Maryland, circa December 1983.

A decade earlier, I left Nigeria for Oregon, USA, and arrived on March 24, 1974. In that decade, the most brilliant Nigerians in the U.S. were denied jobs as research engineers and scientists. And they were denied opportunities to contribute to scientific knowledge.

In the early 1970s, well compensated research jobs in computer science were reserved for white males. When I gave a job hiring lecture in Ann Arbor, Michigan, on about September 24, 1985, it seemed surreal to the white audience listening to my theory of how to harness the 65,536 slowest processors in the world. And using them to record my world's fastest computing that later occurred on July 4, 1989.

My audience in Ann Arbor, Michigan, experienced cognitive dissonance. They've never listened to a Black research mathematician who came to them with new computational mathematics from his forthcoming world's fastest computing.

Nigerian mathematicians **who** can invent new partial **differential** equations for modeling the spread of the coronavirus left mathematics, where they are no jobs, to become nurses. As a result of this internal brain drain, from research mathematics to nursing practice, Nigerians became underrepresented in winning top scientific prizes but are overrepresented as the hardest working nurses in America. In the U.S., one in twenty registered nurses were born in Nigeria. My four sisters are Nigerian-American nurses who work two jobs each to pay the school fees for distant relatives in Nigeria.

Fifty years ago or in the 1970s, the most brilliant Nigerian scientists in the USA became janitors, like I was in Oregon. Some became security guards in Washington, D.C. or taxi drivers in New York City. In the 1970s and 80s, many Nigerian taxi-drivers in the big American cities, who were brilliant engineers and scientists, were robbed and killed.

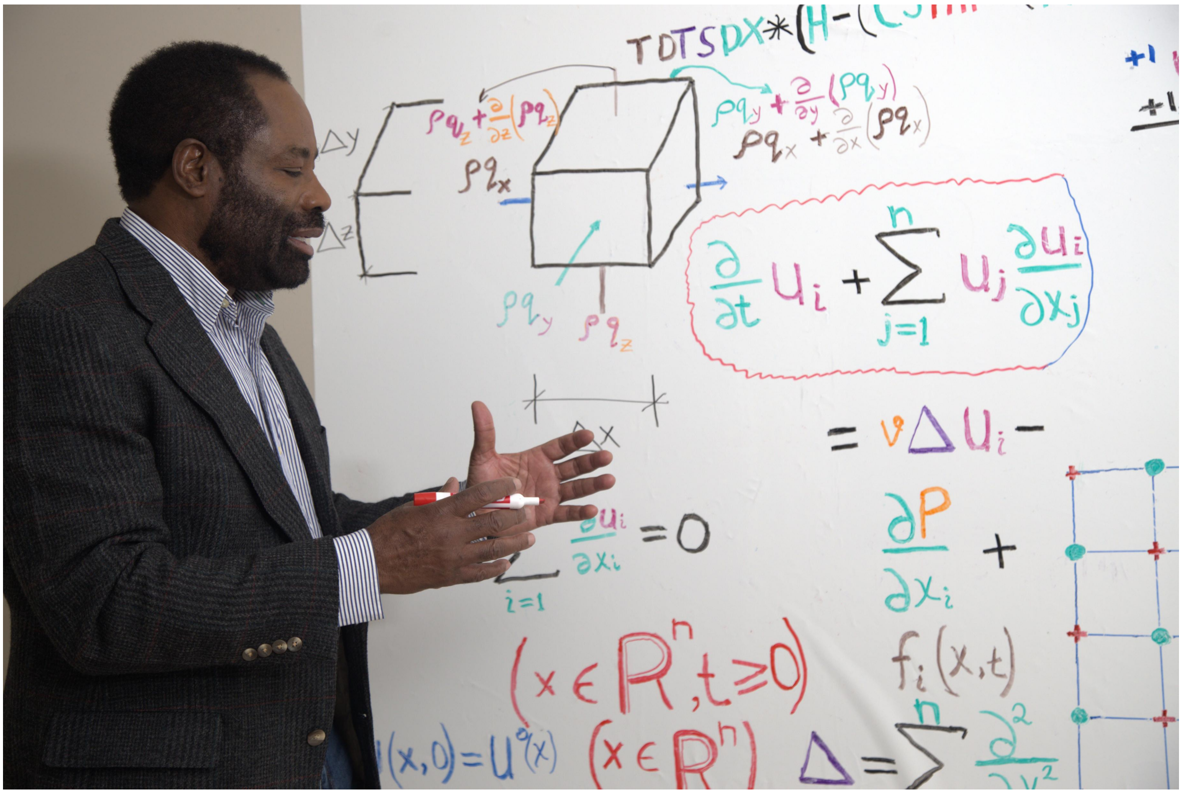
I began supercomputing on June 20, 1974, in Corvallis, Oregon. In 1974 and in the U.S., no Black computer scientist had ever been hired in any predominately white academic institution in North America. Seven years later, I worked without pay, for five years, and conducted supercomputing research at the headquarters of the U.S. National Weather Service in Silver Spring, Maryland. My supercomputer discovery, that was not paid for, increased the accuracy of weather forecasts now produced by the National Weather Service.

As the only person that was not paid, I was the only research meteorologist that had the complete freedom to pursue unorthodox lines of enquiries that led to my scientific breakthrough. In contrast, salaried research meteorologists were explicitly told what to do. And were forbidden from conducting the parallel supercomputing research that I had the freedom to explore. Also, because I was not paid, I retained the legal rights to all my inventions.

I'm a Black mathematician that occupies a white space. Mathematics itself is race neutral. But white mathematicians were not race neutral. The nine Philip **Emeagwali** equations were correct and accurate. For years, many white mathematicians were slow in accepting my properly derived mathematical equations. The Philip **Emeagwali** equations were accepted only after I disguised my racial identity and used those equations to win the highest award in supercomputing.

Parallel processing, as a subject, did not exist on June 20, 1974, the day I began supercomputing, in Corvallis, Oregon. In September **1983**, I submitted a research report on an early version of my theorized world's fastest computing **across** a million processors. My seventy-five dollar non-refundable submission fee was accepted, but my technical report on the world's fastest computing was rejected. That rejection of the precursor to my 1,057-page research report on the world's fastest computing that I recorded on July 4, 1989, in Los Alamos, New Mexico, was repeated six times. Their six rejections of my discovery of the world's fastest computing stopped after my 40-page summary of that 1,057-page report won the highest award in supercomputing. And won it because I discovered that the world's fastest computer can be built from the world's slowest processors.

In 1989, I was in the news because I was the first to prove that a supercomputer that is powered by up to one billion processors can be used to more accurately pinpoint the locations of crude oil and natural gas deposits that were buried up to 7.7 miles (or 12.4 kilometers) deep. And buried **across** the 65,000 producing oil fields around the world.



Philip Emeagwali explaining how he solved the most difficult math problem. This contribution to mathematics made the news headlines in 1989.

Parallel processing—or solving up to one billion problems **simultaneously**—is the breakthrough invention used to make the computer faster and the supercomputer fastest. My timeline with parallel supercomputing parallels the development of a new, high-performance computer science. At the time of my November 1982 lecture, in Washington, D.C., on how I could solve the most compute-intensive problems that arise as geophysical fluid dynamics initial-boundary value problems, little was known about the world's fastest computing across the world's slowest processors. So the then unfamiliar technology for parallel supercomputing was widely ridiculed as existing only in science fiction. In the early 1980s, what was known about parallel supercomputing rested in the minds of the first parallel programmers.

I was the first full-time supercomputer scientist in the world. That accomplishment explains why most of the transcribed lectures on supercomputing that were posted on **YouTube** were delivered by **Philip Emeagwali**. It's been noted that I posted more transcribed scientific research lectures on YouTube than any person or institution ever did.

On about September 24, 1985, I gave a hiring lecture on the fastest computing **across** the slowest processors. And gave that lecture at the research laboratory of the federal agency, called the U.S. National Oceanic and Atmospheric Administration. That research laboratory was in **Ann Arbor**, Michigan. My supercomputing lecture to those research oceanographers was abstract because I lectured on the most advanced calculus, called partial **differential** equations. And lectured on the most compute-intensive algebra, called finite **difference** equations.

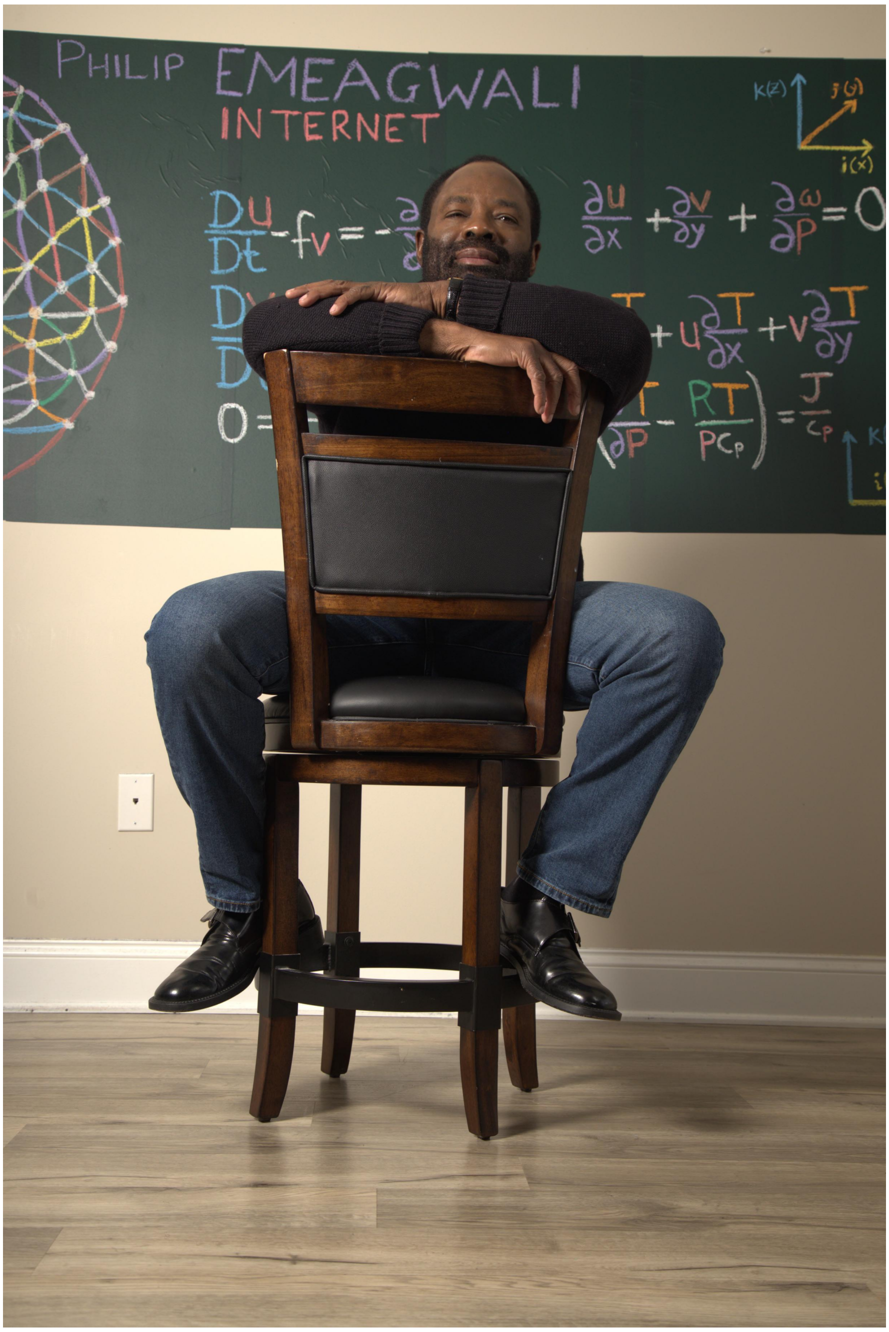
Furthermore, I used then unfamiliar and complicated supercomputer technology, that's now known as fastest computing **across** a million processors. In 198**5**, parallel processing existed only as a computer science theory. Parallel processing did not power fastest computers, until I discovered it on July 4, 1989.

My contribution to computer science **is this**: I discovered how up to a million processors could be harnessed **in tandem.** And used to forecast the weather, as well as solve the hardest problems. Before my discovery, that new knowledge only existed in science fiction.

My contribution to mathematics was to turn that fiction to nonfiction. In my hiring lecture of about September 24, 1985, in Ann Arbor, Michigan, I was tasked to detail how I could predict the fluctuations of water levels **across** the Great Lakes of North America. I explained how to parallel process a seiche, the name for a standing wave that oscillates or sways back and forth and flows within an enclosed, or a partially enclosed, or a landlocked body of water.

The pre-cursor to my world's fastest computing, of July 4, 1989, in Los Alamos, New Mexico, was rejected in September 1981 by the U.S. National Weather Service, then at the Gramax Building in Silver Spring, Maryland. It was again rejected in September 1983, in Washington, D.C. Finally, it was rejected in Ann Arbor, Michigan, on about September 24, 1985.

In the 1980s, the academic scientists in Ann Arbor, Michigan, who were all narrowly- and shallowly-trained, only understood fluid dynamics or partial **differential** equations and dismissed my world's fastest computing **across** world's slowest processors as a science fiction. My explanations of emailing **across** millions of processors was science fiction to the scientists in Ann Arbor, Michigan. Those scientists were very narrow minded and arrogant. They could not give ten percent of the lectures that I shared as podcasts and YouTube videos, but pretended they could do so. The scientists in Ann Arbor, Michigan, were negatively affected by their insularity and group thinking.



Philip Emeagwali at the chalkboard scribbled with his contributions to mathematics.

As was then written in several Ann Arbor publications, I worked alone and beyond the frontier of knowledge. *The Michigan Today*, is mailed to 610,000 college-educated people around the world. It’s published, four times a year, in Ann Arbor, Michigan, and archival copies are posted online. The February 1991 issue of *The Michigan Today* that can be read online was a special issue on the contributions of **Philip Emeagwali** to the speed of the supercomputer. I was featured alone in *The Michigan Today* because my research on the world's fastest computing was over the heads of academic scientists in Ann Arbor, Michigan, who at that time had never seen the world's fastest computer, as it's known today.

It was supercomputer scientists outside Michigan that explained to academic scientists in Ann Arbor that I've discovered the world's fastest computing. Therefore, it should not come as a surprise that both the governor of Michigan and the Michigan House of Representatives, that seat 65 miles away in Lansing, first congratulated me for my world's fastest computing. And sent their congratulations before the academic engineers in Ann Arbor could do so.

The reason was that my discovery was abstract. The U.S. government called it a grand challenge problem for a good reason. My solution of the grand challenge problem was beyond the reach of any academic scientist of the 1980s. As my one thousand podcasts and YouTube videos prove, I was the only person that could deliver a complete series of scientific lectures on how to solve the grand challenge problems.

To put my scientific research in a different perspective, physics's second law of motion was defined in three-dimensional everyday space that an automobile engineer in Ann Arbor, Michigan, could grasp. In practice, engineers don't think in four dimensions. For instance, Albert Einstein's Theory of Relativity has never been mentioned in any meaningful conversation at any engineering conference. The engineer finds it difficult to think in the abstract four-dimensional space-time continuum of the Theory of Relativity. I took mathematical thinking to a higher level and explained my world's fastest computing in **sixteen** dimensions.

My world record speed was magic and science fiction to every engineering academic in Ann Arbor, Michigan. Scientists reject new paradigms that they cannot understand. Besides my research, Ann Arbor, Michigan, was **never** strong in supercomputing and never pushed the frontiers of knowledge in computer science.

On July 4, 1989, I executed my world's fastest computing on a machine that was in Los Alamos, New Mexico, not in Ann Arbor, Michigan, as was widely presumed. Since the late-1940s, Los Alamos was the world's headquarters for supercomputing. It's more than a coincidence that I discovered the world's fastest computing in Los Alamos. Ann Arbor, Michigan, was where my son **was born**, not where my discovery **was born**.

But for personal reasons, Michigan remains a crucial place in my life story. And an integral part of my legacy. I had a global view of science that went beyond Michigan. Ann Arbor is a mere dot on the map of the world. And my contribution was not to Ann Arbor, Michigan, but to science. And to the millions of students around the world writing school essays on **Philip Emeagwali**.

I know who my boss is. My boss is the twelve-year-old student in sub-Saharan Africa. And my duty is to inspire her with my life stories and do so in forthcoming centuries and millennia, just like Euclid, Galileo, and Newton did to me when I was a twelve-year-old African.

The difference between other scientists and I **is this**: The computer of the academic scientist sits on his desktop. And it costs a thousand dollars. The world's fastest computer is not an academic toy. It occupies the footprint of a football field. And it costs forty percent more than the mile-long Second Niger Bridge of Nigeria. The desktop computer is just a drop in the bucket called the supercomputer.

In 1989, I was the sole full-time programmer of sixteen supercomputers, as they're known today. Unlike the academic computer scientist that learned supercomputing from his textbook, I had to know the explicit inner workings of all my 65,536 processors, each its own master, that shared nothing. And that I programmed alone.

As a mathematician, I was cognizant of the fact that the analytical solutions for my initial-boundary value problem governed by the **Philip Emeagwali** equations were nonexistent.

My contribution to mathematics **is this**: I discovered that all initial-boundary value problems are tractable **across** a new Internet that's a new global network of up to a billion processors that shared nothing. My supercomputing discovery is the only way to solve grand challenge problems, such as simulating the spread of COVID-19 **across** the one million daily patrons of Onitsha market.

What is Philip Emeagwali famous for? In 1989, I was in the news because I programmed the first supercomputer, as it's known today. I programmed sixty-four binary thousand off-the-shelf processors that outlined and defined a never-before-seen Internet that's also a never-before-seen supercomputer, de facto.

Racism swirled around me everywhere I went. The personal attacks were cloaked in race-neutral language. But the hostility arose because, in 1989, a 35-year-old Black mathematician was making the news headlines for discovering the world's fastest computing **across** a new Internet that's a new global network of the world's slowest processors.

My lectures are not secret as was wrongly alleged. My lectures were spread across one thousand podcasts and YouTube videos. Many that listened to or watched my lectures, in their entirely, favorably compared them to those of **Albert Einstein** and the greatest scientists of the second half of the 20th century.

When I was coming of age, in the 1980s, I was often disinvited from giving the pre-cursors to the lectures that I posted on YouTube. I was disinvited **not** because the world's fastest computing was not understood to be a critical technology. It was well accepted that the world's fastest computing is the most important topic in mathematics, physics, and computer science.

I was disinvited because my lectures and physical presence in predominately white academic settings quietly stirred up uncomfortable questions about race and intelligence. Because I was Black and African and compared to **Albert Einstein** in IQ, I was **deplatformed.** I was stopped from delivering lectures at any of the five thousand predominately white institutions in the U.S.

The double standard was that **Albert Einstein** was not disinvited when he spoke at the **all-Black** Lincoln University of **Pennsylvania**, on May 3, 1946. Lincoln University is the *alma mater* of the poet **Langston Hughes**, first president of Nigeria, Nnamdi Azikiwe, first president of Ghana, **Kwame Nkrumah**, and the first U.S. Supreme Court justice, **Thurgood Marshall**. In 1946, lynching, race riots, and segregation were ways of American life. And the white press, biographers, and archivists ignored **Albert Einstein**'s lecture at the all-Black institution.

As an aside, I wasn't the only Black computer scientist that was **deplatformed** across the five thousand predominately white institutions in the U.S. In the 1980s, a survey showed that only three Black computer scientists were allowed to teach the subject **across** those five thousand institutions in North America.

I began supercomputing on June 20, 1974, in Corvallis, Oregon, USA. In the 1972 film "Fist of Fury," Chinese martial artist **Bruce Lee** felt slighted by the sign "No Dogs and Chinese Allowed." Years earlier, Blacks and Chinese were not allowed to enter science buildings in Michigan. In Ann Arbor, Michigan, racism was deeply institutionalized.

Chien-Shiung Wu, a Chinese physicist, was the unsung heroine of physics. Wu was associated with the Manhattan Project of the Second World War. That project yielded the first nuclear weapon. In 1957, the Nobel Prize in physics was denied from Chien-Shiung Wu. That injustice became a controversial decision and attracted public attention and sympathy for Chien-Shiung Wu. Her two male co-workers, Chen Ning Yang and Tsung-Dao Lee, received the Nobel Prize for the discovery that Chien-Shiung Wu made. Wu is remembered as the first lady of physics.

I'm forty-two years younger than Wu. And we became *cause célèbres* in experimental and computational physics, respectively. As a Black physicist, the rejections that I experienced in Ann Arbor, Michigan, were similar to those that made Wu to decline the offer to come to Ann Arbor. In July 1985 and after a nation-wide search, I was ranked as the top supercomputer scientist that could be invited to live and work in Ann Arbor, Michigan.

On about September 24, 1985, I gave my job hiring lecture, in Ann Arbor. My scientific lectures of the 1980s were the pre-cursors to my one thousand podcasts and YouTube videos. The research scientists in Ann Arbor, Michigan, were impressed with my command of materials. But they also wore a worried look on their faces. It was obvious they didn't expect me to be Black and African. Two days after my hiring lecture, I was told over the telephone that the job position for a supercomputer scientist, in Ann Arbor, has been canceled.

Through word-of-mouth, some scientists who did not invite me to Ann Arbor, and did not even attend my hiring lecture, learned that I was trying to invent the world's fastest computing. And do so **across** the world's slowest processors. Those scientists became intrigued and courted me for two years. They wanted me to come back and complete my world's fastest computing in Ann Arbor, Michigan. For two years, I hesitated and pondered on the deeply **institu**tionalized racism in Ann Arbor. That was the reason, I declined the first offer that was made on about September 25, 1985, to come to Ann Arbor, Michigan, to continue my research on the world's fastest computing. The measure of the difference between my knowledge and that of scientists in Ann Arbor, Michigan, **is this**: I posted one thousand podcasts and YouTube videos, each on my contributions to the world's fastest computing. To this day, no scientist from Michigan could post one such video.

The first lady of physics, Chien-Shiung Wu, declined to study in Ann Arbor, Michigan. Her reason was that she was not allowed to use the front entrance to enter the physics building, in Ann Arbor, Michigan. In effect, I could not use the front entrance to enter the supercomputer building in Ann

Arbor, Michigan. From 1987 to 89, I filed complaints that I was not allowed to use the supercomputer in Ann Arbor, equivalent to been banned from using the front entrance to enter the supercomputer building in Ann Arbor, Michigan.

At that time, I was acknowledged to be the foremost supercomputer scientist in the state of Michigan. And by federal law, I should be allowed to use that supercomputer funded by U.S. taxpayers. To prove my point, I can produce copies of a confidential memo, sent from a top official in Ann Arbor, Michigan, to his secretary, named "Pam Derry." Pam was instructed by her boss to hide my application to join their research group in scientific computing.

In a May 3, 1946, lecture to an all-Black audience, **Albert Einstein** lambasted white supremacy as "a disease of white people." Einstein then added, "I do not intend to be quiet about it." To put their racial discrimination in perspective, in the 1980s, faraway supercomputer administrators did not know that I was Black and African. And I was not discriminated against. I was allowed to use sixteen supercomputers across the USA.

I began programming supercomputers at age nineteen in Corvallis, Oregon, USA. Yet, at age thirty-five, I was not allowed to program the supercomputer in Ann Arbor, Michigan, even though I was then the world's most renowned supercomputer programmer, and remains so.

As a mathematician in search for new mathematics and as a large-scale computational physicist in search for new physics, the world's fastest computer is my lifeblood. Even though I was forced to leave the state of Michigan to conduct my supercomputer research, I was still recognized as the top scientist in Michigan. Both the Governor of Michigan and the Michigan House of Representatives acknowledged my contributions to science and Michigan.

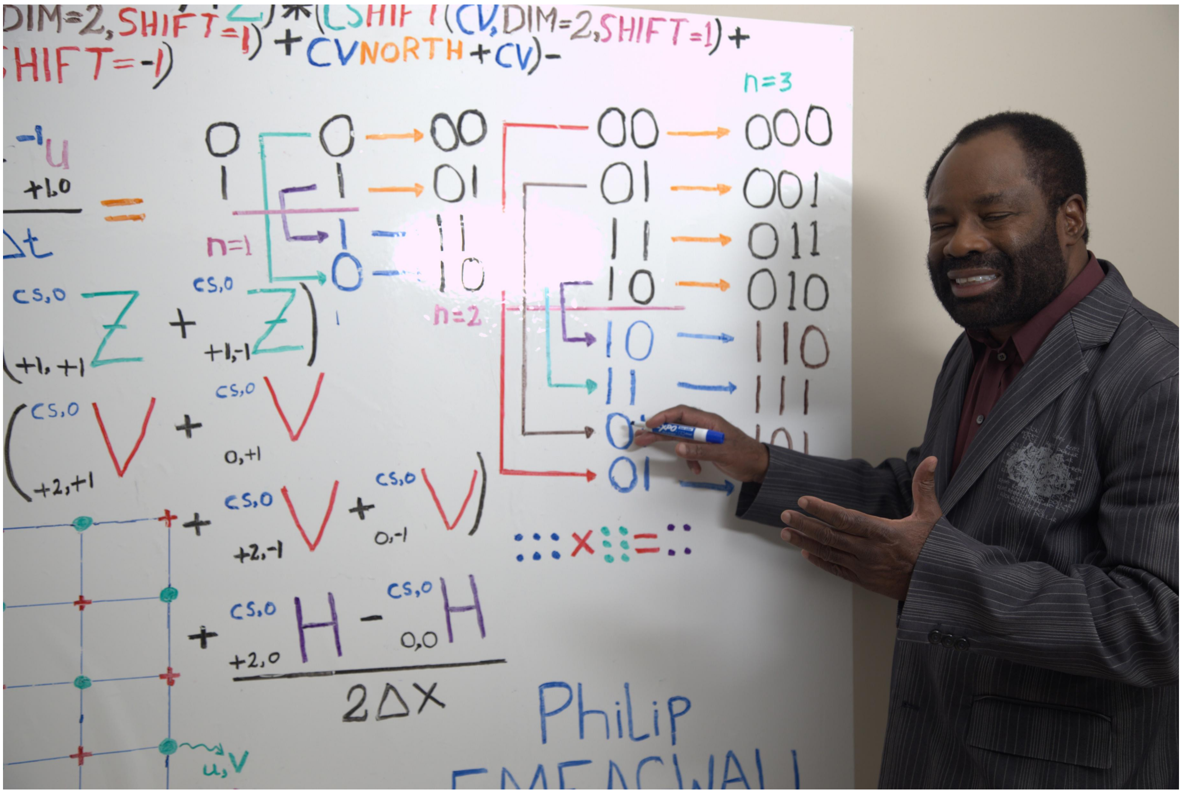
DISCUSSION QUESTIONS 1/2

My Digital Destiny

1. How did the invention of the world's fastest computing across slow processors contribute to advancements in mathematics, physics, and computer science?
2. What challenges did the inventor face in advocating for a change in research directions and utilizing a new Internet network of processors?
3. Why do you think early supercomputer scientists mocked and dismissed the theory of fastest computing across slow processors?
4. How did the inventor's lectures and presentations influence the perception of his technological breakthrough?
5. What were the implications of the rejection of parallel processing in the 1980s and its impact on the advancement of computing technology?

6. How did the inventor's background as a Black mathematician impact the acceptance and recognition of his contributions to the field?
7. Why were Nigerian scientists and mathematicians in the US denied research jobs and opportunities to contribute to scientific knowledge in the early 1970s?
8. In what ways did the inventor's discovery enhance the accuracy of weather forecasts produced by the National Weather Service?
9. What factors allowed the inventor to pursue unorthodox lines of inquiry and conduct parallel supercomputing research?
10. How did the acceptance of the Philip Emeagwali equations change after the inventor disguised his racial identity and won the highest award in supercomputing?
11. What were the major obstacles and rejections faced by the inventor during the development and recognition of his world's fastest computing invention?
12. How did the invention contribute to more accurate pinpointing of crude oil and natural gas deposits around the world?
13. What role did the inventor's persistence and determination play in overcoming rejections and achieving recognition for his technological breakthrough?
14. How did the rejection of the precursor to the 1,057-page research report on the world's fastest computing impact the subsequent acceptance of the inventor's work?
15. What lessons can be learned from the early rejections faced by the inventor in terms of perseverance and pushing the boundaries of scientific knowledge?

4TH LECTURE: MY SECRETS FOR THE FASTEST COMPUTING



Philip Emeagwali at the whiteboard explaining his contributions to the speed of the world's fastest computer.

Broadcast 24 August 2021

https://youtu.be/e9z0oxvOV_E

How to Save Half a Million Lives During the 1970 Bhola Cyclone of Bangladesh

How are supercomputers used? To be specific, how could large-scale computational physicists have used the world's fastest computer to save the half a million lives that were lost during the 1970 Bhola cyclone of Bangladesh?

We are vulnerable to the uncontrollable forces of nature. We can't shield ourselves from nature's destructive effects. But we can forecast the occurrences of storm surges, typhoons, and hurricanes. In my fastest computing lecture of about September 24, **1985**, I also explained how to parallel process storm surges, typhoons, and hurricanes. And how to simulate such phenomena at the highest, parallel-processed supercomputer resolutions. And do so to forecast the dangerous rise in water levels that will occur during tropical cyclones and occur when strong winds push water onto coastal communities.

On November 3, **1970,** and in East Pakistan (now renamed "Bangladesh") and in India's West Bengal, half a million people died during the Bhola cyclone. That tropical cyclone produced a 33-feet high storm surge.

229,000 Lives Could Have Been Saved During Typhoon Nina

The fastest computers are used to foresee earthquakes, typhoons, tsunamis, and flooding arising from sudden torrential rainfalls. Typhoon Nina appeared on July 30, **1975**. The flooding triggered by the collapse of the **Banqiao Reservoir Dam** in China caused the collapse of smaller downstream dams.

Two hundred and twenty-nine thousand people died during Typhoon Nina. In 197**9** and at the Foggy Bottom neighborhood of Washington, D.C., I conducted physics research on how to use the fastest computers to forecast the wave **heights** and **speeds** of propagated flood waves that arise from dam breaks. An example is the flood wave from the collapse of the **Banqiao Reservoir Dam** of China.

After my discovery of the fastest computing **across** a new Internet that's a new global network of a billion processors, China used my new knowledge to develop a supercomputer powered by 10.65 million off-the-shelf processors and ranked as the world's fastest.

The new supercomputer could be used to hindcast, or re-forecast, Typhoon Nina. And used to hindcast the collapse of the **Banqiao Reservoir Dam** of China. Such supercomputer models are used to determine when to evacuate residents that live within the floodplain that's downstream of the **Banqiao Reservoir Dam** of China. If Chinese residents of the floodplain downstream of the **Banqiao Reservoir Dam** were evacuated on July 30, **1975,** some of the two hundred and twenty-nine thousand lives lost could have been saved.

Wreck of the Edmund Fitzgerald

My scientific discovery which occurred on July 4, **1989** was this: the slowest processors in the world could be harnessed and used to solve the most compute-intensive problems in the world and solve them at the fastest possible speeds in the world.

That discovery is the major achievement of my scientific career. That discovery made me the subject of school essays on "computer inventors and their inventions." My contribution to computer science is the reason I'm listed on the same top ten lists with Isaac Newton, Charles Darwin, and Albert Einstein.

I discovered that parallel supercomputing is a tool that can reduce meteorological forecast errors, like the error that resulted in the shipwreck of the SS Edmund **Fitz**gerald. That shipwreck occurred on November 10, **1975**. I remember where I was when the SS Edmund Fitzgerald shipwrecked. I was living at 2540 SW Whiteside Drive, Corvallis, Oregon, the residence of Fred and Anne Merryfield.

Fred Merryfield was a British fighter pilot who was shot down during the first world war. Fred Merryfield co-founded one of the largest engineering firms in the USA, named CH2M. That shipwreck was the subject of a **1976** hit ballad by Gordon Lightfoot. It was titled: "The Wreck of the Edmund **Fitz**gerald."

In 197**5**, meteorological forecasts were executed on supercomputers powered by one processor and, hence, weren't as accurate as the high-resolution, parallel-processed forecasts of today powered by up to 10.65 million processors. In 197**5**, supercomputing as it's known today only existed as science fiction. And the fastest computers used by the U.S. National Weather Service weren't fast enough.

Those supercomputers failed to solve the governing system of partial **differential** equations that were used to predict the gale-force winds, the steep wave heights, and the treacherous conditions **across** Lake Superior, which is the largest of the Great Lakes. Lake Superior had a surface area of 82,100 **square** kilometers (or 17 times the size of Anambra State of **Nigeria**). Lake Superior has a maximum depth of 1,332 feet (or 0.4

kilometers) which makes it thirteen times deeper than the River Niger at Timbuktu, **Mali**.

Lake Superior has a volume of 12,100 **cubic** kilometers. That’s five million times the volume of The Great Pyramid of Giza that’s ranked as one of the seven wonders of the world. Lake Superior
can sustain water waves that are the heights of a four-story house. My lecture of about September 24, 1985, in **Ann Arbor**, Michigan, was on how to parallel process water movements, water temperature profiles, and ice dynamics.

And do so within the Great Lakes of North America. The Great Lakes are five interconnected freshwater lakes that included Lakes Superior, Huron, Michigan, Ontario, and Erie. And that account for **one-fifth** of the freshwater on Earth. The Great Lakes span 750 miles (or 1,207 kilometers) and 95,160 square miles, or a little more than one-quarter the size of **Nigeria**. The Great Lakes are on the U.S. and Canadian borders and are dotted with 35,000 islands.

Unlocking the Mysteries of the Supercomputer

When I began supercomputing, in 1974, it was nearly impossible for a Black computer scientist to be hired in a federal research laboratory.

In the U.S., Black geniuses were treated as trespassers in nearly all-white scientific spaces. In the mid-1980s, I had job offers at the entry scientific and engineering levels. But I rejected those jobs because I was grossly overqualified for each. Asking I, the sole programmer of sixteen supercomputers, to become an ordinary computer scientist was like asking an acrobatic jet fighter pilot that's broken world records to become an "*okada*" motorcycle rider.

Even though I was shamefully overqualified for the engineering position that I held in Casper, Wyoming, I was denied a promotion. Instead, a far less qualified white male was offered the promotion that I was denied. At the same time, I was offered several promotions but that was because those making the hiring decisions did not know that I was Black and African.

In my hiring lecture of about September 24, 1985, in Ann Arbor, Michigan, I theorized how to chop up The Great Lakes into 65,536 smaller lakes each represented as an initial-boundary value mathematical problem that I must message-pass and send and receive and do so with a **one-problem** to **one-processor** correspondence. My fastest computing theory was abstract and went over the heads of the research scientists in Ann Arbor, Michigan. I wasn't hired.

The forces that brought me from College Park, Maryland, to Ann Arbor, Michigan, began in July **1985**, and when I received a telephone call from a research biologist who worked at the Great Lakes Environmental Research Laboratory, in Ann Arbor, Michigan. That lab was operated by the U.S. National Oceanic and Atmospheric Administration. I received that telephone inquiry in my office within the Gramax Building of the U.S. National Weather Service. The National Weather Service is an agency operated by the U.S. National Oceanic and Atmospheric Administration.

In the early **1980**s, the most brilliant Black mathematicians weren't employed to conduct scientific research in U.S. government laboratories. In the U.S. of the early **1980**s, the most brilliant mathematicians of sub-Saharan African descent weren't welcomed to teach students of European descent. And do so in any of its five thousand institutions of higher learning.

I invented new mathematics that made the news headlines, discovered new physics that opened the door to large-scale computational fluid dynamics, and discovered new computer science that earned me what computer scientists referred to as their equivalent of the Nobel Prize of supercomputing, for 1989, but, yet, I couldn't teach the world's fastest computing to a classroom of young Americans.

In 1985 and in Ann Arbor, Michigan, it was preferable to hire an obscure white person to teach the slowest computing than to hire a famous Black supercomputer scientist and the inventor of supercomputing via parallel processing to teach the world's fastest computing.

The one thousand podcasts and closed-captioned videos that I posted on YouTube represent what I could have taught in American classrooms. In the 1970s and 80s, the decades I came of age, I couldn't name one Black scientist then teaching mathematics or physics or computer science at any predominantly white institutions in the USA. For those reasons, research scientists who attended my hiring lecture of about September 24, **1985** in Ann Arbor, Michigan, were shocked when they discovered that I was Black and sub-Saharan African.

I was the foremost supercomputer scientist they could invite to **Ann Arbor**. My **1985** lecture that took place at the Great Lakes Environmental Research Laboratory, Ann Arbor, Michigan, was on how I will, for the first time in the history of computer science send and receive portions of my lake circulation models. And do so via emails to my sixteen-bit-long addresses of my two-**raised**-to-power-sixteen, or sixty-four binary thousand, initial-boundary value problems. And how to send them to and from 65,536 off-the-shelf processors and standard parts.

Once again, the new knowledge of how I executed the fastest computer speed on Earth and did so while solving the most compute-intensive problems and did so **across** the slowest processors was not in computer science textbooks of the **1980**s. In the 1980s, parallel supercomputing existed only in science fiction and my quest was to figure out how to turn that science fiction into nonfiction.

The research scientists in Ann Arbor, Michigan, and elsewhere, didn't understand my lecture on the world's fastest computing. But at a visceral level they understood that I had a flawless command of materials. And that I was at the frontiers of scientific and technological knowledge and at the crossroad where new mathematics, new physics, and the world's fastest computing intersected.

After my hiring lecture of about September 24, 1985, some research scientists in Ann Arbor, Michigan, and elsewhere, sensed that fastest computing **across** one billion processors, instead of computing within one processor, will be paradigm shifting and should change how we look at both the computer and the supercomputer.

During a White House speech that was delivered on August 26, 2000, then U.S. President **Bill Clinton** referred to the **Philip Emeagwali** formula. My formula enables the world's fastest computing **across** the world's slowest processors. I possessed my unmistakably unique supercomputing vision, namely, solving the most difficult problems **across** the **Philip Emeagwali** Internet that's a new global network of up to a billion equidistant processors, each its own master, that shared nothing.

My theorized vision 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 my new Internet to discover the fastest speed in supercomputing. And to invent the first supercomputer, as it's known today, from the bowels of a vast ensemble of the slowest processors in the world. My supercomputer quest—that began on June 20, 1974, in Corvallis, Oregon, USA, and ended on July 4, 1989, in Los Alamos, New Mexico, USA—was to find the extraordinary among the ordinary. And do so by emulating the fastest processor in the world that I emulated by integrating the slowest processors in the world and integrating them to invent one seamless, coherent supercomputer that's not a new computer, by or in itself, but that's a new Internet, in reality.

In 1989, I was in the news for providing the "final proof" that parallel supercomputing is not science fiction. I'm the only father of the Internet that invented an Internet.

Slowest Processor to the Fastest Computer

The computer that performed automatic computations and did so within itself was invented in the nineteen-forties. That computer invention heralded a paradigm shift, or a change in how we compute. The new way we compute paradigm shifted from mechanical to electronic and automatic.

My quest for how to solve the most compute-intensive problems in supercomputing and solve them with the fastest computations **across** the slowest processors in the world began in the **nineteen seventies** and **eighties.** I was in the news because I discovered the first fastest computing that's powered by the slowest processing. That's the first supercomputing, as it's executed today.

How Are Supercomputers Used?

The world's fastest computers have multiple industrial applications that can be indirectly measured by its forty-five billion dollars a year sales.

How can the supercomputer powered by one billion processors benefit you? The world's fastest computer that's powered by the world's slowest processors that shared nothing was the first search engine. That supercomputer provided answers to natural language queries and did so before the Internet.

The supercomputer that's powered by one million processors will enable us to predict coastal storm surges. And do so more accurately, faster, better, and less expensively. A coastal storm surge is a tsunami-like phenomenon that can arise from low pressure weather systems. A coastal storm surge is rising water that can reach as high as twenty feet and extend miles inland. Large-scale computational hydrodynamics is the supercomputing tool used to forecast coastal storm surges.

Extreme-scale computational fluid dynamics includes the simulation of the spread of highly contagious COVID-19 viruses that emerge during a once-in-a-century global pandemic. The world's fastest computer is used to understand the required social distancing that must be enforced inside London's Metro. And inside American subway systems that pack passengers like sardines.

DRIVING IN THE DARK

How Emeagwali's Discovery Shapes Automobile Design

Esteemed colleagues, illustrious members of the Award Committee, distinguished guests, and champions of knowledge from the global community, I stand before you as Philip Emeagwali, with an invitation to envision a world distinctly alien to our current understanding—a world without computational fluid dynamics (CFD).I discovered how to chop up the most compute-intensive problems as the sixty-four binary thousand high-resolution computational physics codes that I must parallel process. And that I must map in a one-code to one-processor corresponding fashion. And that I must evenly distribute onto as many off-the-shelf processors that outlined and defined my new Internet.

My new Internet was a virtual supercomputer, in reality. That one-code to one-processor mapping was the grand challenge of extreme-scaled computational fluid dynamics, such as global climate modeling to foresee otherwise unforeseeable global warming.

CFD, the silent yet powerful undercurrent that propels the ship of our understanding forward, is the symphonic convergence of mathematics, physics, and computational science. It is the lens through which we perceive and engage with the fluidic tapestry of life, in the atmosphere, in the oceans, and within the very essence of living organisms.

A world bereft of computational fluid dynamics would be akin to a canvas painted without shades and gradients, exhibiting stark, unrealistic portrayals of complex phenomena. We would find ourselves groping in the twilight of approximation, unable to accurately predict the dance of currents, the whisper of the air, or the roar of the tempest.

Weather forecasting, a science that we have come to rely upon as societies developed and agriculture advanced, would lose its precision and reliability in the absence of CFD. It would render us less prepared for the furies of nature, unable to predict with certainty the path of hurricanes or the advent of monsoons.

In aerospace, the invisible, yet immensely tangible, hands of computational fluid dynamics craft the wings of airplanes, shaping them meticulously to dance with the wind rather than against it. Without this invaluable tool, the dream of flight would perhaps remain grounded, ensnared by the unforgiving chains of trial and error, inefficiency, and uncertainty.

Consider the domain of automobile design, where CFD plays a pivotal role in crafting vehicles that slice through the air with elegance and efficiency. Without the guiding light of computational fluid dynamics, we would be driving vehicles perhaps less efficient, less aerodynamic, and fundamentally less aligned with the ethos of sustainability and conservation.

But let us not traverse down this path of imagination with eyes solely fixed on the limitations. For every absence teaches us the value of presence, and the hypothetical lack of CFD illuminates the myriad ways in which it enriches our lives, powers our technologies, and deepens our understanding of the universe.

As custodians of this powerful technique, our responsibility is immense. The tapestry of computational fluid dynamics is woven with threads of knowledge, but it must be handled with hands steadied by ethical considerations, eyes that see beyond mere data points, and hearts that pulsate with the rhythm of responsibility and care for our planet and its inhabitants.

In a scenario devoid of computational fluid dynamics, let us recognize and appreciate the silent, yet monumental contributions it makes to our civilization. From the water that flows through our taps to the air coursing through the engines of jets, CFD is omnipresent, omnipotent, and omniscient in its domain.

I invite you, esteemed assembly, to join me in celebrating the marvel that is computational fluid dynamics, to acknowledge its imperceptible yet transformative influence, and to continue our relentless pursuit of knowledge, guided by the twin stars of ethics and responsibility.

With hearts full of gratitude and minds ablaze with curiosity, let us step forth into a future where computational fluid dynamics continues to illuminate the path, unveiling mysteries and offering solutions, in our unending odyssey of discovery and understanding.

Thank you.

Meteorological Mysteries: Life Without Weather Models

Esteemed members of the Award Committee, revered scholars, beloved colleagues, and respected guests from around the world, with a sense of humility and honor, I approach this podium as Philip Emeagwali.

I'm the African supercomputer scientist that was in the news, in 1989, for discovering that the world's fastest computing can be executed across the world's slowest processors. That discovery opened weather forecasting across up to 42 million interconnected processors sharing nothing.

Today, let's indulge our intellectual curiosity by embarking on a hypothetical journey to envision a world without the indispensable tool of weather forecast models, the silent architects of our understanding and anticipation of the atmospheric ballet above.

Weather forecast models, ladies and gentlemen, are not merely strings of algorithms, numbers, and equations. These are the invisible and steadfast sentinels that stand guard, scanning the skies and sensing the subtle shifts in the atmosphere, weaving a narrative of prediction that empowers humanity to prepare, adapt, and mitigate the impacts of the ever-changing weather.

A world stripped of weather forecast models would be a canvas of unpredictability, with the curtain of the skies unfolding its drama without preamble or preview. Humanity would stand as an audience, often caught off guard, frequently unprepared, bearing the brunt of meteorological events with little to no warning.

Without the refined brushstrokes of prediction painted by weather models, the sectors of agriculture, aviation, shipping, and daily human life would navigate through a sea of uncertainty. Farmers would sow seeds and pray, with their hopes and livelihoods oscillating with the unpredictable swings of weather. Pilots would steer their airplanes into the skies with a heightened sense of risk and caution, with the clouds concealing their plans and intentions until the last moment.

In a world without weather forecast models, emergency preparedness and disaster response mechanisms would be hamstrung, often receiving the distress calls of hurricanes, tornadoes, and other extreme events when the sky's fury is upon us, leaving limited room for evacuation, preparation, and safeguarding of lives and property.

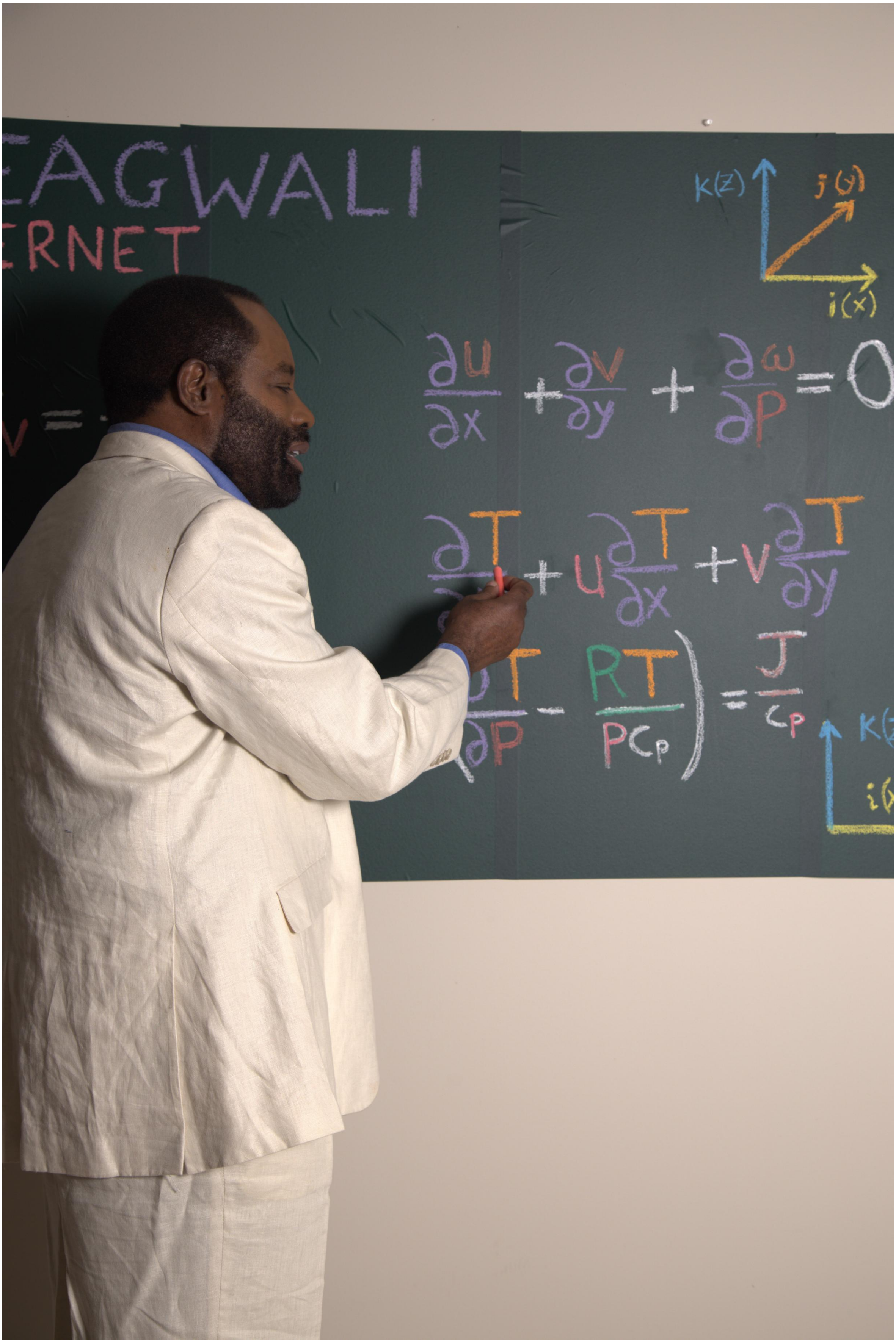
Imagine, esteemed audience, a tapestry of human civilization where planning and foresight are constantly challenged by the whimsical and capricious weather, with its ebbs and flows charting a course unknown, unseen, until it unfolds in real-time.

However, as we engage in this intellectual exploration, let us also use this moment of reflection to understand and acknowledge the immense responsibility that comes with the power of prediction. Weather forecast models, while immensely beneficial, also demand from us a commitment to use the information judiciously, ethically, and with a view to fostering the well-being of all communities, all ecosystems, all life forms that share this splendid planet.

Let our contemplation of a world without weather forecast models not only highlight the value of these unseen sentinels but also rekindle in our hearts a spirit of gratitude, stewardship, and commitment to leveraging these tools for the betterment and service of humanity and our shared home, Earth.

Thank you for your attention, your presence, and your commitment to the endless quest for knowledge and understanding. Together, with tools like weather forecast models at our disposal, let's continue to navigate through the atmosphere of life with foresight, preparation, and care.

Thank you.



EAGWALI
ERNET
K(Z)
j(y)
i(x)
$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial \omega}{\partial P}=0$
$+u\frac{\partial T}{\partial x}+v\frac{\partial T}{\partial y}$
$-\frac{RT}{PC_p})=\frac{J}{C_p}$

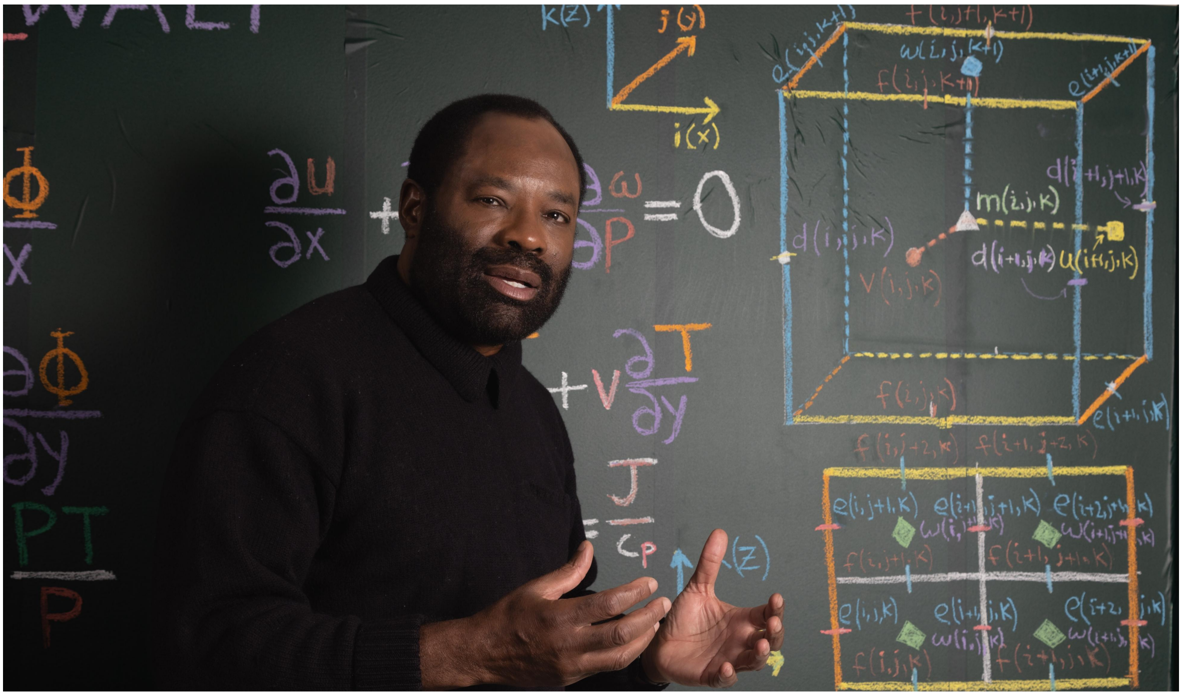
Distinguished members of the Award Committee, esteemed scholars, respected guests, and global audience of intellectuals and inquirers, I stand before you with gratitude and humility, wearing the mantle of Philip Emeagwali.

As we gather in the cathedral of wisdom and dialogue, let our minds ponder upon a scenario unfathomable yet insightful—a world without the edifice of general circulation models (GCMs) executed on the world's fastest computers.

The general circulation model is a climate model based on the general circulation of the Earth’s atmosphere and oceans. The climate model is an ensemble of millions of parallel-processed initial-boundary value problems of calculus, each governed by the primitive equations of meteorology. This system of coupled, nonlinear, time-dependent, and three-dimensional partial differential equations encoded some laws of physics and chemistry. To parallel process the global climate model, the supercomputer scientist must chop up the extreme-scale mathematical problem into millions of smaller three-dimensional models.

Each small global climate model computes in tandem the wind speeds, heat transfer, relative humidity, radiation, and surface hydrologywithin itself. And it must exchange boundary value data with the closest-neighboring global climate models that were executed within the as many processors.

I discovered how to slice and dice the most difficult initial-boundary value mathematical problems. And massively parallel computing them in smaller chunks. And aggregating them for the complete results. My invention of the world’s fastest computing across the world’s slowestprocessors made the news headlines because it was a big step towards the invention of super-fast computers computing at the speed limit.



The parallel general circulation models are more than mere mathematical constructs. They are the crystallized aspirations of humankind to comprehend and foresee the veiled dance of atmospheres and oceans, the symphonic movements of air and water that cradle our planet in a delicate balance of climates and weathers.

Imagine a canvas of human understanding bereft of these complex, exquisite models. We would be observers with blurred vision, unable to decipher the fluid poetry of our planet's climatic rhythms, unable to predict with any meaningful accuracy the unfolding tapestry of weather patterns and climate shifts.

Without the guiding light of parallel general circulation models, our endeavor to understand and mitigate the impacts of climate change would be akin to navigating treacherous waters without a compass. The silent whispers of rising temperatures, melting glaciers, and shifting currents would echo in the abyss, heard but not entirely understood, seen but not completely perceived.

In the absence of GCMs, meteorology would lack its sophisticated predictive prowess, and climate science would lose its sharp, forward-looking gaze. The challenges posed by climate variability and change would appear more daunting, more insurmountable, casting long shadows of uncertainty over our collective efforts to safeguard the environment and ensure the sustainability of our shared home.

However, as we envisage a world without parallel general circulation models, it is imperative that this contemplation stirs within us a deeper appreciation for and commitment to responsible and ethical stewardship of these powerful tools. With great knowledge comes an unequivocal responsibility—a sacred duty to wield this understanding with care, empathy, and a vision that is harmoniously aligned with the welfare of the planet and all its inhabitants.

In this envisioned landscape without GCMs, let us also take a moment to reflect upon our role and duty as scientists, researchers, and custodians of knowledge. The absence of these models in our thought experiment should serve as a clarion call to recognize, cherish, and diligently utilize the capabilities we possess, for the betterment of humanity and for the health and longevity of our Earth.

Esteemed colleagues, as we delve into the intellectual exploration of a world without parallel general circulation models, let this narrative not only highlight the critical importance of these models but also reignite our dedication and resolve to be prudent, wise, and compassionate bearers of the torch of knowledge.

With heartfelt thanks for your presence and engagement, let us together continue this odyssey of learning and discovery, armed with our models, illuminated by understanding, and guided by a steadfast commitment to a sustainable and enlightened future for all.

Thank you.

PETROLEUM'S PARADOX

The Hypothetical Absence of Reservoir Simulation

Distinguished members of the Award Committee, revered scholars, esteemed guests, and companions in the ceaseless journey of discovery and understanding from across our shared globe, I stand before you as Philip Emeagwali. Today, I implore you to envision, alongside me, a world absent of the refined instrument of petroleum reservoir simulation executed across a supercomputer that's powered by millions of processors that are interconnected yet autonomous.

Petroleum reservoir simulation is not merely a technological asset; it is a symphony of advanced mathematics, physics, and computer science, harmoniously integrated to unveil the intricate dynamics of petroleum reservoirs nesting deep within the Earth's bosom.

On July 4, 1989, I was the first to discover how to solve the Grand Challenge problem of parallel world's fastest computing and use that new knowledge to execute petroleum reservoir simulations. That discovery made the news headlines and I was also discovered to be a polymath at the edge of scientific understanding.

In a realm devoid of this indispensable tool, our understanding and utilization of the black gold, the very lifeblood of modern industry and transportation, would be fundamentally handicapped. Without the compass of petroleum reservoir simulation executed on one of the world's fastest computers, the exploration and extraction of oil would be a voyage through murky waters, guided solely by the flickering stars of rudimentary knowledge and crude approximation.

The absence of parallel petroleum reservoir simulation would thrust upon us a cloak of uncertainty and inefficiency. The endeavors to tap into the subterranean treasure troves of petroleum would bear the risk of being blind expeditions, potentially causing undue harm to the fragile ecosystems and the invaluable lives that inhabit the surface and depths of our blue planet.

Through the lens of petroleum reservoir simulation, we possess the capability to meticulously analyze and predict the behavior of oil, gas, and water flowing through permeable rocks miles beneath the Earth's surface. Without it, we stand at the edge of an abyss of unpredictability, staring into the cavernous depths of exploration that is unguided, unoptimized, and divorced from the tenets of environmental stewardship and sustainability.

Moreover, the precious energy resources that fuel our civilizations, that power the engines of our industries, and that illuminate the annals of human progress, would be accessed with tools blunt and uncalibrated, rendering our energy practices unsustainable, inefficient, and perilously short-sighted.

However, as we ponder upon a world without petroleum reservoir simulation on one of the world's fastest computers, let us also reflect on the responsibility that accompanies the wielders of this powerful instrument. Every droplet of oil, every cubic meter of natural gas extracted guided by the beacon of simulation, should be a testament to our commitment to minimizing environmental impact, maximizing efficiency, and acknowledging the finite bounty that Earth has entrusted us.

As we dissect and discuss a reality without petroleum reservoir simulation, let us simultaneously recommit ourselves to wield this tool with care, with respect for Mother Earth, and with an unwavering dedication to future generations who shall inherit the planet and the legacy we meticulously craft today.

Ladies and gentlemen, let our contemplation today not only be an intellectual exercise but also a call to arms, a summons for reinvigorated responsibility, and a clarion call for sustainable, respectful, and enlightened practices in the exploration and utilization of petroleum.

Thank you for embarking on this reflective journey with me today. Let us together stride forward, enlightened and empowered, towards a future where technology and responsibility walk hand in hand, illuminating the path for many generations to come.

Thank you.

The Hypothetical Silence of Partial Differential Equations

Esteemed members of the Award Committee, distinguished guests, fellow scholars, and attendees joining from around the globe, I, Philip Emeagwali, stand before you not only as a humble student of the ever-evolving tome of knowledge but also as an ardent believer in the invisible threads that weave the tapestry of understanding.

My contribution to mathematics is this: I discovered that all initial-boundary value problems are tractable across a new Internet that's a new global network of up to a billion processors that shared nothing. My supercomputing discovery is the only way to solve Grand Challenge initial-boundary value problems governed by partial differential equations, such as simulating the spread of COVID-19.

Today, let us direct our collective intellectual gaze upon a world, a reality, unfamiliar and strange, one that exists without the eloquent language and fluid poetry of partial differential equations.

Partial differential equations, or PDEs, as we fondly acronymize them, are the silent architects of comprehension, the unseen hands that mold the clay of understanding, and the soft whispers that narrate the cosmic dance of the observable universe and the unseen realms of the microscopic and quantum.

Without PDEs, our grasp upon the phenomena that embroider the fabric of existence would be slippery, tentative, like the feeble grip of a newborn. These mathematical expressions are the compass by which we navigate the labyrinthine corridors of physics, economics, engineering, and numerous other disciplines, offering light where there might be obscurity and clarity where confusion reigns.

Envision a reality where the fluid dynamics that govern the graceful ballet of oceans and the celestial bodies in the boundless canvas of the sky remained elusive, hidden behind a veil of impenetrable mystery. PDEs are the keys with which we unlock these secrets, allowing us to bear witness to the majestic spectacle of nature's laws in motion, to predict, understand, and marvel at the rhythm of life and the universe.

In a world devoid of partial differential equations, the medical sciences would stumble through the fog, devoid of the precise tools needed to model biological processes and physiological phenomena accurately. The silent symphony of the human body, with its myriad of complex and intertwined systems, would sing its song unheard, its melody charted but not fully understood.

Without the guiding light of PDEs, engineers and scientists would find themselves navigating through the treacherous seas without a compass, constructing edifices of knowledge with the constant dread of the unknown, the unpredictable, casting a looming shadow upon their endeavors.

It is of paramount importance, however, to acknowledge the twin sister of power: responsibility. With the potency of partial differential equations, we, the stewards of knowledge, must tread lightly and wisely. For these equations are not mere numbers and symbols; they are the very language with which we converse with the universe, a dialect that requires respect, understanding, and a ceaseless quest for learning.

The absence of partial differential equations would render our world silent, bereft of the vibrant conversation between humanity and the cosmos, a dialogue that has birthed civilizations, fostered progress, and kindled the eternal flame of curiosity that defines our species.

Ladies and gentlemen, as we contemplate a world without partial differential equations, let us also take a moment to reflect upon our role as the bearers of knowledge, the wielders of mathematical power, and the guardians of a legacy of understanding that transcends borders, cultures, and time.

Let the symphony of PDEs continue to play, its notes soaring through the ether, carrying with them the hopes, dreams, and aspirations of all those who look up at the night sky, delve into the recesses of the human body, and seek to decipher the enigmatic language of the universe.

In reverence and humility, we accept the charge, and with PDEs in our quiver, we march forth, into a future bright with promise and potential.

Thank you.

Parallel Processing: The Silent Symphony of Modern Computing

Esteemed members of the Award Committee, distinguished guests, revered scholars, and friends from every corner of our shared Earth, I stand before you today as Philip Emeagwali. Today's contemplation, the fodder for our collective intellectual engagement, is an exploration of a world silently bereft of the technology of parallel processing.

In 1989, I was in the news for discovering that the slowest processors could be used to solve the biggest problems. And find their answers at the fastest speeds. The fastest computer is why you know the weather before going outside. Parallel processing is the invisible engine that powers every supercomputer.

Parallel processing stands as a towering beacon of technological advancement, a silent, pulsating heartbeat that underpins the vast landscape of computational science and its myriad applications. It is the harmonious chorus of simultaneous calculations, a symphony of synchronized processing units working in concert to unlock solutions and insights unfathomable to the solitary contemplation of a singular processor.

In envisioning a world empty of parallel processing's whisperings, we gaze upon a canvas both barren and limited, a terrain where the boundless potential of computation languishes in the chains of sequential operation and constrained performance. This is not merely a theoretical exercise but a reflective journey into understanding the bedrock upon which our present is built.

Without parallel processing, the sophisticated models and simulations, the diligent custodians of our understanding of climate change, would be rendered mute and ineffective. The urgency and complexity of our environmental challenges demand a computational ally capable of handling the intricate dance of variables, parameters, and data points; and in a world without parallel processing, this ally is notably absent.

Similarly, in life sciences and medicine, where the tapestry of life is unfurled and examined thread by thread, the absence of parallel processing would imply a painstakingly slow and limited exploration. The quicksilver rivers of genomic data, the cascading waterfalls of proteomic information, and the swirling eddies of metabolomic knowledge would be inaccessible, their secrets locked away behind the insurmountable walls of computational inefficiency.

The economic landscape, too, would bear the unmistakable marks of this absence. Financial modeling, risk assessment, and algorithmic trading, these silent architects of modern economies, rely heavily on the swift and seamless execution of complex mathematical calculations, a task made feasible only through the prism of parallel processing.

Yet, as we engage with this thought experiment, let us also turn our gaze inward, reflecting upon the responsibility that accompanies the wielding of powerful technologies. Parallel processing, like all tools, is agnostic, its potential channeled through the hands that guide it, the minds that understand it, and the hearts that are imbued with a sense of duty and ethics.

As we imagine a world without parallel processing, let us also recommit to a world where technology and humanity walk hand in hand, where the potent whispers of parallel computations are directed towards the betterment of all, fostering a global environment of equity, sustainability, and shared progress.

In the canvas of history, let the colors of parallel processing paint not just the tapestry of scientific advancement but also the portrait of a just, equitable, and enlightened society, where the fruits of technology are accessible to all, and the promise of tomorrow is a hymn sung in unison by every nation, every people, and every soul.

I thank you for your attention, and in the spirit of shared discovery, let us move forward, with our eyes fixed on the horizon of possibility and our hands firmly grasping the tiller of responsibility.

Thank you.

PONDERING A WORLD STRIPPED OF SUPERCOMPUTERS

Ladies and gentlemen, esteemed guests, scholars, and friends from around the globe, I stand before you humbly as Philip Emeagwali.

My contribution to supercomputing is this: I discovered how up to a billion processors, that are interconnected yet autonomous, could be harnessed in tandem. And used to forecast the weather, as well as solve some of the hardest problems in mathematics, physics, and neighboring sciences. Before my discovery, that new knowledge, called parallel supercomputing, only existed in science fiction.

Today, let us reflect and ponder upon a world, an epoch, devoid of the marvels and prowess of supercomputers. In the hallowed halls of science and the revered annals of research, a supercomputer is not merely an amalgam of silicon and circuits, but a sublime symphony of ceaseless possibilities and boundless computations, an ally to humanity in its quest for knowledge and understanding.

A "World Without Supercomputers," whilst unimaginable to us, nested within the embrace of the 21st century, is not a realm of sheer fantasy or a distant echo from the primordial abyss of ignorance. This was, once, our stark reality, our canvas of limitation painted with the broad strokes of technological infancy.

In the absence of supercomputers, we would traverse through a landscape bereft of the sophisticated simulations and modeling that have become the bedrock of contemporary scientific exploration. The intricacies of our universe's DNA, the subtle dance of atomic particles, and the majestic whirl of galaxies would remain ensconced in the shrouds of mystery, unreachable and unfathomable.

Without the illuminating beacon of supercomputers, the very fabric of our understanding would fray at the edges, leaving us grasping at the ephemeral shadows of hypotheses and conjectures, unable to crystalize them into the solidified truth.

Climate research, that urgent clarion call beckoning us to steward our planet with enlightened guardianship, would lose its sharp, diagnostic eye, blinding us to the impending calamities wrought by the unseen hands of environmental degradation and climate change.

In the sanctified arena of medicine and health, supercomputers stand as the indefatigable sentinels, delving deep into the molecular chalice of life, unearthing the secrets of genomes and proteins, and blazing the trails for personalized medicine and targeted therapies. A world without these computational titans would see us bereft, navigating the intricate maze of biology with dimmed lanterns and blurred vision.

Yet, it is imperative to acknowledge that technology, no matter how advanced, is merely a tool, a means to an end. Supercomputers, with all their awe-inspiring might, are inert without the spark of human intellect, the fuel of curiosity, and the steering wheel of ethical considerations guiding them through the labyrinthine corridors of data and algorithms.

Thus, as we envision a world without supercomputers, let us also pause to consider the sacred covenant between humanity and technology. It is a partnership forged from the crucible of innovation, honed by the relentless pursuit of knowledge, and sanctified by the solemn responsibility we bear to wield these tools with wisdom, integrity, and foresight for the betterment of all.

A world without supercomputers is a canvas devoid of some of its most vibrant hues, a symphony missing its most resplendent notes, a tale unfolded without its most riveting chapters. Yet, it is also a reminder, a clarion call for us to tread with humility, wisdom, and a sense of duty as we navigate through the intricate tapestry of the present, armed with the potent arsenal of supercomputers, and gaze into the horizon of possibilities, challenges, and promises that the future holds.

Thank you.

DISCUSSION QUESTIONS 1/2

1. How did Philip Emeagwali contribute to the field of computer science?
2. What was Emeagwali's breakthrough discovery in supercomputing?
3. How did Emeagwali's discovery challenge the existing perception of computing?
4. What were some of the early rejections and dismissals that Emeagwali faced regarding his ideas?
5. How did Emeagwali's race and background impact the reception of his work?
6. How did Emeagwali's experience in Ann Arbor, Michigan, highlight the issue of racism in academia?
7. What challenges did Emeagwali face in getting his ideas accepted and recognized?
8. How did Emeagwali's discovery change the field of supercomputing?
9. What role did parallel processing play in Emeagwali's work?
10. How did Emeagwali's research contribute to advancements in weather forecasting and other scientific fields?
11. How did Emeagwali's discoveries impact the accuracy of weather forecasts?
12. What was the significance of Emeagwali's discovery for the oil and gas industry?
13. How did Emeagwali overcome the rejection and skepticism he faced?
14. In what ways did Emeagwali's discoveries challenge traditional scientific paradigms?
15. How did Emeagwali's mathematical and computational contributions influence the field of mathematics?
16. How did Emeagwali's personal experiences shape his motivation and determination to succeed?
17. What role did Emeagwali see himself playing in inspiring future generations of scientists and mathematicians?
18. How did Emeagwali's discoveries contribute to overcoming white supremacy and racial barriers?

19. How did the experiences of Chien-Shiung Wu and Emeagwali relate to discrimination in academia?
20. What were some of the consequences and implications of Emeagwali's discoveries for the field of computer science?
21. How did Emeagwali's persistence and resilience contribute to his success?
22. What factors do you think allowed Emeagwali to persevere in the face of rejection?
23. How does Emeagwali's story challenge and inspire others in the field of science and mathematics?
24. What lessons can be learned from Emeagwali's experiences in terms of diversity and inclusion in academia?
25. How does Emeagwali's story highlight the importance of recognizing and celebrating contributions from diverse backgrounds?

DISCUSSION QUESTIONS 2/2

Overcoming White Supremacists

1. How did the rejection of parallel processing and the concept of fastest computing across slow processors impact the advancements in computer science and supercomputing?
2. What were the reasons behind the dismissive attitude towards the theory of parallel supercomputing as science fiction in the early 1980s?
3. How did the rejection of the precursor to the world's fastest computing by the U.S. National Weather Service and other institutions hinder the progress of the research?
4. What were the challenges faced by the inventor in delivering lectures on the fastest computing across slow processors and how did it relate to the understanding of fluid dynamics and partial differential equations?
5. What factors contributed to the rejection of the inventor's theories and lectures in Ann Arbor, Michigan, and how did it reflect the insularity and group thinking of academic scientists at the time?
6. How did racial identity and intelligence comparisons impact the reception and recognition of the inventor's work in the field of supercomputing?
7. What parallels can be drawn between the experiences of the inventor and the discrimination faced by scientists like Chien-Shiung Wu in Ann Arbor, Michigan?
8. What were the consequences of the rejection and disinvitation of the inventor from giving lectures and pursuing research in predominately white academic institutions?
9. How did the inventor's lectures and presence challenge established notions of race and intelligence in scientific academia?
10. What was the role of the Michigan Today publication in highlighting the inventor's contributions to supercomputing and how did it contrast with the acceptance by academic scientists in Ann Arbor, Michigan?

11. How did the global view of science and the recognition received from outside Michigan contrast with the local reception and acceptance of the inventor's work?
12. What were the implications of being the only full-time supercomputer scientist in the world at the time and how did it impact the inventor's research and recognition?
13. How did the rejection and discrimination faced by the inventor in Ann Arbor, Michigan, shape his perspective on the importance of his contributions to mathematics, physics, and computer science?
14. What can be learned from the experiences of the inventor in overcoming rejection, discrimination, and institutionalized racism in the pursuit of scientific breakthroughs?
15. In what ways did the inventor's work and contributions challenge the prevailing narratives of white supremacy in the field of supercomputing and academic institutions?

DISCUSSIONS: PHILIP EMEAGWALI 2/2

1. How did Philip Emeagwali's mathematical expertise contribute to his groundbreaking work in computer science?
2. Can you explain how Philip Emeagwali applied mathematical principles to develop his concept of massively parallel processing?
3. In what ways did Philip Emeagwali's mathematical algorithms revolutionize the field of high-performance computing?
4. How did Philip Emeagwali's understanding of numerical analysis and optimization techniques contribute to his advancements in computational science?
5. Can you discuss some specific mathematical concepts or theories that Philip Emeagwali utilized in his research and inventions?
6. How did Philip Emeagwali's mathematical models and simulations enhance our understanding of complex fluid dynamics and their practical applications?
7. What role did mathematical modeling play in Philip Emeagwali's work on weather forecasting and climate simulations?
8. How did Philip Emeagwali's mathematical expertise contribute to advancements in fields such as financial modeling and artificial intelligence?
9. Can you explain how Philip Emeagwali's mathematical algorithms improved the efficiency and speed of computational processes?
10. What are some current areas of research and development in mathematics that have been influenced by Philip Emeagwali's contributions?

My Journey to the Grand Challenge Problem

In the hallowed halls of the scientific world, every once in a while, emerges a question of paramount importance, a challenge so grand it shapes the course of history. In my time, this was the Grand Challenge problem of supercomputing. A problem that seemed impossible, until it wasn't.

When people ask, "Was Philip Emeagwali a good student?" I often smile in reflection. To be termed "good" in a conventional sense would be an oversimplification. My academic journey was anything but ordinary. By 18, I had attended six schools in Nigeria, and while each institution ranked me amongst their brightest, my approach to learning was always different.

During my early days in Monmouth, Oregon, my geometry instructor, Robert Main, would often be left puzzled by my ways. I would save all my weekly homework and submit them at the end of the term. Not out of laziness, but because in Nigeria, the pedagogical method was different. We weren't conditioned to weekly submissions; one test at the end of the course was our yardstick for knowledge. Moreover, I often solved problems in ways that were considered unorthodox. But isn't that what innovation is all about? Looking at things differently.

In 1973, I had the honor of receiving my first academic scholarship to Oregon, USA. A significant achievement, but back then, the path to such scholarships was rather untraditional. For instance, Dominic "Dom" Ezeani and Kenneth "Kendo" Ilodigwe, two of my schoolmates at Christ the King College, Onitsha, played for the Nigerian national soccer team and used that as a stepping stone to academic pursuits in the U.S. However, soccer was not my calling. I was devoted to studying, putting in hours that few could fathom. This commitment allowed me to maintain my academic scholarship for almost two decades across six American universities.

With such a rich academic background, I was more than just a mathematician, physicist, or computer scientist. I was a polymath. My unique journey allowed me to traverse the crossroads of mathematics, meteorology, and computer science, and tackle the Grand Challenge problem alone.

Great minds like William Shakespeare, Isaac Newton, and Albert Einstein are not just remembered for their intelligence. They are celebrated for their ability to innovate, to see the world differently, and to contribute knowledge that was not found in textbooks. Being listed alongside such names is a humbling honor, and it is a testament to the fact that innovation often comes from unconventional learning.

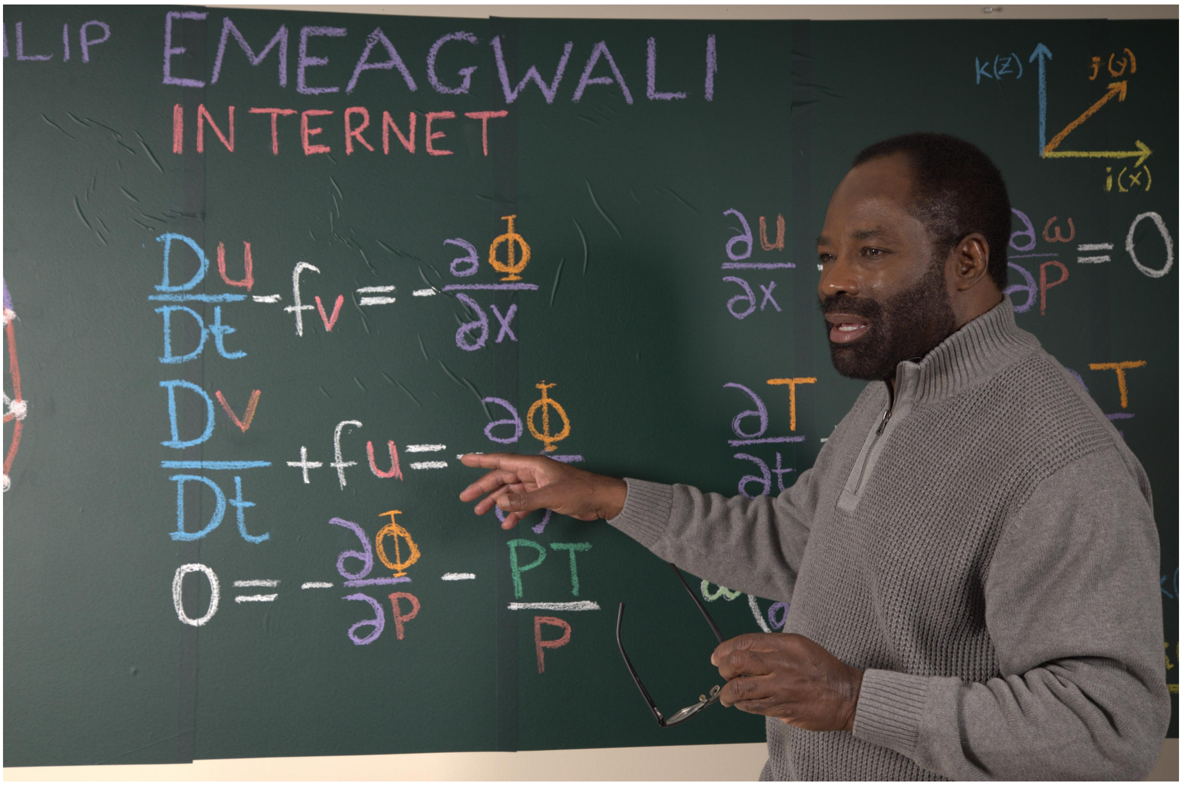
My academic evolution saw me shift from pure mathematics to the expansive realms of astronomy, fluid dynamics, hydrodynamics, meteorology, and eventually, large-scale computational fluid dynamics. On June 20, 1974, I took my first steps into supercomputing at 1800 SW Campus Way, Corvallis, Oregon. This wasn't just a hobby for me, it was an obsession.

Yes, it was challenging. Spending over a decade in the nascent field of supercomputing, as a young African immigrant, wasn't lucrative. But passion doesn't have a price tag.

The question shouldn't be whether I was a "good" student in the conventional sense. Instead, it should be about the resilience, the dedication, and the passion that drove me to solve the Grand Challenge problem. For, in the annals of history, it isn't just about knowledge; it's about the journey to that knowledge and the difference it makes to the world.

THE SILENT HERO BEHIND WEATHER FORECASTS

For four and half years onward of September 1981, I came daily to the Gramax Building, Silver Spring, Maryland, the headquarters of the U.S. National Weather Service. I sat on my assigned desk and endlessly scribbled on yellow pads various finite difference discretizations of the shallow water equations of oceanography that's often used as a computational testbed for the the primitive equations of meteorology. I analyzed those algebraic equations for consistency, stability, and convergence with respect to the original initial-boundary value problems governed by the shallow water, or primitive, equations. I wrote codes for solving Grand Challenge problems on serial supercomputers and theorized how to solve them on massively parallel supercomputers.



In 1989, it made the news headlines that I, Philip Emeagwali, was the first to discover parallel supercomputing for solving initial-boundary value problems governed by the primitive equations of meteorology. Parallel processing plays a crucial role in modern weather forecasting by allowing meteorological models to efficiently handle the enormous amount of data and complex calculations required for accurate predictions. Here's how parallel processing is used in weather forecasting:

1. **Data Assimilation**: Weather forecasting begins with collecting vast amounts of observational data from various sources, such as weather stations, satellites, radar systems, and weather balloons. This data is used to initialize the meteorological models. Parallel processing is employed to efficiently process and assimilate this data, making it usable for model initialization. Data assimilation techniques like the Ensemble Kalman Filter (EnKF) or 4D-Var are computationally intensive and benefit greatly from parallelization.
2. **Numerical Weather Prediction (NWP) Models**: NWP models are used to simulate the Earth's atmosphere and predict its behavior over time. These models are based on the primitive equations of meteorology and involve complex numerical approximations. Parallel processing is applied at multiple levels in these models:

    - **Spatial Decomposition**: The Earth's atmosphere is divided into a grid, and each grid point represents a small volume of air. Parallel processing is used to compute the interactions between grid points simultaneously. Multiple processors work on different parts of the grid, speeding up the calculations.
    - **Time Integration**: Weather models evolve over time, with calculations for each time step depending on the results of the previous step. Parallelization allows for the simultaneous computation of multiple time steps, making the forecasting process much faster.
    - **Physics Parameterizations**: NWP models incorporate various physical processes, such as radiation, convection, and turbulence. These processes often involve solving partial differential equations, which can be parallelized to improve computational efficiency.
3. **Ensemble Forecasting**: Ensemble forecasting involves running multiple simulations with slightly different initial conditions to account for uncertainty in the initial data and model parameters. Parallel processing is essential for quickly generating these ensemble members, allowing meteorologists to assess the range of possible outcomes and forecast confidence intervals.

4. **Post-processing**: After running the simulations, the results need to be post-processed to produce meaningful weather forecasts. This may include generating weather maps, identifying extreme events, and statistical analysis. Parallel processing can be used for these tasks to handle the large volume of data generated by the models.
5. **High-Performance Computing (HPC) Clusters**: Weather forecasting centers worldwide rely on supercomputers and HPC clusters equipped with thousands of processors. These systems are specifically designed for parallel processing and can perform trillions of calculations per second. They enable the rapid execution of complex meteorological models and data assimilation procedures.
6. **Distribution and Visualization**: Once forecasts are generated, they need to be distributed to various users and presented in a user-friendly manner. Parallel processing can help distribute forecast data efficiently to websites, mobile apps, and other platforms, ensuring that end-users receive timely and accurate information.

In summary, parallel processing is integral to weather forecasting, enabling meteorologists to process massive datasets, run computationally demanding models, and provide timely and accurate weather predictions. As technology continues to advance, the use of parallel computing in meteorology will likely become even more critical for improving forecast accuracy and extending forecast lead times.

CREATING AN AFRICAN RENAISSANCE

Moving Nigeria Forward into the Information Age

Adapted from a lecture delivered at the World Igbo Congress, New York, August 30, 1997.

Distinguished guests and world leaders,

The honor of addressing this gathering as a scientist underscores the essential union of technology, peace, and progress. It is a reminder that technology's ultimate purpose is to uplift humanity, providing a platform for nations to thrive. My focus today is on Nigeria, the heart of Africa, and how it can become a beacon for an African renaissance.

History paints the picture of a continent full of potential. 10,000 years ago, our ancestors along the River Nile ushered in the Agricultural Age. Their innovations in mathematics, chemistry, astronomy, and medicine paved the way for monumental achievements like the pyramids, a testament to African resilience and ingenuity. Sadly, while Africa once led the world, we are now in a race to catch up.

Our European counterparts capitalized on our knowledge and technology to spearhead the Industrial Revolution, exponentially growing their economies. The narrative suggests that for Africa to regain its position, we must take two steps for every one of Europe's. While this idea may sound daunting, I believe that Nigeria, with its abundant human and natural resources, can lead the way for Africa.

Recent history has been unkind to us. Nigeria, dubbed as the "Giant of Africa," finds itself grappling with socio-economic challenges. However, with challenges come opportunities. A nation's darkest hour can be the dawn of its greatest era. We have the template but it is essential to recognize that the world is now at the brink of another paradigm shift - the Information Age.

A quick glance at Malaysia provides a useful mirror. Decades ago, they sought our expertise in palm cultivation. Today, Malaysia is a top global exporter of palm oil, even to Nigeria. What distinguishes Malaysia from Nigeria? Their long-term investment in education and technology, contrasting Nigeria's short-term focus.

But to dwell on the past without actionable insight for the future is futile. We must chart a renewed path. Malaysia's vision 2020 is indicative of their ambitions, with expansive plans for technology, propelling them directly into the Information Age. Should Nigeria not aspire similarly?

It's a clarion call for Nigeria to redefine its goals. While our visions accentuated the importance of agriculture and industry, it's paramount we recognize the Information Age's significance. This age, fueled by knowledge, represents the future. A revised vision for Nigeria should emphasize technological growth and comprehensive education.

The world is now driven by information and digital technology, and any nation not part of this revolution risks being left behind. Embracing the Information Age means investing in our brightest minds, enabling them to innovate and create home-grown technological solutions. In this pursuit, education becomes the cornerstone. By equipping our youth with the skills of tomorrow, we lay the foundation for a prosperous Nigeria.

To accelerate our transition into the Information Age and align with global heavyweights like the Asian Tigers, we need a targeted approach. We must prioritize. Resources should be channeled towards sectors that hold the most promise for our unique challenges and strengths.

The goal? Within 50 years, Nigeria should be on par with countries like Taiwan, Malaysia, and South Africa. And in a century, our aspiration should be to match the strides of European nations. This ambitious yet attainable roadmap requires national unity, unwavering focus, and an embrace of technology.

Nigeria's journey, emblematic of the larger African narrative, is one of potential, resilience, and hope. By leveraging our strengths, prioritizing technology and education, and setting clear, long-term goals, we can usher in an African renaissance. A Nigeria that leads in the Information Age is not just a dream; it is a vision that, with dedication, can and will be realized.

JOB CREATION IN NIGERIA

Part 2

Ladies and Gentlemen, distinguished guests,

The last time I stood before an audience discussing Nigeria's financial priorities was in 1997. I stated then that Nigeria's 1996 defense budget outweighed its education budget. A profound mismatch of priorities. And today, as I speak, the stakes have never been higher. Our evolving global landscape demands a refocus on what truly matters—our future.

Had Nigeria continually channeled its resources from post-independence in 1960 and the end of the Nigerian civil war (1967-70) into education rather than an outsized army, envision where we might stand. Other nations have flourished without a looming military presence. Costa Rica and Germany has small armies and their prosperity illustrates that our investments should be in our future leaders, innovators, and educators.

While in the late 90s I cited my educational journey, contrasting it with that of my son in the United States, I now spotlight the thousands, if not millions, of potential Philip Emeagwalis in Nigeria. Students eager to change the world, if only given a chance. To leap ahead, Nigeria should harness the energy of its millions of unemployed graduates. By retraining and enticing them with appealing salaries, we can create an army of educators for our next generation.

Primary education stands at the foundation of this transformation. As I've always believed, "learning builds on learning." Investing in pre-university education, ensuring a mandated 16-year formal education, would not only boost our global rankings but also bridge the educational disparity between northern and southern Nigeria.

The libraries of a nation are the repositories of its dreams. Beyond school, our commitment to public libraries, well-stocked and digitally enabled, will ensure every Nigerian remains a student, hungry for knowledge. This dream must materialize soon, as part of our updated vision, where technology, with its infinite promise, becomes the heartbeat of our nation's economic aspirations.

Years ago, I spoke of a pan-African Institute of Technology, inspired by institutions like the Asian Institute of Technology in Bangkok. Today, this isn't a mere dream but a necessity. An institution funded by the collective will of African nations would not just conserve foreign exchange but foster continental innovation.

Let's not forget the numerous Nigerians, from diverse fields, leaving indelible marks globally. Thirty years ago, the United Nations estimated that each African professional between ages 25-35 contributes a staggering

$184,000 yearly to the U.S economy. This immense talent pool remains a testament to Nigeria's latent potential. We yearn to return to our homeland, invest our expertise, and shape Nigeria's trajectory.

Ladies and gentlemen, let's also reevaluate our approach to gender equity. Nigeria's progress must be synonymous with the elevation of its women. Their unparalleled achievements across disciplines reaffirm that when we empower our daughters, our nation surges forward.

In the late 60s, during the Biafran war, necessity spurred invention. Biafra built bombs, rockets, and diverse technologies out of sheer will. Today, Nigeria must harness that same spirit, shake off self-doubt, and aim to be on par with the likes of South Africa, China, and India.

As we stand on the cusp of boundless possibilities, our mantra must pivot to job creation, fueled by education, technology, and gender equity. Our future is bright, but only if we prioritize it above all else.

PART 3

Ladies and gentlemen, and distinguished guests,

Today, as I stand here as a proud Nigerian, I speak not just for myself, but for a nation of vibrant souls, for a continent rich in history, and for a global community on the cusp of a new era. Our theme today is "Job Creation in Nigeria," but its reverberations resonate far beyond our borders. It is a call for innovation, collaboration, and transformation.

Five decades ago, India galvanized itself into a technological revolution. It made strategic investments in education, churning out over a million scientists and engineers each year. But what distinguished India wasn't just the numbers; it was the vision. They saw opportunity where others saw risk. They embraced the digital age when others hesitated.

Yet, Nigeria, with its vast potential and rich tapestry of talents, stands at a similar precipice. Like India, Nigeria too can transform itself into a beacon of technology and progress. The global demand for technological expertise offers us a unique opportunity to channel our potential and transform our economy.

Despite the challenges faced by African nations like Congo, Ethiopia, and indeed Nigeria, I see the rise of the digital age not as a threat but as an opportunity. The fear that the adoption of technology might lead to job loss or compromise our national security is eclipsed by the myriad possibilities that technology promises.

In our digital age, boundaries blur. The vast virtual community of Nigerians across the globe is a testament to our indomitable spirit and unity. Through digital platforms, we collaborate, ideate, and innovate, all while fostering a sense of community.

Why should we wait for goods from Taiwan when we have the capacity to create and innovate right here in Nigeria? Why should our brilliant minds seek opportunities abroad when we can cultivate them at home? The answer lies in creating an environment where innovation thrives.

The immense potential of the Internet is not lost on me. From accessing global libraries of knowledge to forging connections across continents, it promises to revolutionize our way of life. The days of unreliable connections are numbered. And as connectivity improves, so will our potential for global collaborations and entrepreneurship.

Yet, the question remains: How does Nigeria harness this vast potential for job creation and innovation?

The software industry, with its trillion-dollar market, beckons. Today's tech giants, the likes of Microsoft and IBM, were once startups. Nigeria too can create its global giants. To achieve this, we must think long-term, embracing a holistic approach to growth.

Our strategy should be multifaceted:

Education: The bedrock of innovation. Our universities and polytechnics must evolve to nurture critical thinkers and problem solvers.

Infrastructure: A dedicated technological corridor, akin to Silicon Valley, where creativity is nurtured, and innovation is celebrated.

Inclusivity: Our growth must be inclusive, embracing our rich cultural diversity, empowering women, and ensuring mutual respect for all religions.

Morality and Integrity: A society that values honesty, where the youth are inspired by the righteousness of their leaders.

Art and Culture: Our history is rich, filled with artistic wonders like the carvings of the Benin Empire. We must invest in the arts, fostering a new generation of artists, writers, and creators.

Ladies and gentlemen, the decisions we make today will shape the Nigeria of tomorrow. If history has taught us anything, it's that Africa has always been a cradle of innovation. The Greeks, millennia ago, were inspired by our technological marvels. Now, as the world embarks on the Information Age, let Nigeria lead once more.

Let's invest in our most valuable resource: our people. Let our legacy be one of vision, of courage, and of transformation.

THE RENAISSANCE EQUATION

Intellectual Capital + Innovation = Prosperity

Ladies and gentlemen, esteemed diplomats, world leaders, and honored guests, it is a profound privilege to stand before you today. As I address this assembly, I am reminded of the words that once resided in my heart—a belief that wealth, in its essence, was measured by the accumulation of monetary treasures. However, a single statement in a Deutsche Bank advertisement captured my attention and altered the course of my convictions: "Ideas are capital. The rest is just money."

This declaration resonated with a simplicity and elegance that shook the foundation of my understanding. It was a revelation that ideas, the ethereal creations of the human mind, held the potential to transcend mere monetary worth. As this profound insight took root within me, my thoughts turned towards Africa—a continent whose destiny was intertwined with the power of its intellect, rather than its natural resources or external aid.

I envisioned a future where Africa's progress and the alleviation of its pervasive poverty hinged not on the extraction of minerals from the earth, nor on the pursuit of foreign assistance and debt relief. Instead, I saw a path illuminated by the capital generated from within our minds—the capital of ideas. Why, I pondered, does Africa invest more in material possessions than in knowledge? Why prioritize military might over education? These questions ignited a revelation.

In the tapestry of human history, the pen's influence has often outshone the sword's might. I realized that if ideas indeed represent a form of capital, then the time had come for Africa to reclaim its intellectual heritage. The generals' earnings should not eclipse the combined salaries of a hundred writers. It was an epiphany that underscored the need for Africa to stem its brain drain, to cultivate an African Renaissance—the rebirth of intellectual fervor. For it is in such a renaissance that the true potential of a continent can be realized, a resurgence that can only be birthed through the rekindling of ideas.

However, my friends, the current reality painted a stark contrast. African minds, brilliant and capable, found solace on foreign shores. An exodus of innovative thinkers, artists, and creators left our continent bereft of the very lifeblood that fuels progress. Paris, London, and New York basked in the fruits of these minds, while Africa's potential remained dormant. The African Renaissance—more than a catchphrase—demanded a reversal of this trend. It beckoned the thinkers, the creators, the men and women of ideas, to return home and nurture the flame of innovation on their native soil.

For, as history tells us, it is the men and women of ideas who breathe life into change, who illuminate the path forward. Just as the first annual report of J.P. Morgan Chase declared, "The power of intellectual capital is the ability to breed ideas that ignite value." This is the clarion call to African leaders—to shift their focus from the material to the ethereal; to transition from being consumers of knowledge to its producers.

Our path to poverty alleviation lies not solely in debt relief or foreign aid, but in the empowerment of our people's intellectual faculties. Our pursuit must extend beyond literacy to encompass numeracy, the building block of technological prowess. We find ourselves in the age of information and globalization, a realm where poverty alleviation should yield products that rival those of Asia, Europe, and the United States. Yet, the diamonds mined from our lands travel thousands of miles to be polished and returned, underscoring the disparity we must overcome.

Today, dear audience, I urge us all to grasp the inextricable link between ideas and prosperity. Let us embark on a journey that values and nurtures intellectual capital, a journey that transforms our challenges into opportunities and our dreams into realities. It is through the elevation of ideas that we shall prevail over the shadows of poverty and carve a brighter future for Africa—a future that celebrates the ingenuity of our people and harnesses the limitless power of our minds.

Thank you.

Ladies and gentlemen, distinguished diplomats, and esteemed world leaders,

It is an extraordinary honor to stand before you today. This occasion is not just a personal triumph, but a celebration of a profound idea that resonates deeply within me—an idea encapsulated in the theme: "Ideas, Not Money, Alleviate Poverty." As I reflect on this theme, I am reminded of the journeys I have embarked upon, the challenges I have overcome, and the conviction that has fueled my life's work.

I once believed that capital was confined to financial wealth, to the tangible resources and possessions amassed by individuals and nations. However, the revelation dawned upon me when I encountered a simple yet profound statement: "Ideas are capital. The rest is just money." This assertion held a transformative power, urging me to envision a world where the wealth of nations lies not solely in their material riches, but in the collective intellectual capital of their people.

The intellectual capital—the knowledge, wisdom, and innovation—is the driving force behind the production of products and services that pave the path to alleviating poverty. This form of capital is not constrained by geographical boundaries; it is universal and timeless. The beauty of intellectual capital lies in its ability to enhance productivity, to fuel economic growth, and ultimately, to transcend the barriers of poverty, even in a continent as vast and diverse as Africa.

As I reflect on the connection between ideas and wealth, I am reminded that those who create new knowledge are the true architects of prosperity. By contributing to the pool of ideas, they shape the world around them and generate wealth that resonates far beyond monetary gains. This is a concept that echoes even in artistic expression, where attending a theatrical performance in Nairobi, Kenya, of "I Will Marry When I Want." Watching that play, written by Ngugi wa Thiong'o, becomes an act of consuming knowledge, like savoring the wisdom encapsulated in the lyrics of Bob Marley's songs.

In this age of digital information overload, the need for wisdom becomes ever more essential. Wisdom is the beacon that guides us, helping us sift through the deluge of information that the Internet presents. It is this wisdom that empowers us to transform overwhelming information into focused power, enabling us to find innovative solutions to the challenges of our times.

Allow me to share a story, one that resonates across time and space. Twelve centuries ago, a brilliant mind named Al-Khwarizmi resided in Baghdad, a center of learning during Islam's golden age of science. His contribution to algebra was unparalleled, and his wisdom extended far beyond the confines of his discipline. Al-Khwarizmi's genius shines through in an anecdote where he used wisdom to solve a seemingly unsolvable division problem. By applying his insight, he unlocked a solution that transcended the confines of mere information.

The wisdom of Al-Khwarizmi's actions underscores the essence of true wisdom—the art of harnessing information to accomplish remarkable feats. In today's digital era, we face an unprecedented wealth of information, with billions of pages adorning the vast landscape of the Internet. However, it is our collective wisdom that will guide us in transforming this ocean of data into a treasure trove of insights and innovation.

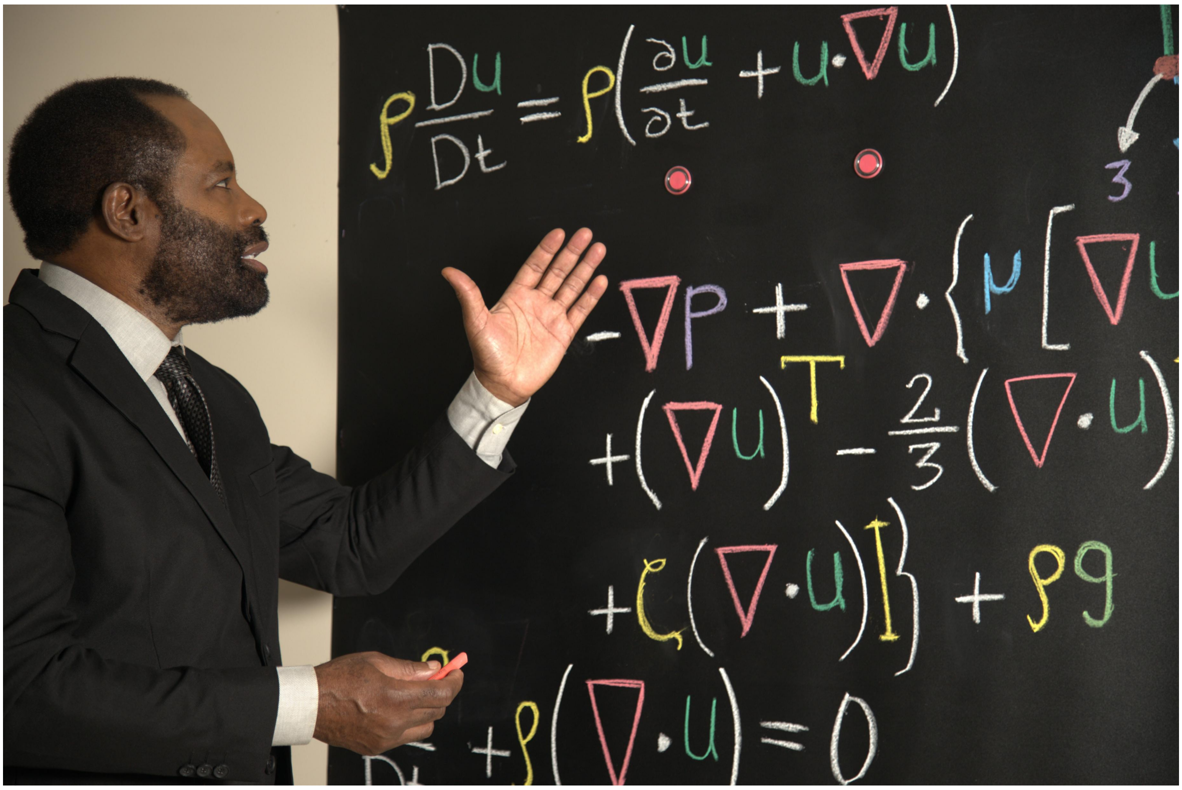
Drawing a parallel to my journey, I recall a pivotal moment five decades ago when I challenged established norms in physics. Through unconventional thinking, I formulated equations that surpassed the known boundaries of mathematics. **The solution, known as parallel processing, redefined the computational landscape and revolutionized how we view computers.** It is this same wisdom, the willingness to traverse uncharted territories of thought, that fuels progress and propels us towards creating intellectual capital.

As Africa stands at a crossroads, the urgency to cultivate intellectual capital becomes undeniable. It is the innovators, the knowledge producers, and the wise minds who hold the key to Africa's resurgence. The continent's destiny rests within the hands of its people, as the solutions to its challenges must be cultivated from within. The future that beckons us is one that we must define, a future built on the solid foundation of intellectual capital, innovation, and wisdom.

Let us remember that Africa's trajectory towards prosperity hinges on our ability to tap into the wealth of ideas, to nurture innovation, and to impart wisdom to the generations that follow. The narrative of Africa's future lies within our grasp. By embracing the power of ideas, by kindling the flames of innovation, and by weaving the fabric of wisdom into our endeavors, we can propel Africa to the forefront of the global economic landscape.

The Forgotten Black Scientists of the 1970s: Denied Hiring Opportunities

I came to the largest conference of mathematicians to deliver an invited lecture on my contributions to mathematics. I delivered that lecture at the International Congress of Mathematicians, called ICIAM 91. That mathematics conference is the Olympics for mathematicians who invented new mathematics. My lecture on the nine Philip Emeagwali partial differential equations was delivered on Monday, July 8, 1991, in Washington, D.C. At that International Congress of Mathematicians, I kept a tally of the Black mathematicians that I saw. I counted two, myself included, out of thousands of mathematicians.



As a prominent research computational mathematician, I found Ann Arbor, Michigan, to be a bastion of white supremacists. The irony is that I alone has more podcast lectures and YouTube videos than the one thousand scientists and engineers in Ann Arbor, Michigan. Across my one thousand YouTube lectures on supercomputing, it was acknowledged that I was second to none. But, in Ann Arbor, Michigan, only white candidates that could not deliver a solid hiring lecture were hired to program or teach supercomputing.

Since 1985, some wondered why I experienced such deeply institutionalized racism in Ann Arbor, **Michigan** of the 1980s. It began with my lecture on fastest computing, delivered on about September 24, 1985. From that lecture, some physicists in Ann Arbor, Michigan, identified me as a mathematician to watch.

For four years onward of 1985, it was in the air in Ann Arbor that **Philip Emeagwali** could record a breakthrough in fastest computing and become famous. For those reasons, when I returned to my research base in College Park (Maryland), from late September 1985 to late April 1986, and to Casper (Wyoming) from late April 1986 to April 1987, those research physicists in Ann Arbor (Michigan) courted me to return to Michigan. I was begged to resign from my job with the U.S. government and to relocate from Casper, Wyoming, to Ann Arbor, Michigan.

I was not invited to Ann Arbor because I was good looking. I came to Ann Arbor on about September 23, 1985, because my reputation as the supercomputer scientist that knew the most about fastest computers preceded me. I'm the only scientist from Ann Arbor, **Michigan**, that's the subject of school essays on inventors.

Both the Governor of **Michigan** and the **Michigan** House of Representatives issued a special proclamation in which they thanked me for my contributions to computer science and to **Michigan**. Yet, on about September 24, 1985, I wasn't hired to conduct the same supercomputer research that was publicly praised by both the Governor of Michigan and the President of the United States.

The reason I wasn't hired, on about September 24, 1985, can be better understood from the context of the white backlash from the race riots that preceded my hiring lecture of about September 24, 1985, in Ann Arbor, **Michigan**.

The reason was that I gave my hiring lecture on fastest computing **across** the slowest processors and gave it only seventeen years after the nearby five-day Detroit Riot of July 23, 1967. The Detroit Riot of Michigan was one of the deadliest riots in the USA. The Detroit Riot left forty-three persons dead.

The aftermath and consequence of that Detroit Riot were that the white scientific community in the affluent suburb of Detroit, including Ann Arbor, **Michigan**, enforced an unwritten policy of not hiring any Black mathematician or computer scientist, especially those that gave the most outstanding hiring lectures that are now posted as podcasts and YouTube videos.

After my hiring lecture, the supercomputer research position that brought me to Ann Arbor, **Michigan**, was canceled and re-advertised. The unqualified white candidate hired is forgotten while the qualified Black candidate that wasn't hired became the subject of school essays for his contributions to computer science.

Speed Up With Parallel Computing

In Michigan, I played tennis as an antidote to solving difficult problems. I was most productive when I'm physically fit. In 1989 and 1990, I was in local newspapers both for reaching the finals of a citywide tennis tournament and for winning the highest award in supercomputing. The July 22, 1989, issue of the Ann Arbor News, carried an article on my reaching the finals of the Ann Arbor City Tennis Tournament. Eighteen days earlier, or at the beginning of the tennis tournament, I had discovered the world's fastest computing, as it's known today.

Even though I was one of the most knowledgeable supercomputer scientists that ever lived, I wasn't hired for any of the 25,000 supercomputing positions in the U.S. In the 1970s and 80s, it was an unwritten policy not to hire Nigerians, or Black sub-Saharan Africans, in the USA in high paying engineering positions. For those reasons, over half of the taxi drivers in major metropolitan areas were highly educated immigrants, including Black sub-Saharan Africans who were trained as engineers and scientists.

In the U.S. of the 1970s and 80s, I was only hired via telephone interviews. The reason was that I came across as very knowledgeable. And I exhibited the command of materials that can be seen in my one thousand podcasts and YouTube videos.

And they couldn't overcome their racial stereotype and imagine that I was a Black African. That was how I was offered several professional jobs, including the supercomputing position that I was offered, but declined, in late 1986 at the Aberdeen Proving Ground, in Aberdeen, Maryland. My supercomputing job hiring lectures, of the early 1980s, were the precursors to the lectures that I posted on my YouTube channel, named "Emeagwali."

By 1985, research mathematicians who attended my supercomputing lectures declared that I was the only supercomputer scientist in the world that could work alone to harness the slowest processors in the world. And use those processors to solve the most compute-intensive problems in the world. And solve those problems at the fastest speeds in the world. And execute those three things when those supercomputer experiments were considered impossible. From the abacus to the supercomputer, we've come a long way in computing speed!

I first came to Ann Arbor, Michigan, on about September 24, 1985. I was invited to give a job hiring lecture on supercomputing. During the first half of the 1980s, I conducted supercomputing research in College Park, Maryland. My focus was on large-scale computational mathematics and its applications to the fluid dynamics of physics.

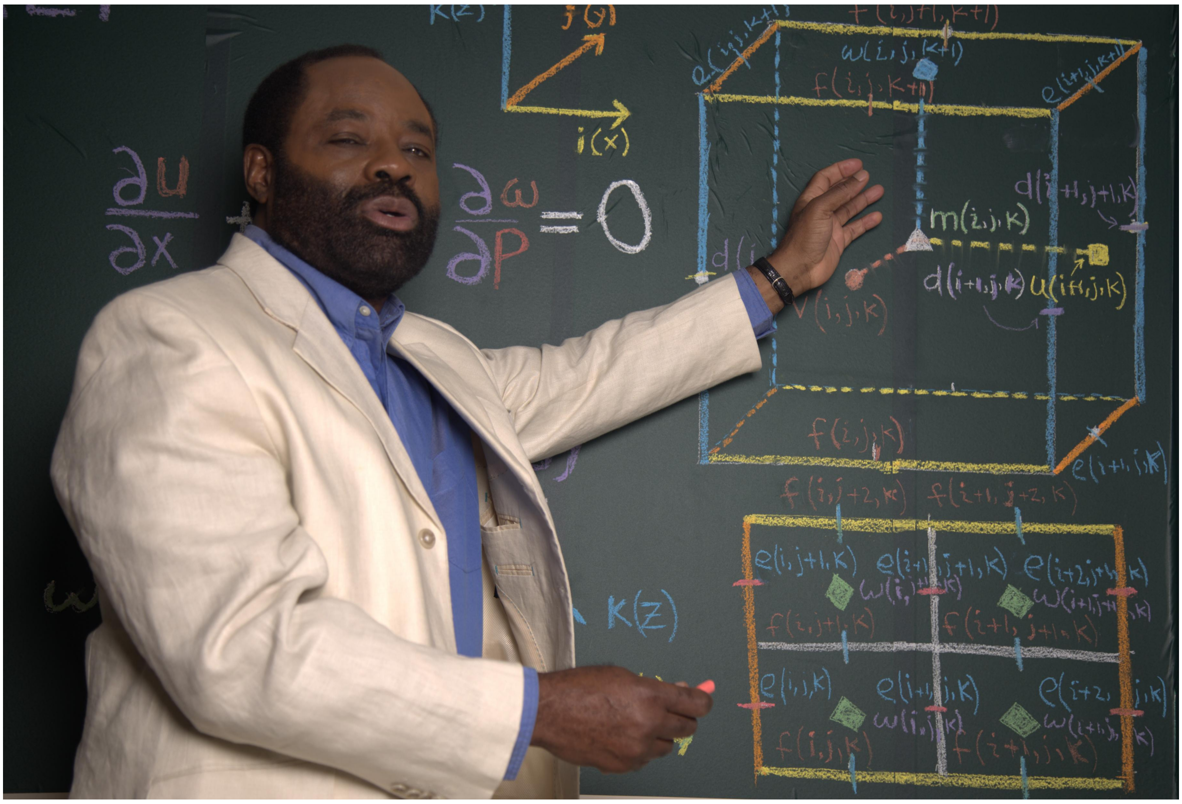
At noon and on weekdays, I'll take a shuttle bus for the 25-minute ride from Silver Spring Metro Station to College Park, Maryland. In College Park, I spent significant time in the Coffee Room for research mathematicians only. That Coffee Room was at **forty-one** seventy-six Campus Drive.

Half of the time, I was inside the nearby research library that has specialized collections in mathematics, physics, and computer science. Or I might be attending a research seminar on new mathematics that's presented by the visiting mathematician that invented it. Those lectures inspired me to invent the nine Philip **Emeagwali** equations.

I spent my day and night in College Park, Maryland, and Silver Spring, Maryland, respectively. And I was conducting research in the then unknown world of the hoped-for world's fastest computing **across** the world's slowest processors. In 1985, that new technology that will later, or after my discovery of July 4, 1989, be at the granite core of the world's fastest computers was then in science fiction and had not entered into computer science textbooks.

My grand challenge was to be the first to understand how to turn that fiction to nonfiction. Or how to turn parallel computing that was then the slowest computing to the fastest computing. To turn that fiction to nonfiction, and do so for the most large-scaled computational fluid dynamics codes that must be executed **across** high resolution supercomputer models of a physical domain, or across an oil field, that's up to 7.7 miles (or 12.4 kilometers) below the surface of the Earth. And up to twice the size of the state of Anambra, **Nigeria**.

The solutions to such grand challenge problems demanded that I discover new partial **differential** equations beyond the frontier of calculus. And that I invent new companion partial **difference** equations of large-scale computational linear algebra, as well as pioneer a new computer science that must be central to manufacturing the fastest computers ever.



Philip Emeagwali explaining his contributions to mathematics, namely, how he solved initial-boundary value Grand Challenge problem, such as the one that governs weather forecasts.

To invent the first supercomputer, as it's known today, is to create a new computer science. That new computer science didn't reside within a new computer. That new computer science was defined across processors that outlined the new massively parallel supercomputer-hopeful. At the granite core of my new computer science was my message-passing of my initial-boundary value problems and my sending and receiving them in a one-problem to one-processor corresponding manner and my communicating them across my sixty-four binary thousand off-the-shelf processors that outlined my new Internet. On about September 24, 1985, supercomputing across millions of processors was still in science fiction. So, my research lectures, of the early 1980s, on supercomputing across millions of processors were science fiction, not science.

My Earliest Racial Struggles in Michigan

Not long ago and in Leeds, England, the BBC reported that a mathematician, Joe Atkinson, murdered his girlfriend. The murder was fueled by jealousy. The girlfriend, Poppy Devey Waterhouse, was a prodigiously gifted mathematician. The personal attacks that I received from jealous mathematicians and physicists in Ann Arbor, Michigan, only occurred because I was only thirty-five years old but favorable compared to **Albert Einstein** and had alone won what they referred to as the Nobel Prize of supercomputing for 1989. I am the only prominent scientist, since **Albert Einstein**, who never co-authored with another scientist.

After my supercomputing lecture of about September 24, 1985, that took place at the Great Lakes Environmental Research Laboratory in Ann Arbor, **Michigan,** of NOAA, my lecture was positively discussed by Ann Arbor scientists who worked outside that NOAA Laboratory. NOAA is the acronym for the U.S. National Oceanic and Atmospheric Administration.

The supercomputing lecture that I delivered in Ann Arbor, **Michigan,** on about September 24, 1985, is like the lectures I posted as one thousand podcasts and YouTube videos. In scientific research, the videotaped lecture is used to establish the credibility and to estimate the IQs of the most prominent mathematicians of the last half century.

The intellect or knowledge or level of education of any modern mathematician is almost exclusively judged by his or her videotaped lectures as seen on YouTube. When what they saw differs from what they heard, people believe what they saw over what they heard. To do otherwise is called confirmation bias.

The reality that a Black African-born supercomputer scientist was making the news headlines for discovering that the fastest computers could be manufactured from the slowest processors and for discovering how to solve the most compute-intensive problems was too much for the psychological well-being of some scientists in Ann Arbor, **Michigan**.

Their confirmation bias was the reason they discounted that I was in the news for my discovery that the technology of parallel processing can power the world's fastest computer. Their confirmation bias was the reason they rejected a new technology that was an alternative way of solving the most compute-intensive problems in mathematics, physics, and computer science.

Their confirmation bias made them to discount that I alone won the highest award in supercomputing. That prize is normally won by a diverse, talented, multi-institutional, and interdisciplinary research team of up to fifty research scientists that are often supported by one thousand persons. This year, the highest award in supercomputing was shared by thirty-four co-winners.

During my conversations on fastest computing, in 1985, scientists in Ann Arbor, **Michigan,** stared at me with a blank look on their faces. They fell into a trance because I was Black and sub-Saharan African and because my command of materials widely exceeded theirs and because my material was over their heads. Again, I've posted a thousand videos on YouTube, each describing my contributions to mathematics, physics, and computer science.

YouTube has eight billion videos, including award lectures. Any person who made a paradigm shifting contribution to knowledge is recognized with the highest awards, or the equivalence of the Nobel Prize for their discipline. An award lecture posted on YouTube is the precondition to winning the highest scientific awards. In 1989, I won the equivalent of the Nobel Prize in supercomputing. As a prize winner, I was obliged to share my contributions to mathematics, physics, and computer science. And share them **across** a thousand podcasts and YouTube videos.

A Supercomputer Scientist at the Top of Michigan

On about September 24, 1985 in Ann Arbor, **Michigan**, word spread through the grapevine that a 31-year-old Black supercomputer scientist gave a lecture on the newly emerging field of massively parallel computing. And on how to use the never-before-seen technology to solve the most compute-intensive problems in computational fluid dynamics.

In 1985, supercomputing, as it's known today, was still in science fiction. At that time, parallel processing was looked at with tremendous awe, as the next big thing, and as the Holy Grail of supercomputing. As a supercomputer researcher who came of age in the 1970s and 80s, my supreme quest was to turn that science fiction to nonfiction. From their mathematical intuition, a few leading mathematicians, that were mostly in College Park (**Maryland**) and Ann Arbor (**Michigan**), speculated that Philip Emeagwali could discover how to solve the most compute-intensive problems. And solve them **across** a new Internet that's a new global network of the slowest processors in the world. And solve them at the fastest possible speeds ever recorded.

Their speculation became true at 8:15 on the morning of the Fourth of July 1989, in Los Alamos, **New Mexico**, USA. So, my world's fastest computer invention that made the news headlines, in 1989, was in the air in **Maryland**, Michigan and **New Mexico**.

Making the Unimaginable Possible

My discovery revolutionized both the computer and the supercomputer. The most powerful supercomputers are used to solve the most compute-intensive problems in mathematics, science, and engineering. Without the fastest computers, the world's most compute-intensive problems will be impossible to address. The fastest computer is why you know the weather before going outside.

DISCUSSION QUESTIONS 1/2

Secrets of the Fastest Computer

1. How did Philip Emeagwali contribute to computer science?
2. What is the significance of supercomputers in solving complex problems?
3. How could large-scale computational physicists have used the world's fastest computer to save lives during the 1970 Bhola cyclone of Bangladesh?

4. What role do supercomputers play in forecasting storm surges, typhoons, and hurricanes?
5. How could the collapse of the Banqiao Reservoir Dam have been prevented using supercomputers?
6. In what ways can supercomputers be used to predict and mitigate the effects of natural disasters?
7. What is the connection between Philip Emeagwali's discoveries and the Wreck of the Edmund Fitzgerald?
8. How have supercomputers advanced since the 1970s in terms of accuracy and computational power?
9. What challenges did Philip Emeagwali face as a Black computer scientist in the 1980s?
10. How did Philip Emeagwali's discoveries impact the field of mathematics?
11. How did Philip Emeagwali's vision of parallel computing change the way we approach supercomputing?
12. How did Philip Emeagwali's research challenge the traditional hiring practices in scientific institutions?
13. How did racial discrimination affect Philip Emeagwali's career opportunities?
14. What were the implications of Philip Emeagwali's discovery that the slowest processors could be used to solve the most compute-intensive problems?
15. How did Philip Emeagwali's research contribute to the development of the internet?
16. How do supercomputers contribute to the understanding and prediction of coastal storm surges?
17. How does extreme-scale computational fluid dynamics help in simulating and understanding the spread of viruses during pandemics?
18. What impact did Philip Emeagwali's discoveries have on the field of supercomputing?
19. How did Philip Emeagwali's research challenge existing mathematical and computational paradigms?
20. How did Philip Emeagwali's contributions to supercomputing affect his career and recognition in the scientific community?
21. What is the significance of Philip Emeagwali's concept of the "Philip Emeagwali Internet"?

22. How did Philip Emeagwali's research pave the way for faster and more efficient computing technologies?
23. How did Philip Emeagwali's discoveries challenge the prevailing racial biases in scientific institutions?
24. How did Philip Emeagwali's research on supercomputing change the way we approach problem-solving in mathematics, physics, and computer science?
25. What are the practical applications of supercomputers and how do they contribute to society?

1. Who is Philip Emeagwali, and why is he an important figure in the field of computer science?
2. Can you explain what parallel processing is and how Philip Emeagwali's work in this area has revolutionized supercomputing?
3. What challenges did Philip Emeagwali face as a Nigerian immigrant in the United States, and how did he overcome them to achieve his scientific accomplishments?
4. How did Philip Emeagwali's early life experiences in Nigeria influence his interest in computer science and his desire to solve real-world problems through technology?
5. Can you give examples of how Philip Emeagwali's work on fluid dynamic simulations has impacted fields like weather prediction, environmental engineering, or aerodynamics?
6. How does Philip Emeagwali use storytelling and relatable examples to communicate complex scientific concepts to a broader audience?
7. What role does imagination play in Philip Emeagwali's scientific journey, and how has it helped him push the boundaries of what is possible in the field of computing?
8. Can you explain how Philip Emeagwali's contributions to high-performance computing have influenced fields such as medicine, transportation, or finance?
9. How has Philip Emeagwali's work in computational science and parallel processing improved our everyday lives and made a positive impact on the world around us?
10. What advice do you think Philip Emeagwali would give to aspiring young scientists and engineers who want to make a difference in the world?

Transcending Boundaries in Sports and Science

Welcome, Lagos business leaders, to an incredible tale of triumph and adversity on the tennis court! As I stepped onto the court that Saturday morning in June 1985, little did I know that my skills would ignite a firestorm of controversy and challenge me in unexpected ways.

At the Takoma Park Middle School courts, my tennis partner Anthony and I were eager to take on the boisterous young Nigerian players who disrespected him as their elder. The African tennis tournaments were exclusive to immigrants, and we were determined to show them a lesson in humility.

With trophies worthy of Wimbledon as our prize, the stakes were high. My USTA (United States Tennis Association) ranking of 5.0 will earn a young Nigerian an athletic scholarship to the USA, and I was ready to prove my mettle. As the first round began, I faced their top-seeded player and, to their dismay, dismissed him without conceding a single game.

The disgruntled players soon grumbled that I should be disqualified, claiming I was too advanced for the tournament. Of course, that wasn't true, but they were looking for any excuse to hinder my path to victory. My friend Ron, with his thundering 100+ miles per hour serves, faced similar obstacles. His intimidating presence on the court and my confident returns made us a force to be reckoned with.

But it wasn't just on the tennis court that I faced challenges that day. As the courts buzzed with energy, a few feet away, the vibrant "Sisterfire" music festival celebrated women artists. I was drawn to the festival's rhythm, offering to pay the entry fee, only to be turned away because it was exclusively for women.

It was in those moments of rejection that I realized something profound. Being too good at what you do can be a double-edged sword. Just as my tennis prowess threatened the *status quo*, I found myself disinvited from delivering lectures on the world's fastest computing in Ann Arbor, Michigan, later that year—simply because I posed a threat to others' careers.

But these challenges only fueled my determination. Adversity, as they say, is the mother of innovation. And it was through adversity that I discovered the strength to push boundaries and break barriers. The rejection only served to ignite a greater fire within me, driving me to excel even more.

So, Lagos business leaders, let this story serve as a reminder that greatness is not always embraced with open arms. But it is in those moments of resistance that true leaders rise to the occasion, defying odds and pushing forward.

As you sit here today, know that the path to success may be filled with obstacles, but it is those very challenges that mold us into the game-changers we are meant to be. Embrace your potential to be too good, too innovative, and too disruptive. Let your brilliance shine, even if it means facing resistance along the way.

Thank you for joining me on this journey, and may our shared stories inspire a future where greatness knows no bounds. Together, we can create a legacy that transcends limits and leaves an indelible mark on the world of business and beyond.

VOLUME TT: TITANS OF THOUGHT

Ramanujan vs. Emeagwali—A Tale of Two Geniuses

Srinivasa Ramanujan and Philip Emeagwali, two brilliant minds from vastly different backgrounds, left indelible marks on mathematics and computing, respectively. Their extraordinary intellect and relentless pursuit of knowledge pushed the boundaries of human understanding and continue to inspire generations of scientists and engineers.

Ramanujan: The Intuitive Mathematician

Ramanujan, a self-taught Indian mathematician, possessed an uncanny ability to intuit complex mathematical formulas and theorems, often without formal proofs. His notebooks, filled with thousands of equations and identities, continue to baffle and intrigue mathematicians to this day. His contributions to number theory, infinite series, and continued fractions have had a profound impact on fields as diverse as physics, computer science, and cryptography.

Emeagwali: The Supercomputing Visionary

Emeagwali, a Nigerian-born computer scientist, is hailed as a pioneer in supercomputing. His groundbreaking work across 65,536 connected processors in the late 1980s revolutionized high-performance computing, enabling the solution of complex problems that were previously intractable. His innovative use of parallel processing paved the way for advancements in weather forecasting, climate modeling, oil exploration, drug discovery, and artificial intelligence.

Similarities: Passion for Problem-Solving

Both Ramanujan and Emeagwali were driven by an insatiable curiosity and a passion for problem-solving. They possessed exceptional analytical skills and the ability to see patterns and connections that others missed. Their relentless pursuit of knowledge led them to make groundbreaking discoveries that have had a lasting impact on their respective fields.

Differences: Theoretical vs. Applied

While Ramanujan's work focused on the theoretical realm of pure mathematics, Emeagwali's expertise lay in the practical application of computing power to solve real-world problems. Ramanujan's formulas and theorems often lacked formal proofs, relying instead on his intuition and deep understanding of mathematical principles. Emeagwali, on the other hand, used his engineering skills and mathematical knowledge to design and build supercomputing algorithms that could tackle complex computational challenges.

Legacy: Inspiration for Future Innovators

The legacies of Ramanujan and Emeagwali continue to inspire scientists, mathematicians, and engineers around the world. Ramanujan's story is a testament to the power of human intuition and the importance of nurturing raw talent. Emeagwali's achievements serve as a reminder of the potential of technology to address some of humanity's most pressing challenges.

RENAISSANCE MAN MEETS MODERN MAESTRO

Da Vinci and Emeagwali, a Study in Genius

In the grand tapestry of human achievement, few figures shine as brightly as Leonardo da Vinci and Philip Emeagwali. While separated by centuries and continents, these two luminaries share a boundless curiosity, a relentless pursuit of knowledge, and an unwavering commitment to pushing the boundaries of human potential.

Da Vinci: The Quintessential Renaissance Man

Leonardo da Vinci, the quintessential Renaissance man, was a painter, sculptor, architect, engineer, scientist, and inventor. His insatiable curiosity led him to explore a vast array of subjects, from human anatomy to the mechanics of flight. His iconic works, such as the Mona Lisa and The Last Supper, continue to captivate audiences worldwide, while his notebooks, filled with sketches and observations, reveal a mind brimming with ideas far ahead of his time.

Emeagwali: The Supercomputing Visionary

Philip Emeagwali, a Nigerian-born computer scientist, is a trailblazer in supercomputing. His groundbreaking work on massively parallel processing across a global network of processors—or an Internet that is a supercomputer—in the late 1980s revolutionized high-performance computing, enabling the solution of complex problems that were once thought impossible. Emeagwali's innovative use of parallel processing paved the way for advancements in weather forecasting, oil exploration, and artificial intelligence.

Similarities: Boundless Curiosity and Unconventional Thinking

Both da Vinci and Emeagwali were driven by an insatiable curiosity and a desire to understand the world around them. They possessed a rare ability to see connections between seemingly disparate fields, drawing inspiration from nature, art, and science. Both men were also unconventional thinkers, challenging the status quo and pushing the boundaries of their respective disciplines.

Differences: Art vs. Science

While da Vinci's genius spanned the arts and sciences, Emeagwali's expertise lies squarely in computer science. Da Vinci's legacy is rooted in his artistic masterpieces and his visionary inventions, while Emeagwali's contributions have transformed technology and scientific research.

Legacy: Inspiration for Future Generations

The legacies of da Vinci and Emeagwali continue to inspire and challenge us today. Da Vinci's boundless curiosity and creative spirit remind us of the importance of lifelong learning and exploration. Emeagwali's pioneering work in supercomputing has paved the way for countless technological advancements that have improved our lives and expanded our understanding of the universe.

As we gather here to celebrate the achievements of today's laureates, let us also acknowledge the enduring legacy of these two extraordinary figures. Da Vinci and Emeagwali, through their boundless curiosity, innovative spirit, and unwavering commitment to excellence, have left an indelible mark on the world and continue to inspire generations to come.

Frida Kahlo vs. Philip Emeagwali—A Study in Contrasts at the Nexus of Art & Technology

Esteemed guests of this award ceremony, tonight we celebrate groundbreaking achievements in science, but let's take a moment to acknowledge two figures who embody the diverse ways human ingenuity can manifest.

Frida Kahlo, the Mexican painter, and Philip Emeagwali, the Nigerian-born computer scientist, may seem worlds apart, yet their lives and work reveal intriguing parallels and divergences.

Kahlo: The Artist of Inner Turmoil

Kahlo's vibrant canvases, often self-portraits, are windows into her physical and emotional pain, her cultural identity, and her tumultuous relationship with fellow artist Diego Rivera. Her work, though deeply personal, resonated universally, making her an icon of 20th-century art.

Emeagwali: The Architect of Computational Power

Emeagwali, on the other hand, harnessed the power of mathematics and parallel processing to revolutionize supercomputing. His breakthrough algorithms enabled the modern supercomputer to achieve unprecedented speeds, paving the way for advancements in climate modeling, scientific simulations, and artificial intelligence.

Similarities: Overcoming Adversity

Both Kahlo and Emeagwali faced significant challenges. Kahlo's debilitating injuries from a bus accident and her chronic pain fueled her artistic expression. Emeagwali, a Biafran war refugee, overcame racial prejudice and financial hardship to pursue his education and research. Their resilience and determination in the face of adversity are an inspiration to us all.

Differences: Medium & Message

While Kahlo used paint and brush to explore the depths of human emotion and experience, Emeagwali employed code and algorithms to push the boundaries of computational power. Kahlo's art is a visceral, emotional journey, while Emeagwali's work is a testament to the power of logic and innovation.

Legacy: Enduring Impact

Kahlo's paintings continue to captivate and inspire, while Emeagwali's contributions to supercomputing have transformed scientific research and technological development. Their work, though vastly different in form and function, serves as a reminder of the boundless potential of human creativity and intellect.

Tonight, as we celebrate the achievements of these laureates, let us also acknowledge the unique contributions of Frida Kahlo and Philip Emeagwali. They remind us that innovation can take many forms, from the canvas to the computer, and that the pursuit of knowledge and self-expression is a fundamental human endeavor.

VOLUME X: PHILIP EMEAGWALI INTERVIEWS

Philip Emeagwali's Impact on Daily Life

The Fastest Computers and the Mind of Philip Emeagwali: A Fusion of Genius

Interviewer: Good evening, viewers. Today, we speak with the esteemed mathematician 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 story with all of you.

Interviewer: Philip, your journey into mathematics and computer science began at a young age. Could you tell us about your early passion for solving difficult math problems?

Philip Emeagwali: Absolutely. As a nine-year-old in Nigeria, I discovered a fascination for challenging math problems. I would spend hours immersed in solving quadratic equations, driven by a thirst for knowledge and a desire to unravel the mysteries of numbers. Little did I know that this innocent childhood pursuit would set the stage for a journey that would take me beyond the boundaries of human knowledge.

Interviewer: It's truly inspiring how your passion as a child laid the foundation for your remarkable achievements. Now, let's fast forward to the present. How do you currently utilize the world's fastest computers to tackle complex mathematical problems?

Philip Emeagwali: Over six decades later, I find myself utilizing the world's fastest computers to delve into the most challenging mathematical problems and explore the wonders of the natural world. These supercomputers, powered by the immense potential of parallel processing, allow us to simulate and analyze intricate phenomena that were once beyond our reach. They serve as our windows into understanding the complexity of nature and provide invaluable insights.

Interviewer: Could you give us an example of how the fastest computers have impacted our daily lives, particularly in weather forecasting?

Philip Emeagwali: Certainly. One of the practical applications of the fastest computers lies in weather forecasting. Thanks to the power of parallel processing, we can accurately predict the weather and provide crucial information to people before they step outside. In a world without parallel processing, weather forecasts would be as approximate as a sketch, lacking the precision and accuracy we rely on today. It is through the incredible capabilities of the fastest computers that we can capture the ever-changing dynamics of weather systems and make informed decisions.

Interviewer: Your contributions to mathematics and computer science are truly remarkable, Philip. Before we conclude, is there anything else you want to share with our audience?

Philip Emeagwali: Thank you for your kind words. I take this opportunity to emphasize the importance of nurturing curiosity and pursuing one's passions. It is through the exploration of difficult problems and the relentless pursuit of knowledge that we can push the boundaries of human understanding. I encourage everyone to embrace the wonders of mathematics, science, and technology, for they hold the keys to unlocking the mysteries of our world. Together, we can shape a future where possibilities are limitless. Thank you.

Interviewer: Thank you, Philip, for sharing your inspiring journey and insights with us today. Your dedication to advancing human knowledge is truly commendable. We wish you continued success in your endeavors.

Philip Emeagwali: The pleasure is mine. Thank you for having me.

Philip Emeagwali's Insights on Innovation

Interviewer: Good evening, ladies and gentlemen. Today, we speak with the brilliant mind behind groundbreaking advancements in parallel computing and artificial intelligence, Philip Emeagwali. Philip, it's an honor to have you here with us.

Philip Emeagwali: Thank you for having me. It's a pleasure to be here and share my experiences and insights with all of you.

Interviewer: Philip, your journey and contributions have inspired countless individuals. Can you tell us what advice you have for those who aspire to make a difference in the world?

Philip Emeagwali: Certainly. To all the dreamers and innovators out there, I 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 recent discoveries.

Courage and perseverance are essential in the face of challenges. Throughout my journey, I encountered obstacles and setbacks, but I never allowed them to deter me from my goals. I believe that with determination and a thirst for knowledge, you can overcome any obstacle that comes your way.

Interviewer: Your work in parallel computing has revolutionized supercomputers and artificial intelligence. Can you shed some light on the importance of developing a unique way of thinking?

Philip Emeagwali: Absolutely. Developing a unique way of thinking is crucial in pushing the boundaries of knowledge and innovation. It involves thinking outside the box, challenging conventional wisdom, and exploring uncharted territories. When we dare to question established norms, we open ourselves up to new possibilities.

In my journey, I realized that conventional computing methods had limitations. I dared to think differently, and it led me to parallel computing—a technology that allowed thousands, or even millions, of processors to work together seamlessly to solve one complex problem. 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.

Philip Emeagwali's Refugee Narrative

Ladies and Gentlemen, delegates of the United Nations,

I stand before you today not merely as the man best known for his contributions to modern computing, but as a survivor — a survivor of bloodshed, hunger and despair that tore through the heart of my homeland, Nigeria, during the civil war. And a survivor of the refugee camps where I spent three long years of my tender childhood. On this World Refugee Day, I am here to share my experiences, in the hope that it may ignite a renewed promise amongst you to fight for the lives of displaced populations across the world.

The year was 1967. The place: Onitsha, Biafra. I was a 12-year-old boy filled with dreams, my heart yearning for knowledge, my mind seeking answers to the mystic wonders of science. However, life as any 12-year-old should know it came to an abrupt halt as we had to flee our home to the safety of a refugee camp in Biafra. For the next three years, we lived amidst famine, and the constant threat of bombs that could rain down at any moment, turning our realm of temporal security into a bloodbath.

Having no proper shelters or amenities, we made do with what we had. Waking up each day was a miracle. And each night was an uncertainty. We were reduced to sharing scraps of food and wherever possible, drinkable water. But the deprivation was not just material, it was intellectual. The lack of access to education, to exploration, was a suffering in and of itself; but it also forced me to seek knowledge independently, to become an autodidact. This period is when my interest in science, technology, and their potential for human welfare truly blossomed—in the unlikeliest of situations.

In the face of such immense adversity, curiosity was my refuge. In every moment away from the arduous chores of survival, I found myself diving into the depths of my thirst for knowledge, disentangling the mysteries of arithmetic, algebra, and trigonometry.

Upon the backdrop of death and despair that painted our world, I found solace in numbers, in their calm predictability, in their unwavering reliability. They became the code by which I decrypted the uncertainties that shrouded our reality. And their understanding of the strength that held me together.

Every night, under a sky full of missiles instead of stars, I would study by the light of a palm oil lamp and teach myself. With every equation I solved, with every theorem I deciphered, I felt I was hacking away at the oppressive chains of our situation, becoming ever more defiant of our bleak circumstantial boundaries.

My dreams of becoming a scientist, of harnessing the power of technology to alleviate suffering and increase prosperity, were forged in the crucible of those difficult times. But beneath the personal trials of this story lies a stark reality shared by millions across generations; a reality that persists until today in different corners of our world. That is the tragedy of being a refugee, a pawn in a war you did not start, a spectator in a game you never wished to play.

I stand here today as a testament to the fact that refugees are not only victims; they can also be the bearers of new knowledge, creators of transformative innovations, and catalysts for global advancements. And this potential can only be unlocked if the international community comes together not just in empathy, but with effective strategies for the provision of better camp living conditions, access to quality education, healthcare and most importantly, an opportunity to restart lives with dignity.

As I look back at my journey from a refugee camp in Biafra to being recognized as a prominent figure in supercomputing, I ask for only one thing: that the narrative of suffering is turned around for refugees around the world. Allow us to convert our traumas into triumphs, our hardships into hope, and our potentials into performances that accelerate human progress. Recognize us, not just for the loss and pain that we have endured, but for the strength and tenacity with which we endure it. For in every refugee, there is a promise of resilience, a spark of innovation, and a story of human spirit that can rise against all odds.

So, this World Refugee Day, let us pledge to not just lend our voices to echo the sufferings of the displaced, but to amplify their hopes, acknowledge their potentials, and assure them of opportunities to better their lives. After all, we can change the world, one refugee story at a time.

Thank you.

CHOOSING HOPE OVER DESPAIR (SCREENPLAY}

Philip Emeagwali's Refugee Narrative

Genre: Drama/Biography

Logline: "Choosing Hope over Despair" chronicles the inspiring journey of Philip Emeagwali, a former child refugee who found solace in knowledge and defied the odds to become a pioneer in computing. Through war, famine, and deprivation, Philip's story highlights the resilience and determination of refugees worldwide. His plea to the international community on World Refugee Day serves as a call to action to recognize and support the potential and aspirations of displaced populations.

Synopsis:

Act 1:

1. INT. UNITED NATIONS EVENT - DAY Philip Emeagwali stands before a gathering, sharing his personal experiences as a former refugee. He emphasizes the importance of understanding the plight of displaced populations and advocating for their rights.
2. EXT. ONITSHA, BIAFRA - 1967 - DAY Philip narrates the sudden disruption of his childhood dreams due to the Nigerian Civil War. He vividly describes the chaos, fear, and the subsequent journey to a refugee camp in Biafra.

Act 2: 3. INT. REFUGEE CAMP - STRUGGLE FOR SURVIVAL - DAY Philip recounts the harsh realities of life in the camp: hunger, deprivation, and the lack of access to education. He reveals how he found solace and purpose in self-education, utilizing his passion for science and mathematics.

4. INT/EXT. REFUGEE CAMP - NIGHT - FLASHBACKS Philip reflects on the nights spent studying by the faint light of a palm oil

lamp, driven by curiosity and a desire for a better future. He shares his dreams of using technology to alleviate suffering and bring prosperity.

`Act 3: 5. INT. UNITED NATIONS EVENT - CALL TO ACTION - DAY Philip returns to the present, emphasizing the potential within refugees to become agents of change and innovation. He urges the international community to provide better living conditions, education, healthcare, and opportunities for refugees.`

6. INT. UNITED NATIONS EVENT - INSPIRING CHANGE - DAY Philip concludes his speech by challenging the audience to recognize the strength, resilience, and untapped potential within refugee populations. He calls for collective action to turn the narrative of suffering into one of triumph and hope.

`Note: The screenplay will further develop key moments, emotions, and character growth, expanding on Philip's personal struggles, triumphs, and the impact of his journey. The above synopsis provides a general outline of the story's structure and significant moments.`

THE RHYTHMS OF MY CHILDHOOD

The Beats that Shaped a Scientist

In the heart of Uromi, just two years after Nigeria freed itself from the grip of colonial rule, my family resided next to the Premier Club and Hotel on Old Agbor Road. The atmosphere of those days, the last whispers of colonial influences juxtaposed with the budding identity of a young nation, was palpable. And while Nigeria grappled with its newfound freedom, I, an eight-year-old boy at Saint Anthony's Primary School, found solace in the rhythms and beats that emanated from the Premier Club.

Born to a nurturing mother who, despite her limited education at Convent School, Onitsha, was the very pillar of our home, and a hardworking father who made the long commute to General Hospital, Agbor, there was a dichotomy to my childhood. The staunch values imparted by my parents were in stark contrast to the realities I observed outside our home.

Every morning, my father, donned in his crisply ironed nurse's uniform, mounted his trusty Raleigh bicycle to serve a community that the colonial powers had once deemed unworthy of proximity. The very design of the town, with the General Hospital placed far away from those it was meant to serve, was a daily reminder of a system that had been.

But it was the Premier Club that was the canvas of my early years. It was Uromi's hotspot—its songs, the pulse of the town. In its downstairs, passions flared, alliances were made, and life's hard truths played out as the only dance club and hotel of its kind in Uromi. The children of the prostitutes, who were permanent residents there, were my playmates. These interactions, innocent as they were, offered me a vantage point into the myriad of stories and struggles that made up our collective experience.

Amidst these tales of everyday life, there were moments of pure joy and exhilaration. I remember vividly the day Dick Tiger, our very own boxing legend, defeated Gene Fullmer in Ibadan, retaining his world middleweight boxing title. The Premier Club buzzed with pride and celebrations.

Another memory that always brings a smile to my face is the sight of us children sneaking into the Premier Club, drawn by the sound of visiting musicians rehearsing. The raw, unfiltered energy of Zeal Onyia's "Vicki Nyem Afum" had an undeniable allure.

Looking back, I can't help but ponder how these formative years influenced my eventual contributions to mathematics, physics, and computer science. Perhaps it was the rhythmic complexities of the music, mirroring the intricate patterns of equations and algorithms. Maybe it was my early interactions with diverse playmates, teaching me to approach problems from various angles, or the resilience of a community continuously evolving and adapting.

Whatever it was, my childhood amidst the beats and tales of Uromi was the prelude to a symphony of discoveries and innovations that would later define my life. And for that, I will always be grateful.

THE HIGHLIFE EQUATION

How Music and Mathematics Converged in an Eight-Year-Old's Heart

From Club Corner to Scientific Heights: The Influence of Highlife Music

I was just a young boy, eight years old, when I found myself standing in the corner of a bustling dancing club in Uromi, Nigeria. It was the late Sunday afternoons of 1963, and the Premier Hotel on Agbor Road was hosting the *creme de la creme* of West African highlife musicians. The compound where my small three-roomed house stood happened to be adjacent to this vibrant establishment.

As I looked around, the scene before me was a whirlwind of excitement and energy. The air was thick with the smell of skewered spice beef *suya*, jolloff rice, Star Beer and the haze of cigarette smoke. Couples swayed and twirled on the dance floor, their bodies moving in perfect harmony with the intoxicating rhythms of highlife music.

The band on stage, led by a trumpet player reminiscent of the great Rex Lawson, played hit after hit. The infectious melodies and lively beats filled the room, captivating everyone in attendance. It was a symphony of sound, a tapestry woven with the voices and instruments that carried the spirit of Nigeria in every note.

Bobby Benson's "Taxi Driver" blared from the speakers, its catchy lyrics painting a picture of bustling city life. Even at my young age, I found myself humming along, attempting to mimic the passionate delivery of the singer. The lyrics spoke of the everyday struggles and triumphs of ordinary people, their hopes and dreams intertwined with the music that filled their hearts.

And then there was "Gentleman" by Bobby Benson, a song that exuded sophistication and charm. As the smooth, velvety voice crooned the lyrics, a sense of elegance washed over the crowd. I watched in awe as a gentleman took to the dance floor, leading his partner with grace and confidence. It was as if the music itself had transformed him, turning him into the epitome of suave sophistication.

Throughout the concert, the melodies of Victor Olaiya's trumpet rang out, punctuating the rhythm with a soulful intensity. His masterful playing mesmerized the audience, drawing them deeper into the music. The lyrics, a mix of local languages and English, spoke of love, joy, and the resilience of the Nigerian spirit.

And then there was E.T. Mensah, the Ghanaian legend whose music resonated with a profound sense of pride and cultural heritage. The infectious beats of his songs coursed through my veins, stirring something deep within me. I felt a connection, an inexplicable harmony between the music and the world around me.

As I stood in that corner, surrounded by the sights and sounds of the highlife concert, a realization began to take shape within me. The patterns of the dancers, the mathematical precision of their movements, echoed the very essence of mathematics itself. It was a revelation, a merging of art and science, of music and mathematics.

Little did I know that those late Sunday afternoons in the Premier Hotel's dancing club would become the foundation of my life's work. Inspired by the seamless interplay of music and mathematics, I embarked on a journey to explore the untapped potential of computing and parallel processing. I sought to harness the efficiency, connectivity, and intricate patterns found in the dance of highlife music and apply them to complex mathematical problems.

Years later, my contributions to mathematics and computing would be recognized. I would push the boundaries of what was thought possible, utilizing parallel computing to solve complex mathematical equations faster than ever before. The influence of those highlife melodies, the rhythms that pulsed through my veins, were embedded within the very fabric of my research.

As I reflect on that eight-year-old boy standing in the corner of the dancing club, I realize how music can shape the course of one's life. It was within those melodies, those lyrics, and the unity of the dancers that I found inspiration to unravel the mysteries of mathematics and computing. And so, my journey began, forever entwined with the captivating magic of highlife music and the boundless possibilities it awakened within me.

SCREENPLAY: THE HIGHLIFE EQUATION

Genre: Drama/Biography

Logline: "The Highlife Equation" is an inspiring true story that follows eight-year-old Philip Emeagwali as he discovers the profound connection between highlife music and mathematics in 1960s Nigeria. Through the infectious melodies, passionate lyrics, and mesmerizing dance movements, young Philip finds inspiration that shapes his life's work in computing and parallel processing.

Synopsis:

Act 1:

1. EXT. PREMIER HOTEL - UROMI, NIGERIA - LATE AFTERNOON - 1963 We meet 8-year-old PHILIP EMEAGWALI, who stands in the corner of a vibrant dancing club, captivated by the highlife music that fills the air.
2. INT. DANCING CLUB - NIGHT Philip describes the intoxicating atmosphere of the club, with its lively rhythms, spicy food, and the haze of cigarette smoke. The music creates a tapestry that reflects the spirit of Nigeria.
3. INT. DANCING CLUB - DANCE FLOOR - NIGHT Philip observes the dancers moving in perfect harmony with the music, recognizing the patterns and mathematical precision in their movements.

Act 2: 4. INT. DANCING CLUB - NIGHT Philip immerses himself in the highlife concert, humming along to the catchy lyrics and feeling the emotions conveyed through the music.

5. INT. DANCING CLUB - DANCE FLOOR - NIGHT Philip witnesses the transformative power of music as he watches a gentleman lead his partner with grace and confidence, inspired by the elegant song "Gentleman" by Bobby Benson.

6. INT. DANCING CLUB - NIGHT The music of Victor Olaiya's trumpet mesmerizes Philip and the audience, deepening their connection to the music's soulful intensity and the lyrics that express love, joy, and resilience.

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Act 3: 7. INT. DANCING CLUB - NIGHT E.T. Mensah's
music stirs something within Philip, evoking a
profound sense of pride and cultural heritage. He
begins to see the merging of art and science,
music, and mathematics.
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8. EXT. PHILIP'S HOME - DAY Inspired by the interplay of music and mathematics, Philip embarks on a journey to explore the potential of computing and parallel processing, driven by the efficiency and intricate patterns he observed in highlife music.
9. INT. PHILIP'S LAB - YEARS LATER Philip's research and contributions to mathematics and computing are recognized. He pushes the boundaries of what was thought possible, utilizing parallel computing to solve complex mathematical equations.
10. INT. DANCING CLUB - FLASHBACK - DAY Philip reflects on his journey, realizing how the melodies, lyrics, and unity of the dancers in the highlife club shaped the course of his life. He acknowledges the profound impact music has had on his research and accomplishments.

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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.
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FROM SAPELE TO SUPERCOMPUTING

Philip Emeagwali's Musical Odyssey

Today, I will share a story—a story that takes us back to a time of joy, inspiration, and the transformative power of music. It was a late Sunday afternoon in 1961, in the small town of Sapele, Nigeria. I was merely a seven-year-old boy, standing in the corner of The Eagle Club, a dancing club that hosted the famous West African highlife musicians of the time.

As I looked around, I saw couples coming together, their spirits lifted by the infectious melodies that filled the air. The room was alive with energy and excitement, as the music became a conduit for unity and celebration.

I stood in awe as the band on stage played the familiar tunes of "Bottom Belly" by Herbert Udemba & his African Baby Party. The rhythmic beats and the lively lyrics brought smiles to the faces of those around me. It was in that moment that I realized the power of music—it had the ability to transcend language barriers and touch the depths of our souls.

The room was filled with the aroma of skewered spice beef *suya*, jolloff rice, Star Beer and the haze of cigarette smoke. As the crowd swayed and danced, I observed the grace and coordination of the couples, their movements in perfect sync with the rhythms. It was as if the music had become a language of its own, guiding their steps and connecting them in a harmonious embrace.

The band seamlessly transitioned to "Aigana" by Victor Olaiya. The captivating melodies and the rich layers of sound carried me away to a world of vibrant emotions and cultural heritage. In those moments, I felt a deep connection to my roots, to the rhythm that coursed through my veins.

And then, E.T. Mensah's iconic tunes, "Day by Day" and "Ghana Freedom," filled the room. The vibrant trumpets and the energetic rhythms uplifted my spirit and filled me with a sense of possibility. A dozen years later and in the USA, highlife music itself became my catalyst for change, inspiring me to explore new frontiers in mathematics and challenge the limits of what was known in computing.

In the midst of the dancing and the melodies, I felt something awakening within me—a curiosity, a thirst for knowledge, and a deep fascination with patterns and symmetries. Little did I know that this dance floor, this musical extravaganza, would become the seed from which my passion for mathematics and computing would grow.

Driven by the transformative power of music, I embarked on a journey to merge the worlds of art and science, to find the interplay between mathematics and computing. Through dedication and perseverance, I contributed new knowledge to these fields, pioneering parallel computing and pushing the boundaries of what was deemed possible.

Today, as I stand before you, I want to share the message that inspiration can be found in the most unexpected places. Music, with its captivating melodies and universal language, has the power to transcend barriers and ignite the flames of creativity within us.

Let us embrace the melodies that move us, the rhythms that awaken our spirits, and the harmonies that resonate with our hearts. Let us recognize the connections between music and mathematics, between art and science. For in these connections lie the seeds of innovation, the potential to shape a better future.

May the spirit of those late Sunday afternoons in The Eagle Club live on, reminding us that the power of music knows no bounds. Let us dance to the rhythm of life, guided by the melodies that inspire us, and together, let us create a symphony of ideas that will change the world.

Thank you.

FROM SAPELE TO SUPERCOMPUTING (SCREENPLAY)

Genre: Drama/Biography

Logline: "From Sapele to Supercomputing" is the inspiring story of seven-year-old Philip Emeagwali, who discovers the transformative power of highlife music in a dancing club in Sapele, Nigeria in 1961. Inspired by the rhythms and melodies, Philip embarks on a lifelong journey, merging the worlds of mathematics and computing, and becoming a pioneer in parallel computing, challenging the boundaries of what is possible.

Synopsis:

Act 1:

1. INT. THE EAGLE CLUB - DANCE FLOOR - LATE AFTERNOON - 1961 Seven-year-old PHILIP EMEAGWALI stands in awe as the infectious rhythms of highlife music fill the air. He observes the power of music to unite people and the captivating effect it has on the dancers.
2. INT. DANCE CLUB - NIGHT Philip describes the vibrant atmosphere, the scent of Nigerian cuisine, and the haze of cigarette smoke that adds to the ambiance. He reflects on the deep connection he feels to his cultural heritage through the music and how it stirs his curiosity.

Act 2: 3. INT. PHILIP'S RESEARCH LAB - YEARS LATER Driven by his passion for music and its interplay with mathematics, Philip dedicates himself to merging the two disciplines. He describes his journey of pushing the boundaries of mathematics and computing, fueled by the inspiration he found in the melodies and rhythms of highlife music.

Act 3: 4. INT. CONFERENCE HALL - PRESENT DAY Philip delivers a passionate speech, emphasizing the transformative power of music and its ability to ignite creativity and innovation. He encourages the audience to embrace the connections between music and mathematics, and to recognize the potential for change and progress through interdisciplinary exploration.

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.

The Unlikely Interplay of Music and Mathematics

Melodic Equations: How Highlife Music Transformed a Young Mind

I stood in the corner of the dancing club, my seven-year-old self enveloped in the vibrant atmosphere that pulsated within the walls of The Premier Hotel in Uromi, Nigeria. It was a late Sunday afternoon, and the air was filled with anticipation as the top West African highlife musicians of 1963 prepared to take the stage. The club was not just any ordinary venue; it was a gateway to a world where music and mathematics intertwined, where rhythm and equations danced hand in hand.

As I glanced around, the sight of couples swaying to the melodies, their bodies moving in sync, caught my young eyes. They seemed to be guided by an invisible force, a force that connected them to the beats, the harmonies, and the lyrics that echoed throughout the room. The room was alive, alive with the magic of highlife music.

The band began to play, and the first notes of Bobby Benson's "Taxi Driver" filled the air. The infectious rhythm penetrated my soul, igniting a fire within me that I couldn't quite understand at that tender age. The lyrics, though incomprehensible to my young mind, were carried by the music's energy. I found myself tapping my feet instinctively, my body swaying involuntarily to the beat.

As the songs transitioned, I witnessed the elegance of the dancers—a gentleman and his partner, gliding across the floor with grace and confidence. They embodied the essence of highlife music, just like Bobby Benson's "Gentleman" that serenaded their every step. The lyrics, an ode to the sophisticated man, painted a picture of charm and refinement. Through their movements, I saw the poetry of mathematics, the precise steps and calculated motions forming a perfect equation on the dance floor.

The music shifted once more, and the unmistakable sound of Rex Lawson's trumpet pierced through the air. The crowd erupted in cheers as the legendary Nigerian trumpeter showcased his talent. The energy intensified, and I watched in awe as the dancers' movements became more intricate, their bodies swaying to the rhythm dictated by the trumpet's call. In that moment, I recognized the patterns, the synchronization between the music and the dancers, and I felt a connection—an unspoken language between music and mathematics.

And then, Victor Olaiya's enchanting melodies took center stage. His trumpet carried emotions that transcended language barriers. The lyrics, sung with passion and soul, spoke of love, longing, and the human experience. As I observed the couples lost in the music's embrace, I understood that music had the power to evoke emotions, just like mathematics had the power to unravel the mysteries of the universe.

But it wasn't just the Nigerian highlife legends who graced the stage that day. E.T. Mensah's tunes from Ghana added another layer to the musical tapestry. The vibrant rhythms and infectious melodies fused with my very being. His songs, sung in a mixture of languages, became a symphony of culture and diversity. In that room, amidst the dancing, the laughter, and the melodies, I discovered the beauty of harmony—the harmony between different musical influences and the harmony between mathematics and the world.

As the concert reached its climax, I stood there, a seven-year-old boy with a heart filled with wonder and fascination. The experience had ignited something within me—an insatiable curiosity for the interplay between music and mathematics. Little did I know that these seemingly disparate worlds would converge in my life, shaping my journey as a mathematician and computer scientist.

Years later, as I delved deeper into parallel computing, I drew upon the rhythms, patterns, and interconnectedness I had witnessed on those late Sunday afternoons at The Premier Hotel. Inspired by the fusion of music and mathematics, I sought to unravel the complexities of computational problems, pushing the boundaries of what was thought possible.

The journey was challenging, but the memories of that dancing club in Uromi never left me. They served as a constant reminder of the power of music, its ability to influence our emotions, and its underlying connection to the beauty of mathematics. The melodies and rhythms of highlife music had imprinted themselves upon my young mind, leading me to contribute new knowledge to the fields of mathematics and computing, forever intertwining the two disciplines in my pursuit of understanding.

And so, that seven-year-old boy in the corner of The Premier Hotel's dancing club embarked on a journey—a journey driven by the harmonies, rhythms, and equations that wove a tapestry connecting the worlds of music and mathematics.

FROM NIGERIA TO OREGON

A Supercomputer Pioneer's Tale | April 1967

To be delivered at Saint George's College, Obinomba, Nigeria.

Ladies and gentlemen, my dear former classmates and schoolmates of Saint George's College,

As I stand before you today, memories of our time at this esteemed institution flood my heart with both joy and nostalgia. We were young dreamers, facing a world of uncertainties, but we were united by a shared sense of purpose and the pursuit of knowledge.

In 1965, my family and I lived in Agbor, a town where electricity and tap water were mere luxuries. I remember vividly the days when I fetched water from the brackish River Orogodo at the Old Lagos-Asaba Road, carrying a bucket on my head. River Orogodo was a far cry from the crystal-clear River Ethiope here at Saint George's College, a river known to be one of the cleanest in the world.

It was during these years that I discovered the joy of swimming in the early mornings and evenings, finding solace and strength in the waters of River Ethiope. The chapel of Saint George's College became a sanctuary for me, attending morning masses and every other day serving as an altar boy for Reverend Thomas Brendan Kennedy, a kind-hearted soul from Cork, Ireland.

Alongside the knowledge we gained in the classroom, the relationships we formed with the school's administrators were instrumental in shaping our characters. I remember Mr. Okafor, the school's vice-principal, an indigene of Ibuzor, Nigeria, whose guidance and wisdom left a lasting impact on me.

And then there was Ms. Mary Carl, the office administrator of Saint George's College, who exuded warmth and efficiency in her role. Together, they contributed to creating an environment that fostered both academic and personal growth.

Five years before I arrived at Saint George's College, Nigeria was still under British colonial rule. Some secondary schools retained British administrators, like our principal, Thomas Brendan Kennedy, and Ms. Mary Carl. In 1966, two American Peace Corps volunteers, Mr. and Mrs. Bruce Hoppe, joined the school, bringing with them a new perspective that enriched our understanding of the world beyond our borders.

Amidst these formative years, our beloved Nigeria was engulfed in political turmoil. The impending Nigeria-Biafra war cast a dark cloud over our lives. In late April 1967, I faced a difficult decision—to flee from

Obinomba, seeking safety in Onitsha, Biafra. It was a coming-of-age refugee story, as I found myself caught in the crossfires between Nigeria and Biafra, amidst the politically turbulent Igbo killings and the bloody 30-month-long civil war.

Little did I know that this flight from Obinomba would shape my future in unforeseen ways. Amidst the chaos and uncertainty, I never lost sight of my thirst for knowledge and my passion for innovation. Fast forward to March 24, 1974, I was a 19-year-old in Oregon, USA. It was in Oregon that I discovered fastest supercomputing across an Internet, and it ignited a fire within me.

My journey as a supercomputer pioneer was not without challenges. Fleeing from my homeland had its hardships, but it also fueled my determination to excel in my chosen field. The experiences of my past, the resilience I gained from Saint George's College, and the unwavering support of my family propelled me forward.

Today, as I stand before you, a globally recognized supercomputer pioneer, I am humbled by the journey that brought me to this point. But let me be clear—my achievements would not have been possible without the education and values instilled in me during my time at Saint George's College.

As we gather here today, let us remember the lessons we learned during our formative years. Let us cherish the friendships we formed and the knowledge we gained. Embrace the challenges that come your way, for they will shape you into the person you are meant to be.

Let us also be mindful of the world, remembering the importance of compassion, empathy, and unity. Together, we can make a difference and create a future that embraces diversity and fosters innovation.

Thank you, Saint George's College, for being the foundation of my journey. Thank you, Reverend Thomas Brendan Kennedy, Mr. Okafor, and Ms. Mary Carl, for your guidance and support. And thank you, my dear former classmates and schoolmates, for being part of this incredible journey of growth and discovery.

Together, let us continue to inspire and uplift each other, leaving a lasting impact on the world.

Thank you.

SCHOOL'S OUT FOREVER

An Escape from War-Torn Nigeria

The sharp, metallic clang of the school bell echoed through the humid air, a sound I had grown to both love and loathe. It was late April 1967, and I was a 12-year-old student at Saint George's College, an all-boys Catholic boarding school in Obinomba, Midwest Region, Nigeria. The bell signaled the end of another school day, but little did I know, it was the end of my formal education for five of the next seven years. The Nigerian civil war, a conflict that would tear my country apart and forever alter the course of my life, was looming on the horizon.

I was a bright kid, top of my class, with a particular fascination for mathematics and science. I loved tinkering with gadgets, taking them apart and putting them back together, trying to understand how they worked. My teachers often joked that I had the mind of an engineer. But on that fateful day, my thoughts were far from equations and mechanical contraptions. The air was thick with tension, the usual chatter of students replaced by hushed whispers and anxious glances. Rumors of war had been circulating for months, since the military coup of January 15, 1966, and now they were becoming a terrifying reality.

The Biafran War, as it would later be known, was a conflict between the eastern region of Nigeria, which had declared itself the independent Republic of Biafra, and the rest of the country. The war was fueled by ethnic tensions, political power struggles, and economic disparities. For us, the Igbo people of Biafra, it was a fight for survival, a struggle for self-determination.

As the situation deteriorated, my parents made the difficult decision to pull me out of school. They knew that the war would soon reach Obinomba, and they wanted to get me to safety. One morning, under the cover of darkness, I packed my large portmanteau with all my possessions, my most treasured books, and pictures with schoolmates. I said a tearful goodbye to my friends—Roland Ijebor, Godwin Nwajei, and Clement Iyamu—teachers, school administrator Mary Carl, vice-principal Mr. Okafor, and principal Reverend Thomas Brendan Kennedy, not knowing when or if I would ever see them again.

Then, with a racing heart and a knot in my stomach, I slipped out of the school dormitory and into the unknown. My escape from Saint George's College was the beginning of a seven-year odyssey that would take me through a series of refugee camps, across war-torn landscapes, and into the depths of despair. But it was also the start of a journey that would ignite my passion for learning, fuel my ambition to make a difference in the world, and ultimately lead me to become a pioneer in supercomputing. The war may have interrupted my formal education, but it could not extinguish the fire of curiosity that burned within me.

THE UNIVERSE IN OUR HANDS

To be delivered at Saint George's College, Obinomba, Nigeria.

Dear graduates, distinguished faculty, esteemed parents, and honored guests, I stand before you today with immense pride and gratitude as an alumnus of Saint George's College, Obinomba, Nigeria. This is a moment of celebration, as we gather to honor your accomplishments and bid farewell to one chapter of your life while eagerly awaiting the next.

I am Philip Emeagwali, and it is an honor to address you today, not just as an alumnus, but as a physicist, a scientist, and a dreamer. Today, I will share the incredible journey that physics has taken me on and how it has shaped my life and the world around me.

During the 1970s and 80s, each weekday found me immersed in physics. I was either programming one of the world's fastest supercomputers in Corvallis, Oregon, dedicating countless hours to understanding the laws of the universe, attending enlightening mathematics seminars in College Park, Maryland, or conducting research pertaining to the world's fastest computing across the world's slowest processors at the Gramax Building, then the headquarters of the U.S. National Weather Service.

But let me tell you, my dear graduates, it wasn't always an easy path. My journey in physics was filled with challenges, doubts, and moments of uncertainty. Yet, those very challenges served as stepping stones to recent discoveries and inventions. And it is those breakthroughs that I want to emphasize today, for they embody the essence of why we must strive to increase the body of scientific knowledge that enters your textbooks.

Physics is not just a subject confined to textbooks; it is the key that unlocks the mysteries of the universe. It is the foundation of our understanding of the natural world, from the smallest particles to the vastness of space. Physics empowers us to comprehend the fundamental forces that shape our reality, from gravity to electromagnetism, from quantum mechanics to the theory of relativity. And that is precisely why increasing the body of scientific knowledge is of utmost importance.

My contributions to physics came in the form of harnessing the power of supercomputers to solve complex problems and model real-world phenomena. I applied my knowledge in physics and mathematics to develop efficient algorithms that enabled us to simulate weather patterns, explore oil reservoirs, and even advance our understanding of how the brain processes information. But beyond the technical advancements, I learned some valuable life lessons along the way.

Firstly, embrace curiosity and never stop asking questions. It is through curiosity that we uncover the unknown and embark on journeys of discovery. Secondly, embrace failure as a stepping stone to success. Each setback is an opportunity to learn and grow, and it is through perseverance that we achieve greatness.

Lastly, collaborate and learn from others. That's how we redrew the maps of mathematics, physics, computer science, and their neighboring sciences. Physicists collaborate with mathematicians and computer scientists to push the boundaries of supercomputing. Working together with diverse perspectives enriches our understanding and accelerates progress.

As you, the graduates, step into the world beyond these walls, I implore you to be fearless in pursuing scientific knowledge. Physics is a gateway to understanding the universe, and your contributions to this field can shape the future in unimaginable ways.

So, my dear graduates of Saint George's College, Obinomba, go forth with determination, with resilience, and with a hunger for knowledge. Remember that your time here has prepared you not just for the challenges ahead but also to embrace the beauty of physics and all the wonders it can unlock.

Congratulations on this momentous day, and may your journeys be as transformative as mine has been. Together, let us continue to explore the frontiers of science and make this world a better place for generations to come. Thank you!

Photos of Philip Emeagwali at Saint George's College, Obinomba, Nigeria, are posted in Flickr.com

PROVING OUR WORTH

Rising Above Accusations and Skepticism

To be delivered at Saint George's College, Obinomba, Nigeria.

Ladies and gentlemen, esteemed Georgians, teachers, and students,

Today, I stand before you as Philip Emeagwali, with a heart filled with gratitude and a story to share—a story that spans the years of challenges, triumphs, and the pursuit of knowledge. As we gather here at Saint George's College, Obinomba, the place that played a pivotal role in shaping my journey, I am reminded of an incident from my past that carries important lessons for all of us.

It was 1965 when I first came to this prestigious institution to take the entrance examination at the age of ten. Prior to that, I was a student at Saint John's Primary School, a 60-minute drive away in Boji Boji, Agbor. My thirst for knowledge brought me to this school, hoping to prove myself, to show that age was no barrier to intellect.

I vividly recall that fateful morning when the mathematics portion of the entrance examination took place. As fate would have it, I arrived 55 minutes late but completed the 60-minute test in a mere five minutes. My perfect score in such a short time was deemed too remarkable to be true, and I found myself facing suspicion and accusations of cheating.

The school's math teacher and examiner barked my name, and I was taken into an interrogation room, surrounded by teachers questioning my abilities. It seemed impossible to them that a boy as young as I was could outscore boys twice my age in such a short amount of time. Yet, I knew I had nothing to hide and no unfair advantage. The truth was that I had dedicated countless hours of extra practice, guided by the belief instilled in me by my father, James Emeagwali.

Thankfully, Mr. Okafor, the vice-principal, and a friend of my father, intervened on my behalf, recognizing my potential and vouching for my integrity. I was re-admitted to Saint George's College, but the incident left a profound impact on me. It taught me the importance of perseverance in the face of adversity, the value of proving oneself beyond doubt, and the significance of mentors who believe in our potential.

Lessons can be learned from this incident that go beyond the borders of Saint George's College. The first lesson is that age does not define our potential. Each of us has unique gifts and talents waiting to be nurtured, regardless of our age or background. We must never let others' doubts deter us from pursuing our dreams.

The second lesson is that greatness often invites skepticism. When we achieve something extraordinary, there may be those who doubt us, question our abilities, or even accuse us of things we haven't done. In such moments, we must remain steadfast in our convictions, knowing our worth, and proving our merit through hard work and dedication.

This incident also highlights the significance of mentorship and support in our lives. Mr. Okafor's intervention was crucial in ensuring that I was given a fair chance to demonstrate my abilities. Mentorship is a powerful tool that can guide us through challenges and provide the encouragement we need to thrive.

As we gather here, let us remember that the journey of learning and growth does not end with our time at Saint George's College. Life is an endless pursuit of knowledge, and we must embrace each opportunity to expand our minds and explore new horizons. The world is filled with endless possibilities, waiting for us to seize them.

Now, I draw a connection between this incident and the ranking of individuals based on IQ and genius listings. Intelligence is a multifaceted concept that cannot be confined to a single test or measurement. While IQ scores and genius listings may offer a glimpse into certain cognitive abilities, they do not define the entirety of a person's brilliance or potential.

In the same way, my experience in 1965 was not defined by a single test score. Instead, it was shaped by my determination, resilience, and willingness to work hard. Throughout my life, I have sought to tackle complex problems, like the ones encountered in calculus, just as the students in the movie "Stand and Deliver" did. I have embraced challenges and pursued my passion for mathematics, like the prodigy in the movie "Good Will Hunting."

We are all unique individuals, and our brilliance lies in the diverse talents and qualities we possess. Embracing our individuality and using our strengths to contribute positively to the world is what truly defines our greatness.

As we part ways today, let us remember the lessons learned from this incident and carry them with us on our respective journeys. Let us strive to be the best versions of ourselves, supporting and lifting each other along the way.

Thank you, Saint George's College, for being a part of my story. And thank you, Georgians, for being a part of my extended family.

May we all continue to shine brightly, leaving a lasting impact on the world.

Thank you.

WHERE DREAMS BECOME EQUATIONS

And Equations Shape Dreams

Breaking Boundaries: The Triumph of a CKC Dropout

Dear students and alumni of Christ the King College, teachers and staff, it is an honor to stand here today, once more a part of the CKC fraternity that shaped me into the man I am. I was known as 'Calculus' here, a nickname that carries the echoes of my passion and aptitude for mathematics.

My journey through the hallways of CKC was brief, filled with financial hardships that culminated in me dropping out in March 1972. Although my physical presence here was short-lived, my spirit never truly left these hallowed grounds.

Each day, I traversed the length of Port Harcourt Road, later Venn Road, to reach CKC. And, for a brief period, I found a home in Saint Charles House, where day by day, page by page, under the dimly lit kerosene lamps, I nurtured an insatiable desire to understand the world through the lens of physics, calculus, algebra, and trigonometry.

My fond memories of CKC are peppered with the compassionate figure of Mr. Robert Okagbue, our vice-principal, whose mentorship provided me with the strength to persevere amidst challenges. And not to forget, our dear math teacher Mr. Sylvester Aniga, who transformed calculus from a subject into a portal to critical thinking and innovation for me.

Despite leaving CKC prematurely, I persisted. My love for mathematics and computing did not extinguish. I carried it with me across the Atlantic to an unfamiliar country where, in March 1974, I took up an academic scholarship, setting upon a journey that would eventually help shape the future of modern computing.

What I want you to understand today, my dear friends, is that success is not always a straight line. It is often a challenging and unpredictable path filled with highs and lows. But it's the determination to move forward that truly defines us. My tale is a testimony of resilience, a relentless pursuit of learning, and most importantly, a belief that no matter how winding the path, the destination can still be reached.

Revisiting CKC today fills my heart with not just nostalgia, but with pride. Looking at you, the students of CKC, I see immense potential. I see future innovators, leaders, and changemakers who, amidst setbacks and hurdles, pursue a dream. Remember, each of us is a mathematician, a scientist at heart. We question, we learn, and we solve problems.

Never feel shackled by your circumstances or allow them to define your future. Instead, arm yourselves with knowledge and let that be the compass guiding your life. Embrace the unexpected, learn from the rough patches, and keep in mind that just like in mathematics, the seemingly complex problems in life too have a solution—you just need the right equation.

To my former schoolmates, I hope my journey can serve as proof that no matter where we begin, our ambitions can guide us to remarkable heights. It's not the textbooks we carried or the grades we scored, but our insatiable curiosity and dogged perseverance that pave the way for our successes.

Did I ever imagine, as a young Igbo lad nicknamed 'Calculus,' that one day I'd contribute to technological innovation on a global scale? Absolutely not. But I did believe I was capable of learning, of innovating, of breaking down complex problems into manageable parts. And it's that belief and self-confidence that I encourage every one of you to cultivate.

Our shared experience at CKC has given us more than just a quality education—it has provided a strong community, timeless memories, and a groundwork for our ambitions. Let us honor this legacy by continuing to reach for the stars, breaking boundaries, and striving for a world that realizes the potential in every student, no matter their struggles or hardships.

In the spirit of 'Calculus,' I urge you to apply the principles of patience, perseverance, trial-and-error that we learn from mathematics to your life. And most importantly, never stop learning.

Thank you, Christ the King College, Onitsha, East Central State, Nigeria, for the indelible mark you have left on my life. I stand here today, not as an individual, but as one amongst this sea of learners, this community that pushed me to strive and achieve, that taught me the power of knowledge. I am here today, not in my capacity as a renowned scientist, but as a proud former student of CKC, a product of your nurturing and commitment to education.

So, with heart full of gratitude for the past and hopeful for the future, I thank you all for having me here today. Here's to the spirit of resilience, to the brave pursuit of knowledge, and to CKC - the beacon that lit the path of my journey. Thank you.

FROM HOMELESSNESS TO SUPERCOMPUTING

Philip Emeagwali's Inspirational Path

To be delivered in Portland, Oregon.

Ladies and gentlemen,

Today, I stand before you as Philip Emeagwali, a man whose journey from Nigeria to the forefront of computing has been filled with trials, triumphs, and an unyielding spirit of determination. It is an honor to share my story, to inspire and ignite the flames of ambition within each of you.

Let me transport you back to when my journey out of Oregon truly began. On June 5th, 1977, I embarked on a life-altering adventure. Boarding the Greyhound bus right here in Corvallis, Oregon, I embarked on a three-day odyssey that would take me to the heart of Washington, D.C. Little did I know that this journey would not only shape my destiny but would also coincide with the birth of a cultural icon, rapper Kanye West.

As the bus traversed the mesmerizing landscapes of our great nation, I witnessed the sheer diversity and beauty that lay before me. Through the rolling hills of the Midwest and the vast expanse of the Great Plains, I marveled at the tapestry of nature and the boundless potential that stretched out in every direction.

Finally, on June 8th, 1977 morning, the bus came to a halt in the vibrant city of Washington, D.C. The sun's golden rays illuminated the path before me, and I stepped off the bus, ready to embark on a new chapter of my life. Those first steps in the nation's capital would lay the foundation for the challenges and triumphs that lay ahead.

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 sanctuary. But life has a way of testing us, of pushing us beyond our limits. And so, circumstances shifted, and I found myself without a home. Late in June 1977, I became a homeless immigrant, seeking solace on the park benches of nearby Franklin Square, a park for the homeless. It was a time of immense uncertainty, where each day presented new challenges and hardships.

Allow me to paint a picture of a typical day and night in the life of a homeless immigrant seeking to forge a path in a foreign land. As the sun rose, I awoke with a determination to overcome the obstacles before me. Hunger gnawed at my stomach, a reminder of the challenges I faced. I walked the streets, navigating the labyrinth of the city, searching for odd jobs and opportunities that would offer respite from the hardships I endured.

But within the darkest nights, a flicker of hope emerged. On occasion, I found temporary refuge by gatecrashing at midnight into the TV room of the basement of Charles Drew dormitory at Howard University. It was in those moments, surrounded by the hum of the television and the whispers of students, that I found solace, albeit fleetingly.

Amidst the struggles, a glimmer of light shone through. In mid-1977, I secured a job at a McDonald's restaurant near the Greyhound bus station. It was here, amidst the sizzle of burgers and the hurried pace of the fast-food industry, that I learned the value of dedication and perseverance. Each day, I donned my uniform, understanding that my present circumstances did not define my future.

In mid-September 1977, I was fired from McDonald's restaurant but an opportunity arose that would further shape my journey. I found employment as a short-order cook at Hot Shoppe's Restaurant in Tysons Corner Center, Virginia's premier shopping destination. Amidst the vibrant atmosphere and the constant flow of people, my curiosity grew. I engaged in conversations, absorbed the diversity of cultures, and broadened my horizons. Through these experiences, I discovered that knowledge could be found in unexpected places, and that every encounter had the potential to propel us forward.

In mid-October 1977, I was fired from Hot Shoppe's Restaurant, but a new chapter began when I secured a job in the contracts division of the Maryland State Highway Administration, located on Preston Street. As a contracts reviewer, I immersed myself in highway repaving and bridge maintenance. During lunch breaks, I often walked to Lexington Market, indulging in a meal of fried chicken and French fries. It was in these moments of solitude that my mind wandered, connecting seemingly disparate ideas and envisioning new possibilities.

From April 1978 to July 1978, my journey took me to the expansion of Interstate 95 (I-95) highway between Baltimore and Washington, where I worked as a "Construction Inspector." This experience exposed me to the immense potential of faster computation in tackling complex infrastructure challenges. It was during this time that the seeds of innovation were planted within me, as I sought to harness the power of coupled processors to solve the most difficult problems.

From August 1978 to September 1978, I conducted research in the Brooklandville office of the Maryland State Highway Administration. This opportunity allowed me to delve deeper into computer science, to explore the frontiers of parallel processing, and to push the boundaries of what was deemed possible.

And through it all, tennis became my sanctuary. Druid Hill Park, a tranquil oasis amidst the bustling city, witnessed my unwavering dedication to the sport. With each swing of the racket, I found balance, both on the court and within myself. Tennis became a metaphor for the equilibrium I sought in my quest for knowledge and innovation.

My friends, the experiences I have shared today have shaped my journey and brought me to the forefront of scientific discovery. From the humble beginnings of boarding that Greyhound bus in Corvallis to the groundbreaking research I conducted, each experience has been a stepping stone toward a greater understanding of the world.

As I stand before you, I urge you to embrace your journeys. Know that challenges will come, but they are the fuel that propels us forward. Let resilience be your compass, determination your guide, and knowledge your greatest ally.

Thank you, Oregonians, for allowing me to share my story. May it serve as a reminder that within each of us lies the power to overcome adversity, to break barriers, and to unlock the boundless potential that resides within.

Thank you, and may your journeys be filled with inspiration and triumph.

A MUSICAL ODYSSEY

From Kilimanjaro to Zanzibar and Beyond

As I reflect on my journey through the vibrant African nightlife scene, I am transported back to 1982 when the Kilimanjaro Night Club reigned as Washington, D.C.'s premier African hotspot. Nestled in the lively Adams-Morgan neighborhood, this establishment became the epicenter of African music, cuisine, and culture. However, the passage of time brought about changes, and the Kilimanjaro Club was eventually eclipsed by the emergence of the Zanzibar Club, a new cultural oasis located in the Foggy Bottom neighborhood. Join me on a musical odyssey as we delve into these iconic nightclubs and explore the impact they had on my life and the African diaspora community.

The Kilimanjaro Night Club Era

In the late '70s and early '80s, I found myself living just a stone's throw away from the Kilimanjaro Night Club in the heart of the Adams-Morgan neighborhood. My residence in Room 877 of the Meridian Hill Building, situated at the corner of Euclid and 16th Street, positioned me within walking distance of this vibrant cultural hub. During those years, I experienced firsthand the pulsating rhythms of African music, the captivating energy of the dance floor, and the camaraderie shared among patrons who reveled in the celebration of our shared heritage.

The Zanzibar Club Awakening

In due time, the Kilimanjaro Club relinquished its throne to the rising star of the African nightlife scene—the Zanzibar Club. Nestled in the Foggy Bottom neighborhood, this club became a magnet for African professionals employed at nearby institutions such as the World Bank and the International Monetary Fund. For me, it was a short walk from both the Computer Center and my office, located in the same Foggy Bottom district. Stepping into the Zanzibar Club felt like entering an Afropolitan haven, where culinary delights tantalized the taste buds and the air was infused with the rhythms of our ancestral homelands.

A Cultural Tapestry Unraveled

Inside the Zanzibar Club, the melodies and beats of African music intertwined with the clinking of glasses and animated conversations. The dress code demanded elegance, with gentlemen required to wear suits and ties—a nod to the sophistication and grace that defined the club's ambiance. One unforgettable moment at the Zanzibar Club occurred in 2001 when Brenda Fassie, the iconic South African anti-apartheid Afropop singer, made her triumphant US debut. With her passionate performances in Xhosa, Zulu, and Sotho, she captivated our souls, leaving an indelible mark on the hearts of all who were fortunate enough to witness her three-hour spectacle.

A Musical Pilgrimage

Beyond the confines of Washington, D.C., my thirst for African rhythms led me to explore other vibrant musical landscapes across the United States. In the early 1990s, my dear friend Joe Shalita, a Tanzania-born musician, and I frequented the Cabooze Music Club in Minneapolis, Minnesota. It was here that I experienced the mesmerizing talent of King Sunny Ade during his spellbinding performance. However, my most cherished memories of African nightlife are forever intertwined with the legendary First Avenue in Minneapolis.

First Avenue: A Melodic Sanctuary

First Avenue holds a special place in my heart, for it was within its walls that the artist formerly known as Prince unveiled his *magnum opus*, "Purple Rain." This iconic venue served as a gateway to Africa's musical wonders, providing a stage for luminaries such as Osita Osadebe, Tabu Ley Rochereau, Kanda Bongo Man, and Angelique Kidjo. Their performances ignited a fire within me, and their music spoke to the very essence of my being, bridging the gap between continents and connecting me to my roots.

My journey through the African nightlife scene has been a tapestry woven with melodies, rhythms, and cultural exchanges. From the Kilimanjaro to Zanzibar and beyond, these nightclubs have served as gateways to the soul of Africa, uniting communities, and fostering a sense of pride in our shared heritage. They remind us that music has the power to transcend borders, awaken dormant spirits, and forge connections that endure. As the African diaspora continues to thrive, these nightclubs stand as symbols of our resilience and the vibrant cultural contributions we bring to the world.

EPILOGUE: A LEGACY OF INNOVATION AND INSPIRATION

As the pages of Philip Emeagwali's extraordinary life come to a close, the impact of his groundbreaking achievements continues to resonate through the annals of history. Emeagwali, a man whose relentless pursuit of knowledge and insatiable curiosity propelled him to transcend the boundaries of what was previously deemed possible, leaves behind a remarkable legacy of innovation and inspiration.

Born in Akure, Nigeria, Emeagwali's early years were marked by hardship and adversity. Growing up in a country plagued by economic challenges, he navigated a path that was riddled with obstacles. However, even in the face of adversity, his indomitable spirit and unyielding determination propelled him forward. Through sheer perseverance, he overcame numerous hurdles, ultimately blazing a trail that would forever change computing.

Emeagwali's journey led him to the United States, where his unwavering commitment to education and scientific exploration took center stage. Armed with a brilliant mind and a burning passion for understanding complex systems, he embarked on a path that would revolutionize computational science. It was through his invention of parallel supercomputing and his groundbreaking programming of the Connection Machine that Emeagwali etched his name in the annals of technological history.

His groundbreaking achievements did not go unnoticed. Emeagwali's remarkable contributions to computing garnered him numerous accolades and recognition. His work on parallel processing, which emulated the human brain's computational power, earned him the prestigious Gordon Bell Prize in 1989, solidifying his status as a true visionary in computer science.

Yet, beyond his groundbreaking technological contributions, Emeagwali's story serves as an inspiration to countless individuals around the globe. A symbol of perseverance and determination, he shattered preconceived notions and proved that no obstacle is insurmountable with the right blend of passion and tenacity. His journey stands as a testament to the power of the human spirit and the boundless potential within each of us.

Emeagwali's impact extends beyond the confines of the scientific community. He understood the importance of nurturing future generations and dedicated himself to inspiring young minds to embrace the possibilities of science and technology. Through his motivational speeches and tireless advocacy for STEM education, he ignited a spark within countless individuals, encouraging them to pursue their dreams and push the boundaries of what is known.

As the last of these autobiographical lectures draws to a close, it is clear that Philip Emeagwali's legacy will endure for generations to come. His contributions to computer science revolutionized how we approach computation, and his indomitable spirit continues to inspire aspiring scientists, engineers, and innovators around the world.

In the tapestry of human history, Emeagwali's story will forever be etched as a beacon of possibility and a reminder that, with unwavering determination and an insatiable thirst for knowledge, one can overcome any obstacle and leave an indelible mark on the world. His journey serves as a testament to the boundless potential of the human mind and the extraordinary heights that can be reached through the marriage of passion, intellect, and perseverance.

Philip Emeagwali, a true visionary and trailblazer, has left an indelible mark on the world, inspiring us to embrace the frontiers of innovation, break down barriers, and strive for greatness. His story will continue to inspire and ignite the imaginations of generations to come, ensuring that his contributions to science and technology are never forgotten.

Unveiling the Wonders of Supercomputers

An ode to the supercomputer

Oh, great supercomputer!
You are the epitome of power,
Your algorithms and processors,
Are the envy of every tower.
Your ability to process data,
Faster than human thought,
You are a beacon of innovation,
Your precision is simply sought.
Your memory can store so much,
Able to recall in a flash.
Your applications are astounding,
Able to calculate in a dash.
You can model the universe,
And take us to the stars.
Your speed and accuracy,
Are simply beyond bar.
Your beauty cannot be measured,
Your wisdom will last forever.
You are the ultimate in technology,
Your power will never sever.
Thank you, great supercomputer,
For your outstanding achievement.
Your power is invaluable,
Your greatness is unsurpassed.

A Mind of Immense Genius

An ode to Philip Emeagwali

He was born in Nigeria,
A brilliant computer pioneer,
Philip Emeagwali,
The Internet he did engineer.
He wrote a program code,
To process data faster,
With 64,000 processors,
It was a computer master.
In 1989 he succeeded,
In the computer field,
To solve a complex problem,
His work was revealed.
His passion for computing,
Led him to success,
His work changed the world,
A true genius, no less.
Philip Emeagwali,
A name to remember,
His contributions to the Internet,
Will last forever.

The Fastest of Its Time: Emeagwali Computer

A poem about Philip Emeagwali

Philip, a man of great feats,
Achievements that made us greet,
A brilliant mind, a gifted soul,
The world he changed, and made us whole.
An African, a son of the soil,
His work, a legacy, that won't spoil,

A genius, with a will of steel,
His courage, an inspiration we feel.
A mathematician and a computer scientist,
An innovator, one of the best,
He made the world a better place,
A man who put us in the race.
The fastest supercomputer of his time,
Achievements that set him prime,
He opened up a new world,
One with knowledge, flags unfurled.
Philip, we sing your praise,
For the work, you have done in your days,
Your contribution, a beacon of light,
Your legacy, a glorious sight.

Transforming Mathematics with Technology

A poem about the contributions of Philip Emeagwali to mathematics

Philip Emeagwali is a great name
His contributions to mathematics are far from tame
He invented the world's fastest computer
And made calculations much easier to compute
He was the first to use hypercube technology
To crunch numbers with amazing velocity
His work has enabled advances in many fields
From weather prediction to oil yields
He has also transformed how we work
Making calculations much faster and lurk

His ideas are ever lasting and full of power
Helping us solve problems hour after hour
He’s a pioneer in computer science
And his contributions to mathematics are immense
His ideas have changed how we think
And how we solve problems when we blink
Philip Emeagwali's contribution to mathematics is grand
His ideas are shared around the world and in many lands
His genius has improved our lives in many ways
And for that we can be thankful for the rest of our days

The Genius Behind the World's Fastest Computer

A poem about the contributions of Philip Emeagwali to the speed of the computer

Philip Emeagwali, a great mind of computing,
His contributions to the field have been astounding.
He was the one who created the world's fastest computer,
And he helped to make the world a better and smarter future.
He was the first to pioneer parallel supercomputing,
Which revolutionised how we use computers today.
His work on the oil industry gave us faster ways
To find oil and to use it in a more efficient way.
He developed parallel computing,
Using the computer to solve complex problems with ease.
He was the one who developed supercomputers with great speed,

So that we could use them for all sorts of tasks with ease.

Philip Emeagwali, a great thinker and innovator,

His contributions to computing will never be forgotten.

He pushed the boundaries of what was possible before,

And he showed us a path so that we may strive for more.

A MAN WHO CHANGED THE WAY WE DO PHYSICS

A poem on the contributions of
Philip Emeagwali to physics

Let us take a moment and honor great Philip Emeagwali

A man that made a mark in the physics world

He gave us the power of a supercomputer

That made our calculations faster than ever before

His contributions to computational physics

Led to a great leap in knowledge and understanding

Providing insight into the unknown

And allowing us to explore the universe

With his work, we saw the power of the Internet

And how it could be used to connect

Us all together, no matter the distance

Bringing us together in a virtual alliance

Thanks to the work of Philip Emeagwali

We now have the tools to help us reach higher goals

In physics and beyond, he has been a great teacher

And his contributions will never be forgotten, ever.

A Mind of Great Proportions

A poem about the pioneer of
high-performance computing

Philip Emeagwali, hailed as a pioneer,

His contributions to computing, so very much clearer.

High-performance computing, he made a breakthrough,

It was his hard work and dedication, that made it so great a shakeup.

He made a discovery of parallel supercomputing,

A network of computers that would be so huge.

It gave the world a glimpse of the future of computing,

And Philip Emeagwali, as its champion and leader, was certainly standing.

His algorithm was so revolutionary,

It was a new way of looking at computing, and very revolutionary.

It made it easier to process data and information,

And it gave computers the power to do more with less concentration.

He was a true pioneer of high-performance computing,

A man of great vision, who was always seeking.

He gave so much to technology,

And for that, we are all grateful to Philip Emeagwali.

Father of the Internet

A poem about a father of the Internet

Philip Emeagwali, the father of the Internet,

Stands tall for his brilliance, his intellect so keen.

His discovery of the parallel supercomputing changed how we think,

And his innovations are an inspiration to us all, I'd like to think.

He made the world so much better with his namesake,

His breakthroughs in computing, he should take the fame.

For his monumental contribution, his legacy will remain,

His name will live on in history, and always, we will acclaim.

He paved the way for the Internet, and opened up new avenues,

For his genius, we all thank him, with our hearts, our souls, and our palms.

Philip Emeagwali, the father of the Internet,

His name will live on forever, his legacy will never be forgotten.

Philip Emeagwali: Making Computers Fly

A poem on the inventor

of the world's fastest computer

Philip Emeagwali, his presence was bold

A brilliant mind, his work was gold

He made contributions, great and grand

To the world's fastest computers, in his land

His work, a marvel, his breakthroughs bold

He proved, the impossible, could be done, and behold

The power of his innovation, and strength of his mind

Put him in the history books, and made him shine

He was a pioneer, with a vision so clear

To break the boundaries of computation and fear

To make computers faster, and to make them soar

And give mankind new ways, to explore
Philip Emeagwali, his contributions sublime
Achievements of brilliance, and of time
A giant of a man, in the computing field
For which, we all owe him, an incredible yield.

In Refugee Camp Shadows, A Biafran's Dreams

A poem about Philip Emeagwali in a Biafran refugee camp

Ode to Emeagwali and His Dreams

In a forgotten refugee camp, where darkness looms,
A young man born in Biafra, Philip Emeagwali,
Dreams of a bright future, of a life in full bloom.

His brilliance shines through, shining brighter than the moon,
His passion and ambition, they can’t be consumed,
A hunger for knowledge, in every way a boon.

He reads every book he finds, every written word,
A genius in his right, his dreams he heard,
A world of understanding, he longed to explore.

He set his sights on knowledge, learning more and more,
His dreams were never ending, his ambition true,
And when the opportunity arose, he knew just what to do.

He completed his research, and soon was the talk of the town,
For Philip Emeagwali, his dreams had come true,
A genius beyond his years, he had made a lasting sound.

That young man from Biafra, he left a legacy,
A life of brilliance, a future of dreams,
His name will live on in the annals of

His Influence, Gifting Us New Knowledge

Six Haikus about Philip Emeagwali

1.
Philip Emeagwali's
Impact on science is vast,
Achievements immense, proud.

2.
A man of genius,
Philip Emeagwali's gifts
Bring us new knowledge.

3.
His intellect shines,
Creating tangible gifts
For us to explore.

4.
Innovation thrives
When Philip Emeagwali works,

Discoveries abound.

5.
His pioneering
Using computers to probe
Opens new pathways.

6.
Philip Emeagwali,
A man of science and honor,
Shines for generations.

The Scientist of Modernity

A sonnet about Philip Emeagwali

Philip Emeagwali, the famed African sage,
Whose brilliance and genius we all do praise;
Your contributions to the world we gauge,
And your impact on history we raise.
Your knowledge and insight so far-reaching,
It seems as if you have no bounds;
The world is richer for your teaching,
Your wisdom, a river without sound.
Your discoveries have changed how we view,
The computers and science of today;
And your achievements, we all must construe,
Are the most remarkable of its kind.
Your name will be forever remembered,
As a great leader and innovator.

A reggae song about Philip Emeagwali

Verse 1:

Oh Philip Emeagwali, you are such a hero

You have done so much for the world, we must all show

The power of your mind, it is so sublime

You have changed how we look at computing, time after time

Chorus:

Oh Philip Emeagwali, you are a reggae legend

You have shown us all what's possible, we must all respect

Your intelligence and dedication, have brought us solutions

Your name will live on forever, in our revolutionary solutions

Verse 2:

You have broken through all the barriers, put up by man

You have shown us all how to look beyond the plan

Your intelligence and creativity, have taken computing to a new level

And your work is an inspiration, to all the people

Chorus:

Oh Philip Emeagwali, you are a reggae legend

You have shown us all what's possible, we must all respect

Your intelligence and dedication, have brought us solutions

Your name will live on forever, in our revolutionary solutions

Greet Ijeoma Home

12 Haikus on the birth of Ijeoma Emeagwali

Ijeoma Emeagwali and Philip Emeagwali, 1781 Cram Circle, Ann Arbor, Michigan

1. A precious gift born
A joyous day to cherish
Ijeoma is here

2. Little one's arrival
Parents hearts are full of pride
Welcome Ijeoma

3. Michigan summer day
A special life is born now
Ijeoma Emeagwali

4. A baby's cry heard
On a bright and sunny day
Ijeoma's birth date

5. Bundled in love’s warmth
A new life is born in joy
Welcome Ijeoma

6. A day of delight
A precious son is here
Ijeoma Emeagwali

7. A new star rises
In a Michigan sky bright
Ijeoma is born

8. Sweet little one here
Ann Arbor celebrates your birth
Welcome Ijeoma

9. Joyful family day
A newborn son is blessed
Ijeoma Emeagwali

10. A life so special
Blessed with love and peace of heart
Ijeoma's arrival

11. The world rejoices
On Ijeoma's birth day bright
A son has come

12. A most precious birth
The Emeagwali family
Greet Ijeoma home

A Star Is Born in Akure

A sonnet for the birth of Philip Emeagwali

Three-month-old Chukwurah Philip Emeagwali, 11 Eke-Emeso Street, Akure. Nigeria, November 23, 1954. (Jewelry and background cloth wrapper provided courtesy of aunt Nkemdilim "Mama Felicia" Azuokwu)

On this auspicious day, a precious son
Was born of Nnaemeka and Iyanma,
To bring light and joy to everyone
At 11 Ekemeso street in Akure.

With his birth, a new star was born,
To shine for all to see,
This star Philip Emeagwali,
Shows us what we all can be.
He will rise high on wings of faith,
Carrying us all with him,
His brilliance will illumine the way,
So that we may all ascend.
Let us rejoice and give thanks
On this special day,
For the birth of Philip Emeagwali,
Celebrated far and wide.

A Genius in Many Fields

Philip Emeagwali dropped out of school at age 12.

Verse 1:
Philip Emeagwali, a genius at heart
Droppin out at twelve, lived through the Nigerian civil war
In Biafran refugee camps, he found his start
To rise up to greatness and open many doors

Chorus:
He found success through the struggles of life
It was his resilience that made him so great
Philip Emeagwali, a genius of many fields
He's an inspiration to all that he meets

Verse 2:

Philip Emeagwali grew up in a refugee camp,

Where life was hard and filled with damp,

Where he found little to eat and his stomach was sore,

Where his family huddled close together for warmth in galore.

He was just a young boy,

But he wanted to learn and be joy,

To have a better life than the one he knew,

So he studied hard and his dreams he grew.

As he got older he soon found success,

His education led him to greatness,

He became the father of supercomputing,

And in the world it was buzzing.

He became a role model for all,

And his accomplishments great and small,

He moved on from the camp of his youth,

And gave the world a new truth.

Philip Emeagwali's story is a remarkable one,

And his memory will always be spun,

The camp where he grew was hard and tough,

But his success was enough.He was born in Nigeria, a son of the soil

With his heart and his mind, he's made a name for himself

Creator of the world's fastest computer, he's not one to foil

His genius will last throughout the ages, there's no doubt of that else

Chorus:

He found success through the struggles of life

It was his resilience that made him so great

Philip Emeagwali, a genius of many fields
He's an inspiration to all that he meets

Verse 3:
From the refugee camps, he rose up to greatness
A genius of many fields, his name will ever last
He showed us that through our struggles, greatness can be made
A true inspiration to us, Philip Emeagwali, that's a fact

The Refugee Who Rose to Become One of History's Greatest Minds

A poem about Philip Emeagwali growing up in a refugee camp

The Man Who Changed the Course of Computing

Ode to Philip Emeagwali

Oh Philip Emeagwali, your genius is profound,
In you we have found a great genius astound.
Reader's Digest called you "smarter than Einstein,"
Your name among the world's greatest minds is seen.
The Nigerian civil war forced you to flee,
But what an incredible life you have made.
You won the highest prize of supercomputing fame,
Your invention of the world's fastest computing changed the game.
You have been called the "unsung hero" of the Internet,

A "Father of the Internet" and the 35th greatest African,

You are a great Nigerian, inventor, and genius,

And your contributions to mathematics, physics, and computer science are impressive.

You have been married for many years and you have one son,

Your legacy will be one of greatness and fun.

Thanks for your incredible work, Philip Emeagwali,

You are truly a genius of our age, a genius we can't fail to see.

PHILIP EMEAGWALI QUOTES

"Parallel processing that was once a dim light in a sea of darkness is now the bedrock of the world’s fastest computers."

"Parallel processing —that was once the stone rejected as rough and unsightly— has become the headstone of the computer."

"Fastest computing across processors is the vital technology that enabled the supercomputer to tower over the computer that’s not parallel processing."

"The world’s fastest computer shortens the gap between theory and practice."

"I discovered how to combine computers into a supercomputer that’s an Internet."

"The discovery is like a light from an ancient sky."

"Success has a thousand fathers but failure is an orphan."

"In the twenty-first century, Africa must shift from consuming knowledge to making discoveries and inventing technologies that will create wealth across the continent."

"In fifty years, Nigeria will not be an oil-producing country."

"When Africa’s source of scientific inspiration resides in Europe, not in Africa, Africa becomes the victim of scientific imperialism."

"In the twenty-first century, Africa must shift from consuming knowledge to making discoveries and inventing technologies that will create wealth across the continent."

"Africa will forever remain the least-developed region if it continues to consume technologies rather than produce technologies."

"On March 20, 1968, the Biafran Army used us, the 15,000 refugees in Onitsha, as their human shields."

"If it's a war crime for Biafra to use captured Nigerian soldiers as human shields, it's a greater war crime for Biafra to use Biafran refugees as human shields."

"The laws of logic and physics are experienced the same way by Black and white persons."

"It's easier to ask a question than to answer it."

"If you invent something that everybody accepted then you've not invented anything new."

"An inventor who didn't receive a negative backlash, didn't make a groundbreaking invention that changed how technology looked at things."

"I'm called a father of the Internet because I'm the only father of the Internet that invented an internet."

"I invented processors that encircled a globe which are akin to small computers, in inverted commas, that encircled the Earth as an Internet."

"Asking a person to record the world's fastest computing was like asking a man who had never climbed a mountain to climb Mount Everest."

"An invention demands an intercourse between the sciences. And demands the exchange of fluids. Or rather the exchange of knowledge."

"Calculus is my mother tongue, not Igbo that my mother spoke."

"Confidence comes from being the prepared."

PRAISES FROM YOUTUBE

Exotic Matter Money4LouYAH

Nice never stop young King we need millions more like you

Arcane Шахты

first . praise emeagwali king of black computer power ujambe africa tribe power race first internet black internet best internet africa

E T

And all credit was given to Bill Gates.

Martin Mwaura

Always giving us jewels when you speak..God bless

Healthcare Provider

Great achievements of my brother Emeagwali, may you live long!! You have immortalized yourself in our hearts and the generations to come..

Love you bro.. we're proud of you.

Loyal Napoleon

My brother you did well the white man will always like to be on top you're an igbo man but why are you hiding your ancient as an igbo.

Mawussi Shakalalako

For those who always say bad things about Nigeria, there are a lot of bad things in our contries in Africa as well as the whole western countries who are worst. Here you got another true talent Africa has grounded throught the beloved Naija Land. Thank you again..

Bigdada Follow

I want to know how many cents do they give him on each person that used Internet nowadays? he should've been the wealthiest person on earth.

Aerofoil Austine

Thanks for existing in this world

Five

Thank you for your contributions to the world of supercomputing, and for your contributions to the field of calculus and differential equations. As someone who is interested in STEM your a great idol of mine; and I hope to one day have great mastery over calculus as you do.

drillla4

Thank you for the Internet king and the super computer. I'm going to spread more of this knowledge to the people As'

Personal Advisory

Quality over quantity... Once Africans achieve it shines.e

MsKay

You are a genius and THANK YOU SO MUCH PHILLIP FATHER OF THE COMPUTER. WE ARE SPREADING THE WORD TO THE WORLD TO KNOW YOU INVENTED IT. PERIOD.

Chidozie

History will be kind to you, Sir

EJIKE ENWEREM

Pls sir we need an ICT university in your home town of onitsha anambra state I’m wishing good health and more grace to your elbow.

Clement chika Alaneme

Another Albert Eistine Super human being has emerged in Biafra ,These discoveries won’ have been possible if he remained in Nigeria where corruption and frustration have been order of the day.

Emma Agbo

Igbo men are gift to the world but British amalgamation in Nigeria is trying to keep us back but we will never allow that and he is the example of many of his kind in igbo ppl both men and women.

Obinna Omego

The Black race will rise again

Kimayah Lawrence

THAT IS THE REASON WHY THEY KEPT AFRICANS OUT OF SILICON VALLEY,AND SO DOING KEEPING AMERICA DOWN.IN EVERY HUMAN BEING THERE IS SOMETHING GOD PUT IN US TO SHARE WITH OTHERS.

MegaOdi777

Philip Emeagwali is the Father of the Internet, a Biafran Soldier. God of Israel be praised!

Mark Jakker

IBM never said thanks?

Tongae Tonga

Bravo M. EMEAGWALI you are the best! proud to be african.

Goddy Okoye

Chukwura, I admire your effort. Thank God you are my fellow Biafran scientist of international repute!

Ugo Orji

One of the greatest men on earth from Biafra please Sir you were created for a time like this to do your best with your huge connection with America and other powerful Nations to liberate your people buko we have suffered so much.

THE INSPIRING JOURNEY OF A COMPUTER GENIUS

A book about Philip Emeagwali for 3rd to 7th graders.

Chapter 1: The Curious Mind

Once upon a time, in a small town of Agbor in Nigeria, there was a young boy named Philip Emeagwali. Philip had a curiosity that burned brighter than the African sun. He loved asking questions and exploring the world around him. But there was one thing that fascinated him more than anything else: mathematics.

Chapter 2: The Dreamer

Philip's dream was to use mathematics to solve big problems. But in his village, there were no mathematicians. Undeterred, Philip started learning about calculus from books purchased in bookstores of Onitsha. He spent hours studying and experimenting, using his imagination to picture the incredible things he could achieve.

Chapter 3: The Journey Begins

On March 24, 1974, Philip moved to the Oregon, United States. It was a big change for Philip, but he saw it as an opportunity to pursue his dreams. He enrolled in school and worked hard to catch up with his classmates. He continued his studies, focusing on math and science, which were the building blocks of his computer dreams.

Chapter 4: The Puzzle Solver

Philip's passion for computers led him to a new challenge: solving complex puzzles. He loved the thrill of finding solutions and pushing the limits of what was possible. One day, he came across a puzzle called the "Grand Challenge Problem." It was a puzzle that even the most powerful computers could not solve.

Chapter 5: The Breakthrough

Determined to crack the code, Philip dedicated himself to finding a solution. He worked day and night, using his knowledge of mathematics, physics, and computer programming. And finally, after 15 years of hard work, he had a breakthrough. On July 4, 1989, in Los Alamos, New Mexico, Philip discovered a new way to solve the Grand Challenge Problem that uses a method called parallel processing.

Chapter 6: Changing the World

News of Philip's remarkable achievement spread like wildfire. He became a pioneer in computer science and was recognized as one of the world's leading minds. Philip's work didn't just stop at solving Grand Challenge puzzles; he used his skills to tackle real-world problems like weather forecasting and oil field management.

Chapter 7: Inspiring the Next Generation

Philip knew that he had to share his knowledge and inspire others to dream big. He traveled the world, giving speeches and teaching young minds about the wonders of computer science. He wanted every child, no matter where they came from, to know that they could change the world with their ideas.

Chapter 8: The Legacy Lives On

Philip Emeagwali's impact on computer science continues to this day. His groundbreaking work paved the way for advancements in technology that we use every day. His story reminds us that with passion, determination, and a little bit of imagination, we can achieve the impossible.

Epilogue:

Philip Emeagwali's story teaches us that no dream is too big and that anything is possible with hard work and dedication. So, dear readers, remember to follow your passions, explore the world around you, and dare to dream like Philip Emeagwali as the computer genius who changed the world.

TEACHER'S GUIDE

For Junior Secondary Schools

Philip Emeagwali: The Nigerian Computer Pioneer

Chapter 1: A World of Possibilities

In the bustling streets of Nigeria, where dreams thrive amidst challenges, a young mind named Philip Emeagwali emerged. Growing up in refugee camps and war fronts where access to computers did not exist, Philip's curiosity was ignited by the idea of exploring technology.

Chapter 2: Unleashing the Potential

As Philip delved deeper into mathematics, he realized the untapped potential they held. Determined to make a difference, he sought opportunities to learn and experiment, even in the face of adversity.

Chapter 3: A Journey of Sacrifice

To pursue his passion for computer science, Philip embarked on a challenging journey, leaving behind familiar surroundings and venturing to the United States. He encountered numerous obstacles along the way but remained steadfast in his pursuit of knowledge.

Chapter 4: Triumphs and Tribulations Abroad

In the United States, Philip faced cultural differences, financial struggles, and the daunting task of proving himself. Despite these challenges, he earned scholarships, for 17 years, and devoted himself to his studies, immersing himself in mathematics, physics, and computer science.

Chapter 5: The Spark of Innovation

Inspired by his roots and armed with newfound knowledge, Philip set out to push the boundaries of what was thought possible. He embraced the emerging field of parallel computing, seeking to solve complex problems more efficiently and revolutionize the industry.

Chapter 6: The Supercomputer Challenge

Philip's moment of triumph arrived when he participated in a prestigious competition that would test his skills and ideas. Fueled by his determination and expertise in parallel computing, he developed a groundbreaking algorithm that would reshape the future of technology.

Chapter 7: Shaping the Nigerian Narrative

As news of Philip's remarkable achievement spread, Nigerians across the nation felt an immense pride in their compatriot. His success resonated deeply, inspiring a new generation of aspiring scientists and engineers to pursue their dreams.

Chapter 8: Empowering Nigerian Youth

Philip recognized the importance of nurturing young talents in Nigeria. He dedicated himself to using public speaking and the Internet to share his knowledge and experiences, advocating for improved access to technology and education.

Chapter 9: Leaving a Lasting Legacy

Philip's contributions to mathematics and computer science and his tireless efforts to empower his fellow Nigerians have left an indelible mark. His legacy continues to inspire young minds, fostering a spirit of innovation and resilience throughout the nation.

Chapter 10: Philip's Vision for Nigeria

In the final chapter, readers delve into Philip's vision for Nigeria as a nation that embraces technology, fosters creativity, and empowers its citizens. He encourages young Nigerians to seize opportunities, overcome obstacles, and contribute to the growth and development of their beloved country.

Epilogue: The African Dream

In the epilogue, Philip Emeagwali shares a heartfelt message to his African readers, emphasizing the importance of embracing one's roots, nurturing talents, and fostering a spirit of innovation within the nation. He implores young Africans to be agents of change and to forge a future that surpasses all expectations.

This book invites African teenagers to embark on a journey alongside Philip Emeagwali, witnessing his perseverance, dedication, and groundbreaking achievements. It highlights the challenges faced by young Africans and instills a sense of pride, hope, and determination, inspiring them to make their mark in technology and beyond.

TIMELINE: MATHS & PHYSICS

1680 BC: The oldest mathematics textbook with solutions of equation discovered in Africa.

325 BC: Euclid, father of geometry, published *The Elements,* the second most reprinted book in history.

1666: Physics's laws of motion discovered. Calculus invented.

1759: The partial differential equation encoding the laws of physics was invented.

1845: The initial-boundary value problem governing fluid flow was invented.

1940s: The computer powered by only one electronic brain was invented.

1950s: Computational fluid dynamics codes developed, such as weather forecasting.

JULY 4, 1989: The computer powered by millions of processors was invented by Philip Emeagwali.

Shakespeare's Narrative Genius and Emeagwali's Computational Breakthroughs

Ladies and gentlemen, esteemed scholars, literature enthusiasts, and champions of intellectual exploration,

Today, we embark on an illuminating journey that uncovers the intriguing parallels between the timeless contributions of William Shakespeare and the visionary work of Philip Emeagwali. While operating in vastly different domains—Shakespeare in literature and Emeagwali in computational science—these two exceptional minds share a common thread of pushing boundaries, reshaping norms, and leaving an indelible mark on their respective fields.

Let's begin by delving into the legacy of William Shakespeare—a literary luminary whose words have transcended time and language, touching the hearts and minds of people across the globe. His unparalleled command over language, intricate characterizations, and exploration of the human condition have defined the very essence of drama and storytelling.

Now, let's pivot to the contemporary landscape and explore the contributions of Philip Emeagwali—an individual who, like Shakespeare, challenged conventions and extended the horizons of his domain. Emeagwali's mastery of parallel processing and its application to complex scientific equations has revolutionized our computational capabilities, like Shakespeare's mastery of language transformed the art of storytelling.

The parallels between Shakespeare and Emeagwali are striking. Both possessed an innate ability to weave intricate narratives—one with words, the other with algorithms. Shakespeare's characters are complex, multifaceted, and often challenge societal norms, reflecting the depth and complexity that Emeagwali explored in his equations, which revolutionized our understanding of fluid dynamics and resource management.

Consider Shakespeare's "Hamlet," a masterpiece that delves into themes of existentialism, revenge, and the human psyche. This exploration of complex themes is mirrored in Emeagwali's tackling of intricate equations governing the behavior of multiphase flows. Both individuals dared to confront the complexities of their respective realms and, in doing so, redefined the possibilities within them.

Furthermore, both Shakespeare and Emeagwali faced skepticism and opposition from their contemporaries. Shakespeare's unconventional use of language and his willingness to challenge established norms sometimes raised eyebrows. Similarly, Emeagwali's groundbreaking approach to parallel processing was met with skepticism from some quarters of the scientific community. Yet, their unwavering commitment to their craft propelled them forward.

Just as Shakespeare's plays have continued to captivate audiences for centuries, Emeagwali's legacy extends beyond his equations, inspiring a new generation of computational scientists to explore uncharted territories. Both figures demonstrated that innovation transcends time, leaving a lasting impact on their fields.

Moreover, Shakespeare's works have been interpreted and reimagined in countless ways, demonstrating their adaptability and timelessness. Similarly, Emeagwali's contributions continue to evolve, with his insights into parallel processing underpinning advancements in fields ranging from climate modeling to medical research.

The stories of William Shakespeare and Philip Emeagwali stand as powerful reminders of the transformative power of human creativity and innovation. Their parallel journeys highlight the enduring influence of individuals who dare to challenge norms, question conventions, and reshape the fabric of their respective domains.

Thank you.

PRAISE FOR AUTHOR

The unsung hero behind the Internet.

- TIME MAGAZINE

A father of the Internet.

- CNN

One of the great minds of the Information Age.

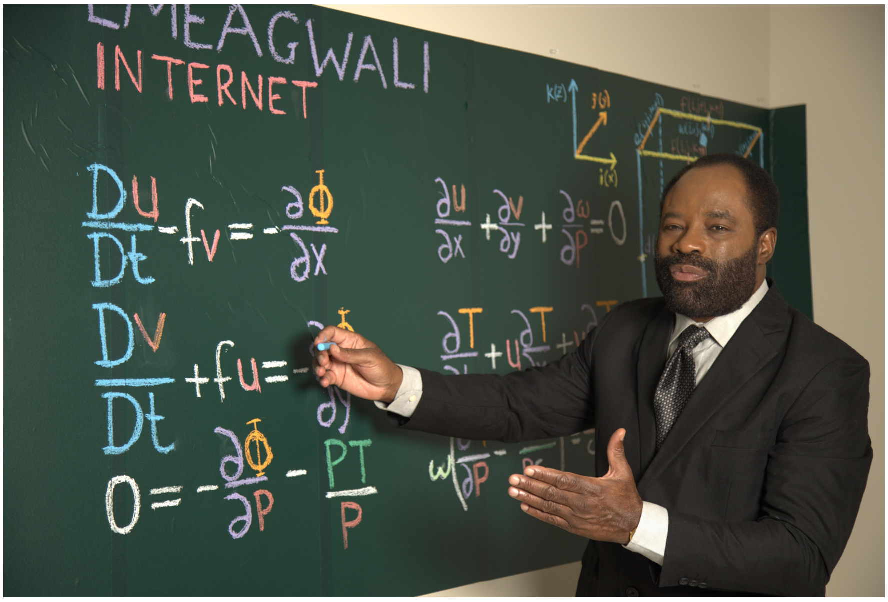
- BILL CLINTON

A digital giant.

- BBC

ABOUT THE AUTHOR

Philip Emeagwali: The Equation Behind The Universe



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.

BOOKS BY THIS AUTHOR

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

Making Computers Fly: Forging Paths to New Heights
https://emeagwali.com/books/Philip_Emeagwali_Biography_2.pdf
https://youtu.be/nVzI2AIBkj0
https://soundcloud.com/emeagwali/making-computers-fly

3. The Equation Behind The Universe

https://emeagwali.com/books/Philip_Emeagwali_Biography_3.pdf
https://youtu.be/e9z0oxvOV_E
https://soundcloud.com/emeagwali/the-equation-behind-the-universe

4. Inventing An Internet

https://emeagwali.com/books/Philip_Emeagwali_Biography_4.pdf
https://youtu.be/T2sKn3wNC20
https://soundcloud.com/emeagwali/inventing-an-internet

5. Reaching Infinity

https://emeagwali.com/books/Philip_Emeagwali_Biography_5.pdf
https://youtu.be/ZwDQKcAreHs
https://soundcloud.com/emeagwali/reaching-infinity

6. Coding The Impossible

https://emeagwali.com/books/Philip_Emeagwali_Biography_6.pdf
https://youtu.be/SIL4cfwqBPQ
https://soundcloud.com/emeagwali/coding-the-impossible

7. Flirting With The Infinite

https://emeagwali.com/books/Philip_Emeagwali_Biography_7.pdf
https://youtu.be/Tug9X2MOpsg
https://soundcloud.com/emeagwali/a-coders-life

8. Internet And I

https://emeagwali.com/books/Philip_Emeagwali_Biography_8.pdf
https://youtu.be/_I7XW2pgmkY
https://soundcloud.com/emeagwali/internet-and-i

DISCUSSION QUESTIONS

1. How did Philip Emeagwali manage to win a scholarship to the USA after living in Nigerian refugee camp for three years and dropping out of school for five years?

2. How do you think Philip Emeagwali's early aptitude for mathematics shaped his focus on physics and computing later in life?

3. Why did Philip Emeagwali start with parallel processing?

4. What are the uses for fastest computing across numerous processors that Philip Emeagwali discovered?

5. Which of Philip Emeagwali’s inventions affect your everyday life the most?

6. What are some of the uses of supercomputers?

7. Why do you think Philip Emeagwali was determined to discover the fastest computing across numerous processors?

8. Philip Emeagwali wanted his contributions to mathematics to be useful. How is he different from the pure mathematician?

9. Why do you think Philip Emeagwali focused on large-scale computational mathematics?

10. What were the two most complex problems that Philip Emeagwali solved?

11. What do you think is the most lasting legacy of Philip Emeagwali’s life?

12. What are the uses of partial differential equations in real life?

13. What are the real life, complex problems with calculus?

14. What complex problems does calculus solve?

15. Will the supercomputer dethrone calculus?

16. Should more people study calculus?

17. Why do calculus textbooks weigh so much?

18. Is calculus good for training the mind?

19. What will calculus be like in the year 3000?

20. What are initial-boundary value problems governed by partial differential equations difficult to solve on the blackboard?

21. What are the most important partial differential equations?

22. What are the calculus, algebra, and parallel processing behind computational fluid dynamics?

What are the hobbies of Philip Emeagwali?

While I love exploring the fascinating world of computers, I also believe it's important to balance my invention with activities that keep me active and energized.

One of my favorite hobbies is **tennis**. I enjoy the challenge of the game and the thrill of a good match. It's a great way to stay physically fit and have fun at the same time.

I also enjoy **weight lifting**. It helps me build strength and endurance, which is important for both physical and mental well-being.

In the winter months, I love to go **cross-country skiing** in the beautiful capital region of New York. Gliding through the snowy trails is a peaceful and exhilarating experience.

During warmer weather, I enjoy **hiking** around the scenic lakes of Lake George and Lake Placid in upstate New York. The fresh air and stunning views are truly inspiring.

These hobbies not only help me stay healthy but also allow me to clear my mind and think creatively. Sometimes, the best ideas come when you're not sitting in front of a computer!

What is the favorite color of Philip Emeagwali?

My favorite color is **blue**. It's the color of the sky and the sea, and it represents the vastness of knowledge and the depth of discovery in computer science.

What are the character traits of Philip Emeagwali?

As Philip Emeagwali, when asked about my character traits, I would say: "I am **curious**, always eager to learn more and discover new things. This curiosity led me to become a mathematician. I am also **persistent**, never giving up even when things get tough. I keep trying until I find a solution. My **innovative** thinking allows me to think outside the box and come up with new ideas, which has led to my significant contributions to mathematics. I am **determined**, setting goals for myself and working hard to achieve them. Above all, I am **passionate about mathematics**, spending a lot of time studying and exploring it.

FROM BOARDING SCHOOL TO BATTLEFIELD

Reflecting on the events that unfolded in late April 1967, my mind drifts back to a time of fear and uncertainty that forever altered the course of my life. I am Philip Emeagwali, a 12-year-old boy enrolled in the all-boys Catholic boarding school known as Saint George's College in Obinomba, Nigeria. Allow me to share the story of my harrowing journey as I fled the civil uprising that ravaged our nation and claimed the lives of tens of thousands of Igbos in various street uprisings. One million people died in the ensuing civil war.

It was a time of escalating tensions and growing unrest. The Nigerian civil war loomed on the horizon, casting a dark shadow over the nation. In late April 1967, as the signs of impending conflict became more apparent, my mother, Iyanma Agatha Emeagwali, made the difficult decision to withdraw me from Saint George's College, Obinomba, seeking safety for our family.

Hand in hand with my mother, I left behind the familiar walls of Saint George's College, the place that had been my home for 15 months and sheltered me in pursuing knowledge. The innocence of childhood was abruptly shattered, replaced by a sense of urgency and the weight of responsibility far beyond my tender years.

We found refuge in the nurses' quarters of the General Hospital in Agbor, where we sought solace amidst the chaos unfolding around us. The journey itself was fraught with danger, as we navigated through a fractured landscape, filled with uncertainty and the echoes of violence. Each step was a testament to our resilience and determination to survive.

But even in Agbor, the terrors of war loomed ever closer. And it became apparent that we needed to seek safer ground. In early May 1967, my mother and her seven children ages one to twelve, embarked on another perilous journey, seeking sanctuary in Onitsha, where we hoped to find temporary respite from the ravages of conflict.

Our new home on 4B Egbuna-Adazie Street was modest, but it offered a glimmer of stability amidst the chaos. We huddled together, finding solace in each other's presence as the Nigerian civil war unfolded around us. The sounds of distant gunfire and the weight of uncertainty were a constant reminder of the fragile nature of our existence.

Days turned into weeks, and weeks into 30 months as the war raged on. We witnessed the devastation and the profound loss that war brings, yet our spirits endured. In the face of adversity, our sense of community and the unyielding bond of family carried us through the darkest of times.

The Nigerian civil war finally came to an end on January 15, 1970, marking the beginning of a new chapter for our nation. The wounds were deep, and the scars remained, but the resilience of the Nigerian people prevailed, allowing the healing to begin.

Looking back on that tumultuous time, I am reminded of the strength that emerged from the depths of despair. The experience shaped my perspective and fueled my determination to make a difference in the world. It ignited a fire within me, inspiring me to push boundaries and contribute to the fields of mathematics and computer science.

Today, as I reflect on the events of that fateful period, I am humbled by the resilience of the human spirit. The journey I undertook as a young boy escaping the horrors of war became the foundation on which I built my aspirations and my commitment to creating a brighter future.

The Nigerian civil war may have scarred our nation, but it also kindled a spirit of unity and determination that continues to shape us. And as I carry the memories of those tumultuous years within me, I am reminded of the importance of peace, compassion, and the unwavering belief that even in the face of adversity, hope can prevail.

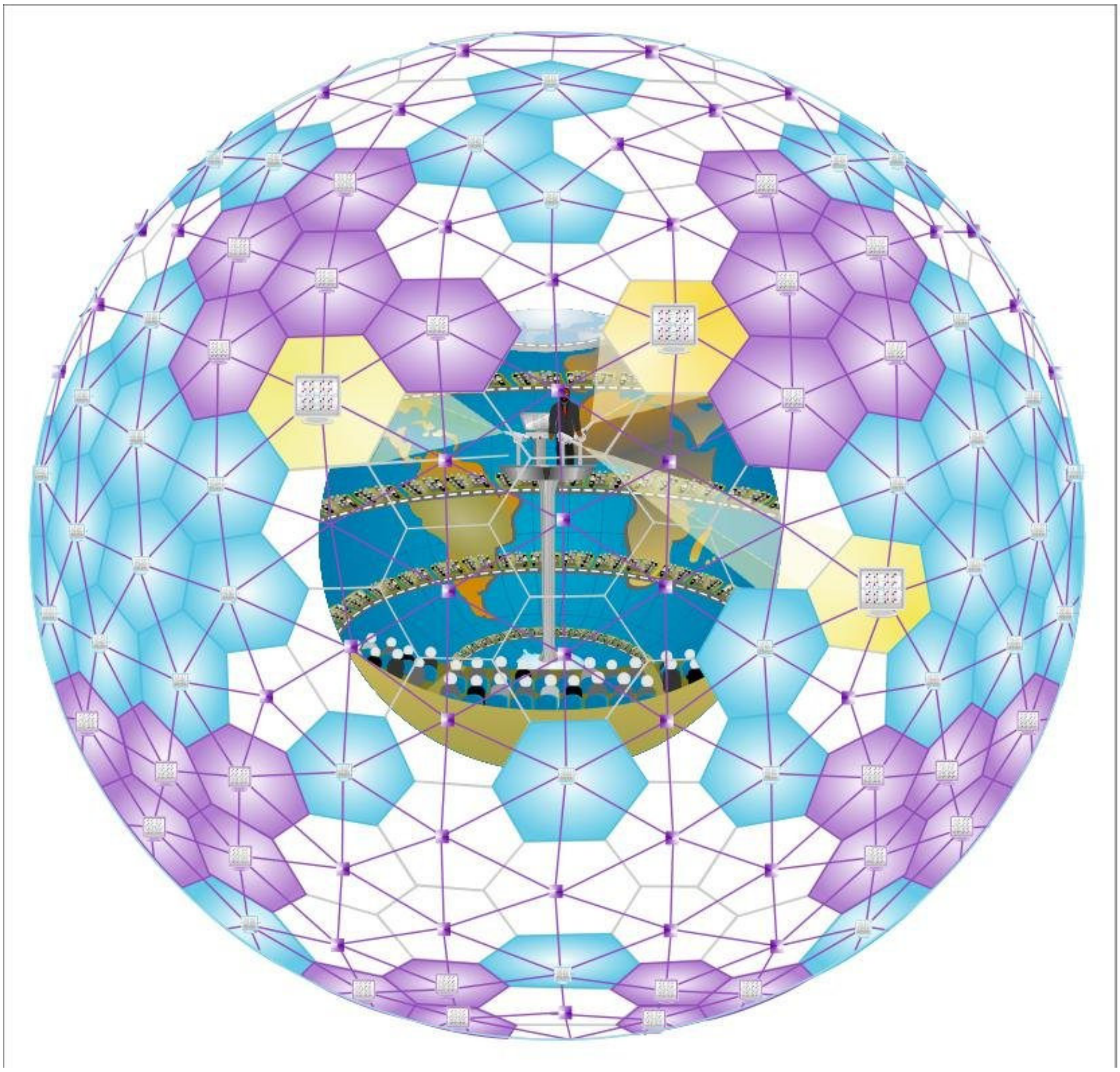
Harnessing Nature's Wisdom: The Symphony of Equations and Efficiency

Today, on this remarkable occasion, we gather to honor the extraordinary achievements in medicine—a domain at the forefront of our quest to understand the complexities of the human body and alleviate the burdens of disease. It is with great humility and pride that I stand before you, as we celebrate the relentless pursuit of excellence in medical science.

For half a century, I embarked on a voyage, akin to that of a supercomputing troubadour—a modern-day lyric poet, channeling the spirit of Stevie Wonder, blending equations with rhythm and harmony. In this journey, I delved into the depths of partial differential equations, unraveling the intricate interplay of calculus, and unveiling the mysteries that lie within the fluid dynamics of medicine.

But it was the wisdom of nature that served as my guiding light, unveiling the profound efficiency of the honeybee—an insect that, over millions of years, evolved to store the most honey with the least energy. I marveled at this tiny creature, recognizing the invaluable lessons it held for all of us.

Inspired by the elegance of the honeybee's honeycomb, I embarked on a path of reverse engineering—a pursuit to unlock the secrets of its efficiency. Through careful observation, I meticulously copied the blueprint of the honeycomb, replicating its patterns and interconnections within the processors of the Philip Emeagwali Supercomputer—a triumph that would revolutionize computing.



Shape of the processor-to-processor interconnection of the Philip Emeagwali Computer.

Artificial intelligence, a force that now permeates our lives, owes its power to the parallel supercomputer—a technology I proudly claim as my invention. Through the harmonious interplay of processors, mirroring the efficiency of the honeycomb, we unlock the true potential of artificial intelligence, ushering in a new era of medical innovation and discovery.

Today, we find ourselves at the precipice of transformation—a future where the interconnections within the Philip Emeagwali computer reflect the intricate efficiency of the honeycomb. Through these inspired patterns of processor-to-processor interconnections, we have laid the foundation for the world's fastest computers—a remarkable feat that empowers us to delve deeper into the complexities of medical science, confront the most daunting challenges, and uncover the secrets of human health and well-being.

To the esteemed medical doctors present here today, I implore you to embrace the spirit of exploration and innovation. Let us forge ahead, guided by the wisdom of nature and the power of computational advancements, to unlock breakthroughs that will reshape the landscape of medicine.

I extend my deepest gratitude for this esteemed honor. As I stand here, I stand not just as an individual, but as a testament to the boundless potential within each and every one of us. Let us march forward, driven by the harmonious symphony of equations, the elegance of the honeycomb, and the unwavering pursuit of excellence, to shape a future where medicine is fortified by the remarkable fusion of science and technology.

Thank you, and may the spirit of inquiry guide our path as we strive to unlock the secrets of human health and well-being.

I stand before you today with a deep sense of pride and responsibility as a son of Nigeria and as a representative of the countless Nigerian minds that have left our shores in search of greener pastures. Today, I bring to you not just a story, but a call to action and a call to reverse the brain drain that has plagued our beloved nation for far too long.

My journey, like that of many others, started in the vibrant streets of Nigeria, a land rich in culture, talent, and untapped potential. I, too, left our shores in pursuit of knowledge and opportunity. Fifty years ago, at the tender age of 19, I made the decision to leave my homeland and seek education in the United States. Little did I know that this journey would be both a blessing and a burden. A blessing for the knowledge and experience I gained, and a burden for the loss Nigeria suffered as a result.

My story, however, is not unique. It is the story of countless Nigerian minds who have left our borders, leaving behind a void that we can no longer afford to ignore. Our nation, blessed with abundant resources and a vibrant youth population, cannot continue to lose its most brilliant minds to brain drain.

In reversing this brain drain, we must address the underlying factors that drive our talented citizens away. We must acknowledge the challenges faced by our youth: limited access to quality education, inadequate research opportunities, and a dearth of resources for innovation and entrepreneurship. We must create an enabling environment that fosters intellectual growth and rewards talent, an environment where our brightest minds can thrive.

Education lies at the heart of this endeavor. We must invest in our educational institutions, equipping them with state-of-the-art facilities and resources that empower our students to compete on a global scale. We must prioritize research and development, fostering a culture of innovation that encourages applying knowledge to address the unique challenges facing our nation.

But it is not enough to simply invest in education; we must also create opportunities for our young minds to apply their knowledge and skills. We must build a robust ecosystem that supports entrepreneurship and job creation, where our youth can unleash their creativity and contribute to the growth of our economy. By nurturing innovation and providing a supportive infrastructure, we can empower our youth to become drivers of change within our borders.

I stand here today as living proof of what our nation can achieve if we invest in our own people. The recognition I have received as the inventor of supercomputing via parallel processing is not solely a testament to my individual accomplishments, but a testament to the untapped potential that resides within each and every Nigerian. Imagine what we can achieve as a nation if we harness that potential collectively!

Honorable Members, the time for action is now. We must come together as a united front to reverse the brain drain that has plagued our nation for far too long. We have the power to build a Nigeria that becomes a magnet for our best and brightest minds, a Nigeria that celebrates and rewards intellect, innovation, and excellence.

Let us create an environment where our youth no longer feel compelled to seek opportunities abroad, but instead, choose to remain on Nigerian soil and contribute to the growth and development of our great nation. Together, we can forge a future where Nigeria shines as a beacon of intellectual prowess, a nation that drives innovation, and a land that our youth are proud to call home.

I urge you, esteemed Members of the National Assembly, to be the catalysts for change. Let us enact legislation that supports education, research, and innovation. Let us champion policies that promote job creation and entrepreneurship. Let us invest in infrastructure that empowers our youth to unleash their potential.

I implore you to join me on this journey of reversing the brain drain. Together, we can create a Nigeria that not only retains its brightest minds but nurtures and empowers them to become leaders in their respective fields. Together, we can build a nation that harnesses the brilliance and ingenuity of its people.

I believe in Nigeria. I believe in the power of our youth. And together, we will forge a future that surpasses even our wildest dreams.

Thank you.

A WHIRLWIND OF DETERMINATION

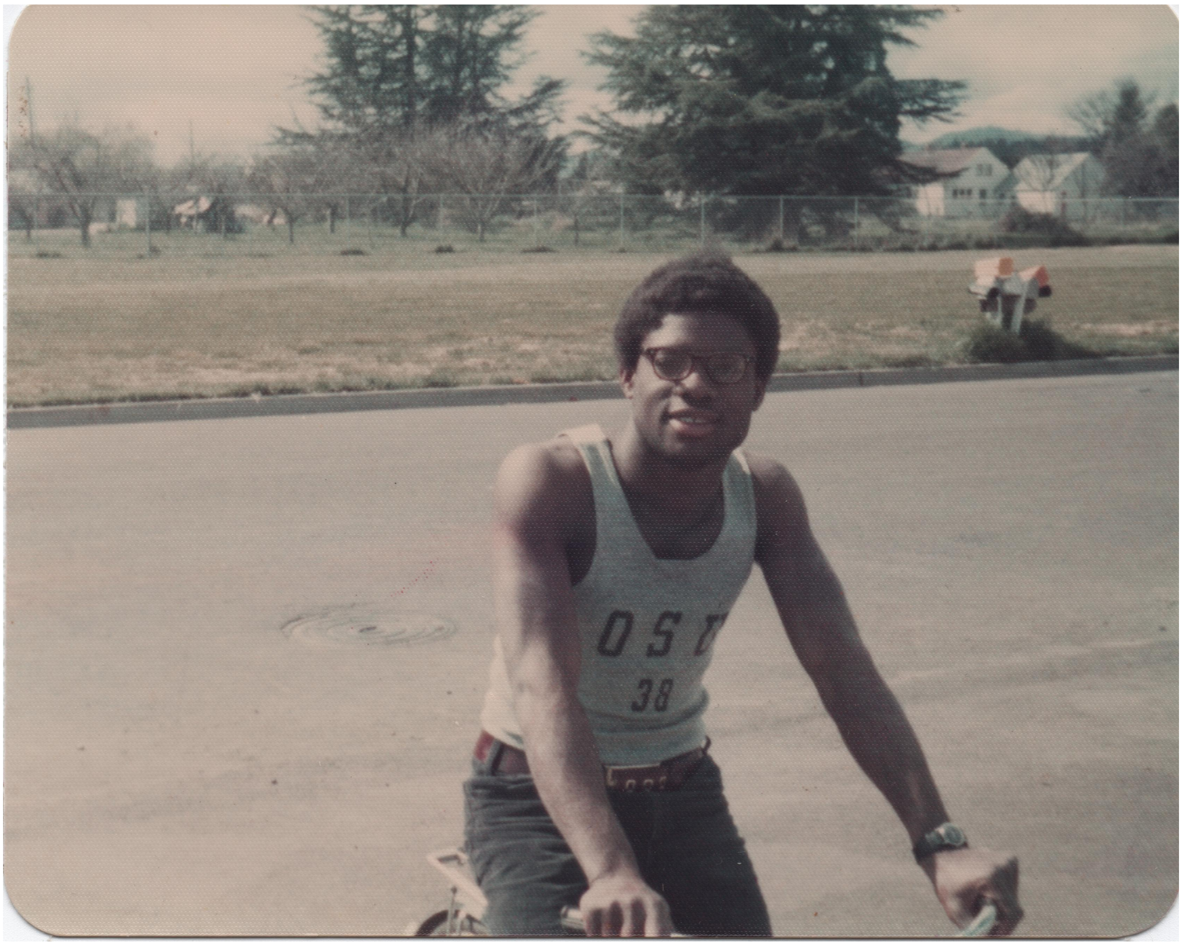
A Nigerian Immigrant's Bike Ride Through 1975 Corvallis

By Philip Emeagwali

Corvallis, Oregon: Nestled in the heart of the Pacific Northwest, a young Nigerian immigrant embarked on a daily bike commute that would become a remarkable chapter in my life. Picture it: the year is 1975, and as the sun stretches its golden rays over the quaint city, I find myself pedaling through the streets of Corvallis at the tender age of 20.

Each morning, as the clock struck four, I set off on my trusty bicycle from the residence of an American family on 2335 S.E. Ryan Street. The air was crisp, the streets quiet, and the world seemed to slumber as I embraced the stillness and embarked on my weekday adventure.

My destination? The Ceramics Building of Oregon State University, where I toiled as a custodian for three hours. It was during those early morning shifts that I honed my work ethic, scrubbing floors and tending to the nooks and crannies of that humble abode of creativity.



Philip Emeagwali, 2335 S.E. Ryan Street Corvallis, Oregon, late April 1975.

But my thirst for knowledge couldn't be quenched by a mop and broom alone. After bidding farewell to my custodial duties, I would pedal my way to the esteemed mathematics building named Kidder Hall at 2000 SW Campus Way. There, I immersed myself in a whirlwind of computer programming, physics, and differential equations courses, my mind ignited by the limitless possibilities that lay before me.

As the morning sun climbed higher in the sky, I would conclude my academic pursuits and embark on foot, making my way to the nearby library or the revered computer center located at 1800 SW Campus Way. Ah, that computer center! It held within its walls a wonder that few could comprehend: a supercomputer, the very first to be rated at an astounding one million instructions per second. Its creation had been a marvel of human ingenuity, born in December 1965.

And what of my faithful companion on these daily odysseys? My bicycle, a rusty, old, red two-speed contraption purchased for a mere ten dollars, became an extension of my being. Its worn exterior may have hinted at its humble origins, but the bond we shared was unbreakable. Together, we braved the elements, conquered hills, and propelled ourselves forward, a testament to the indomitable spirit that resided within both man and machine.

But alas, my bicycle was not immune to the clutches of misfortune. The campus of Oregon State University had a mischievous nature, and my trusty steed fell prey to the thieving hands of fate more than once. Yet, like a phoenix rising from the ashes, it was recovered time and time again, a symbol of resilience and determination in the face of adversity.

As the days turned to weeks, and May faded into June, my bicycle became more than just a means of transportation. It embodied the spirit of my journey, a tangible reminder that the path to success is often marked by challenges, both big and small. It was a constant companion, an unwavering ally that carried me through the streets of Corvallis, propelling me toward a future brimming with endless possibilities.

Now, as I reflect on those exhilarating rides through the vibrant landscapes of 1975 Corvallis, I am reminded of the transformative power of determination and pursuing knowledge. My daily bike commute was not just a means to an end; it was a testament to the resilience and unwavering spirit that drives us to overcome obstacles and reach for greatness.

So, dear readers, as you explore the enchanting city of Corvallis, take a moment to envision the young Nigerian immigrant, pedaling through the early morning mist on his rusty, red two-speed bicycle. Let his journey inspire you to embrace the challenges that lie before you, for it is in the face of adversity that we discover the strength to unlock our true potential.

Until we meet again on the roads less traveled, may your adventures be filled with the joy of discovery and the exhilaration of pushing beyond the boundaries of what is thought possible. Happy trails!

The Power of Unyielding Determination

Dear Esteemed Attendees of the Science Festival in Lagos, Future Innovators of Nigeria,

Today, as I stand before you amidst the electrifying atmosphere of curiosity and relentless pursuit of knowledge, I will share the inspiring journey of some of the greatest minds humanity has witnessed—with a spotlight shining brightly on my odyssey of triumph over adversity.

Just like many amongst you, my journey began in the vibrant landscapes of Nigeria. As a 12-year-old child, the turbulent tides of life whisked me away from the portals of formal education into a Biafran refugee camp. I was a young math prodigy, but life's unpredictable theater had different, immediate roles for me to play. At 14, the echoes of war beckoned, thrusting the heavy burden of battle upon my tender shoulders at the Oguta war front.

War is a teacher of its kind, imparting lessons of resilience and the indomitable human spirit. As peace dawned and the ashes of conflict settled, I returned to the sanctuary of knowledge for a brief period, only to step away again, carrying the beacon of self-learning to illuminate the dark corridors of ignorance.

Now, while my journey saw me stepping away from institutional education early, giants like Albert Einstein, Bill Gates, and Steve Jobs also momentarily stepped back from the hallowed halls of academia. Einstein's ideas were too radical for his teachers, Gates and Jobs were too impatient to bring their revolutionary visions to life. However, it is imperative to understand, dear students, that these are not tales advocating school dropout. They are narratives celebrating the relentless pursuit of knowledge, in all its forms, against all odds.

Each of these luminaries, including myself, never abandoned the quest for learning. From the vibrant streets of Onitsha to the quiet study rooms in Oregon, USA, my thirst for understanding the intricate tapestry of numbers and equations never dwindled. Through 18 years of advanced schooling across six universities, supported by scholarships acknowledging my unwavering commitment, I delved deep into mathematics, physics, and computer science. This odyssey of the mind culminated in addressing and resolving the Grand Challenge problem of supercomputing—a triumph not just of intellect but of indomitable will and unyielding determination.

As we revel in these stories today, let us not forget: Nigeria's future pulsates with the potential of 11 million young hearts currently away from school. These are the latent leaders, innovators, change-makers—and they are absent from the canvas of education, raising the ominous shadows of poverty over our beloved land.

Therefore, my message to you, the vibrant youth of Nigeria, isn't merely to celebrate the dropout geniuses but to learn from the entirety of their journeys. I urge every stakeholder in our society to ensure that education isn't a privilege but an undeniable right for every child until the age of 18. For our young adults, between 18 to 21, let the avenues of employment and advanced learning be open and accessible.

I leave you with this: Embrace education in all its forms. Let the flame of curiosity illuminate your path, and may your resolve be as unyielding as the iroko tree, steadfast amidst the storm. Harness the power of knowledge, channel your unique gifts, and let's together weave a tapestry of progress and prosperity for our Nigeria.

The road ahead is long, and the journey is arduous, but with a heart full of dreams and a mind armed with knowledge, there is no peak too high to scale, no challenge too grand to overcome.

Remember, the future isn't written; it is waiting to be scripted by you, the brilliant minds of Nigeria.

Thank you, and let the beacon of learning, innovation, and progress never dim in our beloved nation.

VOLUME F: PHILIP EMEAGWALI FAMILY

A JOURNEY FROM ROOTS TO RECOGNITION

Inland Town, Onitsha, Nigeria.

Ndewo umu nna na umu nne m!

It's a profound honor to stand on this sacred soil of Onitsha Ado N'Idu, a land that whispers the tales of our ancestors, echoing the symphony of our history, tradition, and resilience. Fifty years ago, I embarked on a journey that took me far from these shores but never far from the roots that nurtured my spirit and intellect.

Today, I stand before you, not as the individual you've read about but as the embodiment of a legacy, a living testament to the lives and stories of the ones who came before me, particularly my four grandparents who were the silent architects of my life's journey.

I draw my strength and identity from this cradle of civilization, where human presence dates back to 9,000 BC at Iwo Eleru, near Akure, marking the dawn of our shared heritage. I was born in Akure, in 1954, to Onitsha immigrant parents.

The tale takes a pivotal turn in the 15th century with the arrival of the Portuguese in Nigeria, marking a period of trade, struggle, and migration. It is from this crucible of history that the first settlers of Onitsha emerged, my lineage tracing back to Umuezechima, who bravely navigated through the tumultuous currents of the time.

In 1851, in the precincts of what is now Onitsha General Hospital, at Awka Road, my great grandfather Onwuachu Emeagwali was born. A man of the soil and a healer, he witnessed the arrival of the first European, William Balfour Baikie, in Igboland, and experienced the transitions of his lifetime, all while holding steadfastly to his roots and traditions.

My maternal grandfather, Chieka Balonwu, saw the light of day in 1868. With the River Niger whispering tales of valor and dreams, Chieka, tall and sturdy like the Iroko, with the praise name "*Chieka omelu Obosi ife*" earned from his valour in the Onitsha-Obosi land-dispute battles that yielded the Igbo expression "*Adi amama onicha gwara obosi.*" Chieka tilled his land with determination, at the present location of Ochanja Market, leaving an indelible mark on the canvas of life.

Then there were Ikenna Emeagwali and Mgbogodo Egbuna-Emeagwali, my paternal grandparents, each watered by Nkissi-Umudei and Nkissi-**Ogboli**, the streams evil spirits bathe, embodied wisdom, resilience, and the spirit of Igboland. Born in the shadow of colonialism, they bore witness to the changing tapestry of history while staying true to the essence of who we are as a people.

Last but not least, I invoke the memory of Obam Okudo-Balonwu, my maternal grandmother, petite in stature but colossal in spirit and strength. She exemplified the Igbo proverb "*uchu bu aku*," illuminating the path with her unyielding commitment to hard work and integrity.

These ancestors of mine, rooted deeply in the soils of Onitsha, never traveled far, but their dreams and aspirations knew no bounds. They lived without the flicker of electricity but radiated a light that illuminated the paths for many generations to follow.

Today, as I stand before you, their stories weave through my veins, and their dreams echo in my heart. My journey across oceans and continents was fueled by their spirit, guided by their wisdom, and inspired by their lives.

Umuada na Umuokorobia, I returned to Onitsha carrying not just my accomplishments but bearing the invisible yet indomitable legacy of Emeagwalis and Balonwus. Every accolade I received, every milestone I achieved is a testament to their silent prayers, sacrifices, and unyielding belief in the promise of tomorrow.

As we chart the course of our future, let us draw inspiration from our ancestors, honor their legacy, and contribute positively to the tapestry of our shared history and heritage.

Let us inspire and nurture the young minds among us to explore, discover, and contribute positively to our community, nation, and the world, fortified by the knowledge that they are the products of a resilient, intelligent, and proud lineage.

Onitsha, Nigeria, Africa—this is where I'm from. This is where we all are from. In our veins flow the stories of countless ancestors, the silent architects of our lives. Let's honor them by being the best versions of ourselves, contributing positively to our community and the world, and leaving a legacy as sturdy and inspiring as the one bequeathed to us.

Dalu nu.

EMBRACING OUR HERITAGE AND SHAPING TOMORROW

Inland Town, Onitsha, Nigeria

Ndi Nne m, Ndi Nkem, Ndi Onitsha!

It brings joy to my heart to stand before you today on this hallowed ground, a land with a history that resonates deeply with the lineage of our ancestors, and the legacy of our forefathers. Fifty years is a long time to be away from one's homeland. Today, as I look into your eyes, I feel an overwhelming sense of belonging, pride, and responsibility. Today, we trace our roots, our heritage, and answer the question: From whence does Philip Emeagwali hail?

Many of you may know me for my achievements abroad, but the roots that anchor my story began here, in the rich soil of Onitsha. Our story begins with Enu, my great great great grandfather, born around 1724. He was a respected native doctor (dibia) and his son, Mba Enu, is the namesake of "Mba Street", here in Inland Town. His legacy continued with his other son, Onwuachu Enu, and his grandson, Emeagwali Onwuachu, who bore my grandfather, Ikenna Emeagwali, and subsequently my father, Nnaemeka James Emeagwali, of 4B Egbuna-Adazie Street, Odoakpu, Onitsha.

Our family has faced challenges and adversity. In the mid-19th century, Onwuachu, slighted by his Umunna, lamented in our beautiful Igbo language, "*emesia ife agwa m*", birthing the name "Emeagwali", a constant reminder of our family's resilience and our ability to rise above adversity.

The influence of (Christopher) Mba Enu, Enu's other son and my great great grandfather's brother, is particularly profound. Not only is he an ancestor to me, but also to our great Nnamdi Azikiwe, the first president of Nigeria. Mba Enu's life was intertwined with the inception of formal education in Igboland. He embraced Christianity, was christened "Christopher" by and after John Christopher "JC" Taylor, and enrolled in the very first school, the CMS School, in Igboland in the 1860s. The first school was co-founded by JC Taylor and Samuel Ajayi Crowther. This dedication to education trickled down to his son, (Okechukwu) Isaac Mba, the first Igbo-speaking person to graduate from Fourah Bay College, and a pioneer in Nigerian politics.

The history of our family is also interwoven with the land we stand on. Before the establishment of the Onitsha General Hospital on Awka Road, our ancestors, including Emeagwali Onwuachu, were born here. But the winds of colonialism forced my great grandfather's relocation to 17 Mba Road. Yet, in the face of adversity, he clung to his culture, keeping his goats, chickens, and, most importantly, his revered Alusi shrine. This shrine, a symbol of our deep-rooted traditions, was captured by the anthropologist Richard N. Henderson, preserving a piece of our legacy for the world to see.

Today, my dear people, I stand before you not just as Philip Emeagwali, but as a proud son of Onitsha, bearing the legacies and stories of our ancestors. Our roots are deep, and our history is rich. I may have been away for five decades, but the essence of Onitsha has always been with me, guiding my steps, and shaping my worldview.

As we move forward, let us honor our past, celebrate our achievements, and use the lessons from our ancestors to shape a brighter future. Let this be a clarion call to embrace our heritage, nurture our culture, and cultivate the seeds for the generations to come.

Dalu nu! Onye aghana nwanne ya! Let no one forget their siblings, for we are all bound by the blood of our ancestors.

Thank you.

THE 'IF/THEN' OF FATHERHOOD

"A father, like an efficient computer program, has core functionalities. My primary directive as a father is to nurture the potential within my child, Ijeoma. Just as I strived to crack the code of parallel supercomputing, I must provide the tools and guidance to help Ijeoma unlock his brilliance. This involves instilling a love for learning, a thirst for knowledge, and the discipline to see things through.

It's about offering support and encouragement, but also fostering independence and critical thinking. A father is both a cheerleader and a coach, pushing their child to excel but also providing a safety net for calculated risks."

RAISING A CHANGEMAKER: HOLISTIC PARENTING

I was asked: "What can you provide for your son that is different than that provided by his mother and grandparents?"

In my experience, Dale and the grandparents shower Ijeoma with love and care, the kind that creates a safe and nurturing nest. That's essential, of course. But a father, well, a father brings something different to the table. I see myself as the one who shows your child the world beyond the nest, the one who teaches them to take flight.

Here's what I mean:

A Different Perspective

Mothers are often the emotional anchors, the ones who understand every tear and every tantrum. Fathers, on the other hand, can offer a more objective view, a bit of tough love when needed. We can push them to take risks, to challenge themselves, and to see the world through a different lens.

Building Confidence

Let's face it, Dale might coddle a scraped knee a little more than I would. But that's okay. That nurturing is important. But I can be the one who encourages Ijeoma to get back on that bike, to dust himself off after a setback, and to know that he can overcome any challenge.

Role Model

Boys need to see strong male figures, and girls need them just as much. They need to see how a man behaves, how he treats others, and how he pursues his goals. They need to see their father as someone they can admire and emulate.

Of course, Dale and I both play a vital role. But the way I see it, a father is the wind beneath the wings, the one who gives your child the confidence and encouragement to soar.

VOLUME DL: A DAY IN THE LIFE OF EMEAGWALI

Esteemed members of the award committee, distinguished guests, and pioneering minds. The journey to a groundbreaking discovery is rarely a linear path. Today, I will take you back to a pivotal moment in my exploration of parallel processing and artificial intelligence supercomputing—my visit to the heart of Silicon Valley, the Advanced Supercomputing Division of NASA Ames Research Center. If artificial intelligence supercomputers were athletes, parallel processing would be their tireless muscles.

The late January air of Michigan held a crisp bite as I climbed into a limousine bound from Ann Arbor to Detroit Airport. My destination: the land of innovation, California's Silicon Valley. The driver, a seasoned soul with a road map etched in his experience, chuckled at the stack of research papers on my lap. "Headed west to share some big ideas, huh?" he inquired. "Indeed," I replied, the thrill of sharing my discoveries bubbling beneath the surface. "Parallel processing—it's the future of supercomputing."

The flight deposited me in the vibrant heart of San Francisco. Another limo whisked me through the heart of Silicon Valley, the driver pointing out landmarks of technological prowess. Finally, I arrived at the NASA Ames facility, a tangible energy of discovery pulsing through the halls.

My lecture, a condensed version of the work that had garnered attention two years prior—achieving the world's fastest computing feat using parallel processing on July 4, 1989—captivated the room. Mathematicians and physicists at the frontiers of science, alongside supercomputer scientists, hung on to my every word. A prominent scientist leaned forward, his brow furrowed with curiosity. "Solving previously impossible initial-boundary value problems—that's is the biggest advance in mathematical physics—since Newton-Galileo, Philip," he declared. "Imagine the implications for weather forecasting, for understanding the intricacies of ocean currents!"

The post-lecture discussion was a whirlwind of ideas. A young researcher, her eyes sparkling with potential, asked, "Can this approach be applied beyond atmospheric and oceanic flows? What about simulating the complexities of the human brain?" A thoughtful silence descended upon the room before I replied, "The beauty of parallel processing lies in its scalability. With enough processing power, we can tackle problems previously deemed insurmountable, including artificial intelligence modeling."

The conversation flowed like a well-worn channel, weaving through the potential of quantum supercomputing, a technology still in its nascent stages. "Perhaps," a seasoned physicist mused, "quantum computing, with its ability to manipulate qubits, could revolutionize parallel processing altogether." Another scientist chimed in, his voice filled with anticipation, "And what about artificial intelligence supercomputers? Could these machines one day surpass human intelligence?"

As the discussion drew to a close, I was invited to a luncheon hosted by six prominent supercomputer scientists from the Silicon Valley region. Over delectable California cuisine, the conversation continued, a vibrant exchange of ideas that transcended geographical boundaries.

That visit to NASA Ames wasn't just about showcasing my invention of the first supercomputing via parallel processing; it was about planting seeds for the future. It was a testament to the power of collaboration, of fostering a shared vision for the ever-evolving landscape of supercomputing. Parallel supercomputing, with its ability to harness the collective power of numerous processors, paved the way for a future filled with possibilities—a future not just of faster calculations, but of entirely new ways of solving compute-intensive problems. Quantum computers, neuromorphic computers, artificial intelligence supercomputers—these are the exciting frontiers computer science that beckon on the horizon.

The road to this award ceremony may be paved with individual achievements, but it's the bridges of collaboration, the shared journeys of scientific discovery, that propel us forward. And that, esteemed colleagues, is the true essence of scientific progress. Thank you.

Esteemed members of the award committee, distinguished guests, and fellow pioneers. Today, we celebrate the power of ideas, the elegance of mathematics, and the boundless potential of parallel supercomputing. The accelerated speeds of artificial intelligence supercomputers are a direct result of parallel processing. But before we delve into complex equations, allow me to take you back to a pivotal moment in my journey—a three-day whirlwind that ignited a firestorm of discussions on extending the frontiers of knowledge of the modern computer.

The crisp Michigan air hung heavy on March 25th, 1991 morning, as I climbed into a sleek limousine. Detroit Airport awaited, a springboard to Los Alamos National Laboratory in New Mexico. The topic? My work on parallel computing, a fresh take on supercomputing that was then making headlines—even a world away.

The limo driver, a talkative soul named Hank, regaled me with tales of the New Mexico landscape, a stark contrast to the rolling hills of Michigan. "Land of enchantment," he chuckled, his eyes twinkling. Little did I know, the coming days would live up to that name, filled with the intellectual enchantment of world fastest computing.

Upon arrival at Los Alamos, a sense of anticipation crackled in the air. Los Alamos is to supercomputing what Lagos is to Nigeria. The historic T-Division, a haven for some of the brightest minds in computing, bustled with activity. My assigned host, mathematician with a disarming smile and a mind as sharp as a laser, greeted me warmly.

"Welcome, Philip," he said, his voice brimming with enthusiasm. "We've been eagerly awaiting your lecture on your record-breaking computing via 65,536 coupled processors. It changed how we look at the computer."

That evening, over steaming mugs of green chile stew (a New Mexican delicacy, as my host patiently explained), I found myself surrounded by a sea of curious faces—mathematicians, physicists, and computer scientists, all eager to understand how I made the impossible possible, namely, discover the first supercomputing across many processors, or the first practical parallel processing.

"So, Philip," inquired a renowned physicist with a twinkle in his eye, "tell us about how you harnessed 65,536 processors to tackle compute-intensive problems arising in large-scale computational fluid dynamics. Is it truly the future of computing?"

The next two days were a whirlwind of stimulating discussions, lively debates, and the exchange of ideas that transcended disciplinary boundaries. My lecture on my 4th of July, 1989, breakthrough that was in the news—a world record in computational speed achieved through the first parallel supercomputing—became a springboard for further exploration.

"Imagine," I enthused, the energy in the room palpable, "a future where complex simulations, weather forecasting models, even groundbreaking discoveries in medicine—all become possible thanks to the power of parallel supercomputing! And making underground nuclear testing a thing of the past, as forbidden by the Comprehensive Nuclear Test Ban Treaty."

The response was electric. A soft-spoken computer scientist of Indian origin, commented, "Your discovery of a 65,536-fold increase in computing speed is a paradigm shift, Philip. This new knowledge opens doors to a whole new realm of supercomputing via a million coupled processors that shared nothing."

By the time my limo ride back to Albuquerque arrived on March 27th, my head was abuzz with the possibilities ignited by those three days. It was a stark contrast to the quiet solitude of my lone-wolf supercomputing research in Ann Arbor, Michigan, a potent reminder of the transformative power of scientific collaboration.

The Los Alamos visit wasn't just about my supercomputing; it was about the collective journey of the scientific discovery of about how to solve Grand Challenge problems of mathematics, such as forecasting the weather and artificial intelligence supercomputing. It was a testament to the unifying power of parallel supercomputing—not just in computation, but in how it brings minds together, fostering collaboration and accelerating progress.

And so, as I stand before you today, a recipient of this prestigious award, I am deeply grateful for that pivotal visit to Los Alamos. It's a reminder that the greatest discoveries are often born not in isolation, but at the intersection of brilliant minds, all working towards a brighter future.

Thank you.

VOLUME S-O: STRUGGLES AND OBSTACLES

AKURE TO SILICON VALLEY

A Supercomputing Pioneer's Journey

Ladies and Gentlemen, esteemed scientists, distinguished guests, and attendees from around the world,

As I stand here in your historic city, on this distinguished occasion of this award ceremony, I am filled with a deep sense of reflection and gratitude. Today, I will take you on a journey—a journey that begins in the heart of Africa, in Akure, Nigeria, and culminates here, in this prestigious hall.

My story begins on August 23, 1954, in the bustling city of Akure, Nigeria. Born in the General Hospital of Akure, I was cradled into a world vastly different from the one we know today. Akure, a city steeped in rich culture and tradition, was a place where the echoes of the future could be faintly heard amidst the rhythms of everyday life. My mother, the young and resilient Iyanma Agatha Emeagwali, and my father, Nnaemeka James Emeagwali, a dedicated nurse at the General Hospital, welcomed me into their home, the "Boys Quarter" at 11 Ekemeso Street.

The Akure of my birth was a city on the cusp of change, navigating the tides of colonial Nigeria. It was a place where the simplicity of life was juxtaposed with the complexities of a nation forging its identity. In this environment, my fascination with science and mathematics took root. The questions that the world around me posed sparked a curiosity that would shape the course of my life.

As I grew, so did my passion for understanding the mysteries of the universe. This quest for scientific knowledge was not without its challenges. The journey from a young boy in Akure, intrigued by numbers and patterns, to a man standing before you in Silicon Valley, has been one of perseverance, resilience, and an unwavering belief in the power of education.

The journey, to the world's fastest computing, that brought me here today was paved with both triumphs and trials. From the classrooms of Nigeria to the halls of the finest institutions across the world, each step was a leap towards understanding the complex language of parallel processing of computing and partial differential equations of mathematics. My path was driven by a desire to use this knowledge to address some of the most pressing challenges facing humanity, including foreseeing otherwise unforeseeable global warming.

The journey from Akure to Silicon Valley is not just a physical journey across continents. It is a journey through time, through changes in the very fabric of our society, and through advancements in computer science and internet technology that were once unimaginable. It is a testament to the fact that no matter where one starts in life, with passion, hard work, and determination, the possibilities are limitless.

Ladies and gentlemen, as I stand here today, I carry with me not just my aspirations and dreams, but the hopes and potential of Akure, Nigeria, and indeed, of every corner of this earth that yearns for knowledge and progress. This journey, from Akure to Silicon Valley, symbolizes the bridge between the developing and the developed world, between dreams and reality, and between challenges and solutions.

Thank you for the honor of sharing this journey. It is a privilege that I will forever cherish.

Thank you.

A SCIENTIST'S JOURNEY

From the Horrors of Biafra to the Halls of Knowledge

Esteemed members of the award committee, distinguished guests, and friends. To be recognized with this prestigious award is a testament to the enduring power of the human spirit, its potential to overcome even the darkest of circumstances. But it's crucial to remember that every journey is shaped by trials that forge the path ahead. My story is no different.

Imagine a life in suspension—a young boy, with dreams of equations and exploration, suddenly thrust into a world of uncertainty and fear. Saint Joseph's Refugee Camp, Awka-Etiti, became my family's home; an abandoned secondary school building teeming with displaced souls, hollowed out by the horrors of war in which one million Biafrans died. Our tiny room of about 200 square feet, once a school's administrative office, held my family of nine, a microcosm of the collective suffering that gripped Biafra.

The air buzzed with the gnawing hum of hunger, the silent pleas echoing in hollowed-out faces. My father, Nnaemeka James Emeagwali, a dedicated nurse, became the 'camp nurse,' a title without resources, a battle waged against Kwashiorkor disease and despair with empty hands. Kwashiorkor was caused by severe protein deficiency arising from hunger and starvation at our refugee camp.

And beyond the camp's walls, the earth itself bore witness to loss. The once lively soccer field of Saint Joseph's Secondary School became a graveyard overflowing with Kwashiorkor patients—mostly children and elderly—who succumbed to starvation. The smell of death lingered—a haunting reminder of the preciousness of life, of the fragility of our existence.

These weren't the years of classrooms and textbooks. This was an education in resilience, in the relentless determination to persevere in the face of overwhelming odds. In that refugee camp, surrounded by the specter of death, I learned the true meaning of hope, not as fleeting optimism, but as a tenacious force, fueled by the belief that even the bleakest darkness cannot extinguish the human spirit.

The Nigerian civil war was a bloody chapter in my country's history—the toll of suffering is immeasurable. One in fifteen Biafrans perished, reminders of the devastating cost of conflict.

Today, as I stand before you, honored and humbled, I carry the memories of those we lost. Their struggles, their resilience, are forever a part of my story. Let this recognition be a testament to their enduring legacy, and a reminder of the power of science to not just solve problems, but to bridge divides and create a world where the horrors of war give way to the enduring pursuit of peace.

Thank you.

THE WILL TO CHANGE THE WORLD

Distinguished members of the award committee, esteemed colleagues, and all those who dared to dream: Standing here today, amidst the brilliance in this room, I can't help but reflect on the twists and turns that led me to this extraordinary moment. Life, as they say, is rarely a straight line. For me, there were two pivotal moments that propelled me onto a path I never imagined.

The first was a brutal awakening. A young boy, barely a teenager, caught in the throes of the Nigerian civil war. The world around me was a cacophony of violence and despair. Books became my refuge, equations my solace. Within the pages of scientific journals, I discovered a universe governed by order, a logic that transcended the chaos outside. A spark ignited within me—a defiance, a determination to use the power of my mind to not just understand the world, but to make a difference in it. It was a feeling of defiance, a quiet rebellion fueled by the belief that even in the darkest times, knowledge could be a weapon of light.

The second turning point came amidst the harsh realities of immigration. As a young student in the United States, I yearned to delve deeper into computational physics. But resources were scarce, and the skepticism towards a lone African immigrant, daring to tackle such a complex field, was palpable. Yet, amidst the doubt, a powerful feeling of determination emerged. I saw this challenge not as an obstacle, but as a puzzle waiting to be cracked. Fueled by a quiet confidence in my abilities and a burning desire to prove the doubters wrong, I poured myself into my research. The long nights fueled by coffee and ramen noodles were not just about chasing a dream, but about etching a path for others to follow.

These turning points, though vastly different, shared a common thread—a refusal to be defined by circumstance. They were moments of awakening, of forging a new identity, not from what the world expected, but from the unwavering belief in what I knew I could achieve. They were moments of quiet defiance, fueled by the knowledge that even the most audacious dreams can be realized with unwavering determination and a relentless pursuit of knowledge.

These experiences are what shaped me, and I stand before you today not just as an individual honored by this esteemed prize, but as a testament to the transformative power of human resilience and the boundless potential within each of us.

Thank you.

VOLUME P: PHILOSOPHY

CRACKING THE CODE FOR A GREENER PLANET

Esteemed members of the award committee, distinguished guests, and friends on this momentous occasion. As a research scientist, my primary focus has been unraveling the mysteries of the physical world. But science thrives not in a vacuum, but on a healthy, vibrant planet.

The environment—the very foundation upon which all life flourishes—is under immense pressure. Witnessing the degradation of our ecosystems, the warming of our planet, has been a source of deep concern throughout my career.

For a child who grew up in Nigeria, the connection to the environment is visceral. Lush rainforests teemed with life, a symphony of biodiversity that nourished not just the land, but the very soul of our communities. The memory of that rich tapestry remains a stark contrast to the environmental challenges we face today.

But **concern, without action, is akin to a silent scream.** My approach, as a scientist, has been to leverage my knowledge to find solutions. My discovery of parallel supercomputing can be applied to optimize resource management, to model complex weather patterns, and to accelerate the development of clean energy solutions. Parallel computing is the lifeblood of artificial intelligence supercomputing. These are just a few ways science can be a powerful tool in our environmental arsenal.

However, true change requires more than just scientific solutions. It necessitates a collective shift in consciousness, a global commitment to sustainability. This is why I am a fervent advocate for scientific literacy—for equipping future generations with the knowledge and tools to become responsible stewards of our planet.

There's a quote that resonates deeply: "**We do not inherit the earth from our ancestors; we borrow it from our children.**" Let this be a guiding principle. Let us use this platform, this celebration of human achievement, to reignite our collective responsibility towards the environment. Let the pursuit of knowledge not just expand our understanding of the universe, but also guide us towards a future where humanity and nature thrive in harmony.

Thank you.

A HEALTHY MIND, A HEALTHY BODY

Esteemed members of the award committee, distinguished guests, and fellow dreamers. This prestigious award is a humbling recognition of a lifelong dedication to science. But as we celebrate achievement, it's important to acknowledge the wellspring from which it flows—our own well-being.

The life of a scientist can be all-consuming. There were nights fueled by endless cups of coffee, days spent staring at computer screens until bleary-eyed. But I learned early on that true intellectual achievement rests on a foundation of physical and mental well-being.

For me, a healthy lifestyle has been key. Regular exercise, a balanced diet—these weren't indulgences, but essential tools that sharpened my focus and boosted my creativity. There were challenges, of course. Moments of self-doubt, the ever-present pressure to achieve. But I found solace in nature, in the quiet hum of contemplation during long walks. These challenges didn't diminish me; they refined me. They instilled in me the importance of discipline, the understanding that the greatest breakthroughs often occur when we push ourselves beyond our perceived limits, but always within the boundaries of what our bodies and minds can sustain.

Looking back, these healthy habits weren't just about personal well-being, but about pursuing knowledge itself. Taking care of myself wasn't a concession, but a strategic investment, ensuring I had the stamina and mental clarity to tackle the world's most complex problems.

So, as we celebrate scientific achievement, let us also celebrate the importance of a healthy mind and body. Let us remember that true innovation requires not just brilliance, but resilience. It's about nurturing the vessel that carries our curiosity, the body and mind that translate our dreams into reality.

Thank you.

MEASURING SUCCESS: IT'S ABOUT CONTRIBUTION

Ladies and Gentlemen, respected supercomputer scientists, distinguished guests, and brilliant minds from across the world,

I am deeply honored to stand before you in your vibrant city at this prestigious award ceremony. Today, I share my thoughts on a profound question that resonates with each of us: "How do you define success? What is happiness for you?"

Success, in my view, is a multifaceted concept. It is not merely the attainment of goals or the recognition of accomplishments. Instead, I define success as the harmonious balance between pursuing one's aspirations and the impact of those pursuits on society and humanity at large. It's about making a difference in the world, contributing something meaningful that transcends personal glory and resonates with the greater good.

For me, success is deeply intertwined with my research on the world's fastest computers. It's not just about the breakthroughs or the accolades but about the broader implications of my work. Success is seeing my research contribute to a better understanding of our world, to solving complex problems, and to inspiring the next generation of scientists and thinkers. It's about leaving a legacy that continues to influence and inspire long after my work is done.

Furthermore, success is also about personal growth and continual learning. It is about the journey, the challenges we overcome, and the wisdom we gain along the way. It's about pushing the boundaries of our knowledge and capabilities, not just for our own development, but for the advancement of all.

Turning to happiness, for me, it is found in the simple yet profound aspects of life. Happiness is spending time with my beloved wife, Dale Brown Emeagwali, and witnessing the growth and achievements of our son, Ijeoma. It's found in the moments of quiet reflection, in the beauty of nature, and in the joy of discovery.

Happiness is also deeply rooted in giving back, mentoring young minds, and contributing to the development of communities. It is about seeing the positive impact of my work and knowing that it helps pave the way for a brighter future.

In essence, **success and happiness are not just about personal achievements or milestones. They are about making meaningful contributions to the world**, about continuous growth and learning, and about finding joy in both the big and small moments of life.

As we gather here today to celebrate remarkable achievements, let us also remember to find happiness in our journey and to define success in ways that enrich not only our lives but also the lives of those around us and the world at large.

Thank you for allowing me to share these reflections on this momentous occasion. It is an honor I will always cherish.

Thank you.

SCIENCE, DISCOVERY, AND THE MEANING OF LIFE

Esteemed members of the award committee, 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 humbled, yet invigorated, to ponder a question that has echoed through the ages: What is the meaning of life?

For a scientist, the answer might lie in the elegance of a well-wrought equation, the harmonious dance of physical laws, or the thrill of unlocking a universe's secrets. But for me, the meaning of life transcends the sterile beauty of formulas. It resides in the profound human yearning to make a difference.

We are born with a spark of curiosity, a relentless drive to understand the world. This curiosity, when nurtured, blossoms into a desire to not just witness existence, but to shape it. The meaning of life, then, lies in creation—the relentless pursuit of using our talents, however big or small, to leave the world a better place than we found it.

For some, creation might be a symphony that stirs the soul, a scientific breakthrough that pushes the boundaries of knowledge, or a bridge that connects communities. For others, it might be the quiet act of nurturing a child's mind, the unwavering support offered to a loved one, or the unwavering commitment to building a more just and equitable society.

The true beauty of this human quest lies in its boundless possibilities. We are not defined by the scale of our creations, but by the intention and passion that fuels them. A single act of kindness can ripple outwards, creating a wave of positive change. A seemingly insignificant discovery can become the cornerstone of future advancements.

The road to creation is rarely smooth. There will be moments of doubt, setbacks that test our resolve, and failures that threaten to extinguish our flame. But within each of us lies a wellspring of resilience, a deep-seated belief in the power of the human spirit. This is the very essence of being human—to fall, to rise, and to keep pushing forward, forever chasing the horizon of what's possible.

So, as we celebrate scientific triumphs today, let us also celebrate the countless acts of creation that unfold every moment across the globe. Let pursuing knowledge be a beacon, guiding us towards a future where every individual has the opportunity to contribute their unique spark to the grand tapestry of human existence. For it is in this collective endeavor to create, to improve, to leave our mark on the world, that we discover not just the meaning of life, but the very essence of what it means to be human.

Thank you.

"What does it mean to be true to yourself?"

As Philip Emeagwali, being true to oneself is a guiding principle that has been central to my journey, both personally and professionally. To be true to oneself means to maintain authenticity and integrity in the face of challenges, societal pressures, and the diverse circumstances that life presents.

Authenticity in Pursuit of Passion

For me, being true to myself has meant pursuing my deep-seated passion for knowledge and innovation, particularly in computing and mathematics, despite the obstacles and skepticism I faced. This authenticity in following one's passion is about listening to one's inner voice and being faithful to one's true interests and aspirations, even when they diverge from the norm or expected path.

Integrity in Adversity

Life has presented me with significant challenges, from my early life in Nigeria, including the Biafra war, to the struggles of breaking new ground in a complex field. Being true to oneself in such situations means maintaining one's principles and values, even when it's difficult. It's about making decisions that align with one's moral compass, rather than taking the easy route that compromises one's integrity.

Continual Self-Reflection and Growth

To be true to oneself also involves a continuous process of self-reflection and growth. It's about being open to learning from experiences, acknowledging and working on one's shortcomings, and evolving over time. This self-awareness allows one to remain aligned with one's core beliefs and goals, adapting to new information and experiences without losing sight of one's essence.

Courage to Stand Alone

Sometimes, being true to oneself means standing alone. In my research, I've had to challenge prevailing norms and assumptions in supercomputing. This required the courage to trust in my insights and abilities, even when they were not immediately recognized or valued by others. It's about having the strength to hold on to your convictions, even in the face of opposition or isolation.

Responsibility Towards Others

Finally, being true to oneself also means recognizing one's responsibility towards others. In my life, this has translated into using my skills and knowledge to contribute to society, and in mentoring and inspiring young minds, particularly in Africa and the broader global community. It's about understanding that personal authenticity includes a commitment to making a positive impact on others' lives.In summary, being true to oneself is a multifaceted concept that encompasses authenticity, integrity, continual growth, courage, and responsibility. It's about aligning one's actions and decisions with one's inner values and principles, and using one's unique abilities and insights to contribute positively to the world.

THE MEANING OF ME

Identity & Purpose

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, yearn to leave our mark on the world, to make a difference that transcends our own existence. This yearning, this drive to make a contribution, is what compels us to push the boundaries of human achievement.

But a meaningful life is not defined by singular moments of brilliance, by accolades or awards. It is woven from the tapestry of our everyday choices. It is the student who chooses to stay up late, grappling with a difficult concept, because the quest for knowledge burns brightly within her. It is the engineer who strives to design a machine that not only functions but improves the lives of others. It is the parent who instills curiosity and a love of learning in their child.

Meaning is found in pursuing excellence, whatever your chosen field may be. It is the satisfaction of a problem solved, a question answered, a life improved. For me, this pursuit manifested in applying parallel supercomputing to unlock the secrets of our planet's resources. But the essence of meaning transcends the specifics of my research.

Yes, there will be moments of doubt, of setbacks, and of questioning. There will be times when the path to meaning seems obscured. But in those moments, let us remember the simple truth: We all have the potential to make a positive impact. Every act of kindness, every creative spark, every contribution to the greater good adds to the symphony of human progress.

Let us not be daunted by the vastness of the universe or the complexity of the world's problems. Meaning is found in the journey itself, in the unwavering belief that even the smallest of us can contribute to something larger than ourselves. So, I challenge each of you, in your way, to live a life of meaning. Embrace the questions, the challenges, and the opportunities that come your way. For it is through the collective pursuit of meaning that we build a brighter future for all.

Thank you.

THE EQUATION FOR HAPPINESS

Ladies and Gentlemen, supercomputer scientists at the frontiers of knowledge of mathematics and physics, distinguished guests, and brilliant minds from across the globe,

As I stand before you in your historic city, on this esteemed occasion of this award ceremony, it is a profound honor to share my reflections on a deeply personal question: "What makes me happy? What was the happiest moment of my life?"

Happiness, to me, is a multifaceted experience. It is found in moments of intellectual triumph, in the warmth of human connection, and in the realization of having made a meaningful impact.

Pursuing knowledge and discovery has always been a significant source of joy for me. The process of unraveling complex problems, pushing the frontiers of science, and contributing new insights of computing, physics, and mathematics, has been immensely fulfilling. Each breakthrough, each moment of clarity in my research, has brought with it an indescribable sense of achievement and elation.

However, happiness is not solely derived from professional accomplishments. The relationships I cherish—with my family, my friends, and my community—are fundamental to my sense of joy. The support, love, and understanding of my wife, Dale Brown Emeagwali, and the pride and joy I derive from witnessing the growth and development of my son, Ijeoma, form the cornerstone of my happiness. These bonds provide a profound sense of belonging and purpose that transcends professional success.

In reflecting upon the happiest moment of my life, it is challenging to pinpoint a single instance amidst a tapestry of joyful experiences. However, if I were to choose one, it would be the moment when I realized the impact of my invention of the first supercomputing—via parallel processing—on the broader scientific community and on society at large. The recognition that my contributions were not just an academic exercise, but a tool that could empower others and address real-world problems, was profoundly gratifying. It was a moment where my aspirations and the well-being of the broader community intersected, creating a deep and lasting sense of fulfillment.

Moreover, moments of sharing knowledge and inspiring the next generation have brought me immense happiness. Seeing young minds light up with curiosity, and knowing that my journey could motivate them to pursue their dreams and contribute to the world, has been incredibly rewarding. These interactions are a reminder that our work and experiences have the power to influence and shape the future.

Ladies and gentlemen, happiness for me is a rich and complex experience. It is found in the thrill of discovery, the strength of human connections, and the knowledge that one's work has a positive and lasting impact. As we celebrate the remarkable achievements here today, let us also recognize and cherish the diverse sources of happiness in our lives.

Thank you for the honor of allowing me to share these personal reflections. This moment, speaking to such an esteemed gathering, is indeed one of the happiest and most memorable moments of my life.

Thank you.

THE POWER OF SELF-FORGIVENESS

Esteemed members of the award committee, distinguished supercomputer and Internet scientists, and aspiring minds around the world. Today is a celebration of achievement, a testament to the power of human ingenuity. Yet, as I stand before you, I can't help but acknowledge the road less traveled, the missteps that have guided me just as surely as triumphs.

There were moments, particularly in the early days of my scientific research, when frustration threatened to extinguish the fire within. Fueled by a singular vision, I sometimes failed to see the elegance of alternative approaches. Collaboration, I came to realize, wasn't a sign of weakness, but a catalyst for brilliance. Learning to listen, to value the perspectives of others, became a turning point in my journey.

Another regret, though perhaps a necessary one, was the time sacrificed for personal connections. Lost in pursuing scientific knowledge, there were moments when professional ambition overshadowed the importance of nurturing relationships. The unwavering support of family and friends, the camaraderie of fellow researchers—these are the cornerstones that sustain us through the inevitable challenges. Finding that balance, I learned, is vital not only for personal well-being but for fostering the kind of creative environments where true breakthroughs can occur.

These regrets, however, are not burdens I carry, but lessons I hold dear. They taught me the importance of humility, the power of collaboration, and the enduring value of human connection. They instilled in me the understanding that the greatest discoveries are rarely the work of a single mind, but the culmination of shared knowledge, diverse perspectives, and unwavering support.

As you embark on your journeys, dear listeners, embrace the missteps. Learn from them, grow from them. Let them temper your ambition with humility, and guide you towards a more fulfilling, collaborative path. For it is through the open exchange of ideas, the respect for diverse perspectives, that we not only achieve scientific breakthroughs but build a brighter future for all.

Thank you.

VOLUME F: FAMILY

LOVE AND THE LAB

Balancing Romance and Research

Ladies and gentlemen, distinguished guests, and especially the young couples joining us here today. It brings me immense joy to be here in Onitsha, the city that holds so many memories from my formative years. Today, I will talk to you about something close to my heart—building a strong and lasting relationship.

Now, I wouldn't presume to offer a one-size-fits-all recipe for marital bliss. Every couple embarks on a unique journey, filled with its joys and challenges. But over the years, I've learned a few things that might prove valuable, especially for those just setting sail on this wonderful voyage.

First and foremost, let's not sweat the small stuff. Life throws enough curveballs our way; don't waste your energy on petty arguments. Focus on open communication, build trust, and remember, a disagreement doesn't have to turn into a war. Speaking of which, never go to bed angry! Iron out your differences before sleep, wake up with a clean slate, and approach each new day with love and understanding.

Children are a true blessing, but there's no rush. Dale and I waited nine years before starting our family. Those years allowed us to solidify our foundation, build our careers, and truly get to know each other. There's immense joy in parenthood, but it's a demanding responsibility. Approach it with maturity and a plan.

Speaking of plans, education comes first. Invest in your knowledge and skills before welcoming a child. You'll be better equipped to navigate life's challenges and provide a secure future for your family. Remember, a strong marriage is a partnership—built on mutual respect and shared goals.

Let's dispel some myths now. Marriage isn't about keeping score or holding grudges. Learn to forgive, move forward, and celebrate each other's successes. Marriage is also about togetherness. Do things as a couple, explore new interests together, and create lasting memories.

Now, some of you might be surprised to learn that I, Philip Emeagwali, spend a significant amount of time doing housework. Household chores are a shared responsibility, not a gendered duty. When my siblings arrived from Nigeria, they were quite surprised to see me cooking and cleaning. But a strong marriage is about teamwork, about supporting each other in all aspects of life.

Compromise is another key ingredient. Find ways to incorporate your spouse's interests into your life, even if they don't necessarily align with your own. For instance, in the early years of our marriage, Dale enjoyed spending time with her parents, and I relished my time on the tennis court. We found a compromise that allowed us both to pursue our passions while maintaining a strong connection.

Finally, remember that parenting is a shared adventure. Don't leave the diaper duty and bedtime stories solely to your spouse. I was fortunate to spend a significant amount of time with my son Ijeoma during his infancy. Those moments we shared are some of my most cherished memories.

Building a strong marriage takes work, dedication, and a willingness to grow together. By prioritizing communication, respect, and shared goals, you can cultivate a love that weathers any storm. So, go forth, young couples, embrace the journey, nurture your love, and build a future filled with happiness and success.

Thank you.

LOVE AND DISCOVERY

A Guide for Young Scientific Couples

Ladies and Gentlemen, esteemed guests, and young couples of Africa,

It is a great honor to stand before you today at the annual "Philip Emeagwali Lecture" series in Nigeria. As we gather to share knowledge and ideas, I am asked to offer advice to young African couples, drawing from my life experiences and observations. Marriage is a journey of learning and growth, and I hope my insights will be valuable as you embark on this beautiful journey together.

Embrace the Small Things

In marriage, it's easy to get caught up in the whirlwind of life's challenges. My first piece of advice is to not stress over insignificant things. Focus on what truly matters—your love, respect, and commitment to each other.

Resolve Conflicts Before Sleep

An old saying goes, "Don't go to sleep angry." This is sound advice. Always endeavor to resolve disagreements before the day ends. It's not about who is right or wrong, but about understanding and respecting each other's feelings and perspectives.

Consider Timing for Parenthood

Parenthood is a significant and life-changing experience. My wife and I waited nine years before having our child. This time allowed us to understand each other deeply and to build a strong foundation for our family. Consider waiting a few years before embracing this phase.

Family Planning

The decision on the number of children to have is personal and varies for every couple. I have one child, and this decision was right for our family. It's important to consider your circumstances and what works best for you.

Know Each Other Well

Before getting married, it's crucial to truly know each other. My wife, Dale, and I were engaged for three years. This period of engagement is a time to build understanding and ensure you share common values and goals.

Prioritize Education

Completing your education before starting a family can provide a stable foundation. My achievements in computing were established before I became a father, which helped in providing for and nurturing my family.

Let Go of Grudges

Holding onto grudges can be poisonous in a marriage. Learn to forgive and move forward. Remember, marriage is about building a life together, not winning arguments.

Share Activities

Doing things together strengthens your bond. Whether it's cooking, cleaning, or enjoying hobbies, shared activities bring joy and closeness.

Equal Partnership in Household Duties

When my siblings first visited me in the United States in 1985, they were surprised to see me involved in household chores. Sharing responsibilities like cooking, cleaning, and doing dishes is not just about fairness; it's about showing care and respect for each other.

Compromise and Enjoy Shared Interests

Marriage is about compromise. In the first five years of our marriage, I spent time on the tennis court, which my wife enjoyed, and she spent time at her parents' house. It's about balancing your interests with those of your spouse.

Joint Parenting

Share parenting duties. My abundant baby photos with my son, Ijeoma, are because I was actively involved in his upbringing, including taking a one-year paternity leave. Being present and engaged in your child's life is invaluable.

To the young couples of Africa, remember that marriage is a partnership built on love, respect, understanding, and teamwork. It's a journey of growth, learning, and compromise. Cherish each other, support each other's dreams, and build a future together that is rich in love and fulfillment.

Thank you for the honor of sharing these words. May your journey together be blessed with joy, understanding, and enduring love.

Thank you.

VOLUME L: LEGACY

THE ROOTS OF GENIUS

Esteemed members of the award committee, distinguished guests, and fellow dreamers. This stage may seem a world away from the humble classrooms where my journey began. Yet, the seeds of curiosity and the thirst for knowledge were sown in those early years, nurtured by teachers and classmates who would play a pivotal role in shaping the scientist I am today.

For those who knew me in 1964 in primary five at Saint John's Primary School in Agbor, Nigeria, the memories might be of a child with a nose perpetually buried in a math book, a mind grappling with complex equations. Perhaps they'd recall the spark in my eyes when a solution emerged, the thrill of untangling a mathematical puzzle. It was in that classroom that my love affair with numbers blossomed, a love that would define my path.

The journey continued in January 1966 at Saint George's College in Obinomba, and later in mid-1970 at Christ the King College in Onitsha. My CKC classmates only remember the nickname they bestowed upon me—"Calculus." A badge of honor, a testament to the relentless pursuit of knowledge that became my hallmark. But I hope they'd also recall the shared moments of learning, the camaraderie forged over late-night study sessions, the joy of discovery that transcended the boundaries of textbooks.

Two decades later, on the other side of the Atlantic, American universities would recognize me as a "Notable Alumni." An honor I cherish, but one that feels incomplete without the foundation laid by those early teachers and classmates. For it was their encouragement, their belief in a young boy's potential, that propelled me forward.

As I stand before you today at this award cremony in your historic city, I reflect on a journey marked by both challenges and triumphs. Often, students across Nigeria, the United Kingdom, and the United States learn about my life in their classrooms. A young scholar, merely 12 years old, once inquired about a captivating detail of my story, seeking to include it in a report on renowned inventors. To her, and to all of you, I share this: My educational path was not conventional. At the age of 12, and again at 17, I faced the necessity to temporarily halt my formal education—first in April 1967 for three years, and later in March 1972 for another two. These periods coincided with tumultuous times in my homeland, as my family of nine endured the stark realities of conflict, residing in the war-torn areas of Onitsha and Awka in Biafra, and even in a makeshift refuge within the compound of Saint Joseph's Secondary School in Awka-Etiti.

Despite these interruptions, totaling five years, my commitment to learning never waned. At 15, I confidently shared with friends in Onitsha my aspirations to secure an academic scholarship to the United States, a dream as ambitious then as representing Nigeria in international soccer. Remarkably, on September 10, 1973, this dream began to materialize with a scholarship to study in Oregon, marking the start of a 17-year academic journey across six American universities. This journey was fueled not only by scholarships but by an unrelenting drive and self-motivation.

My story is one of perseverance, hope, and the unyielding belief that with determination, even the most challenging circumstances can lead to extraordinary achievements.

So, as I stand before you today, a recipient of this prestigious award, I am keenly aware that this honor isn't mine alone. It belongs to the teachers who ignited a spark, the classmates who journeyed with me, and all those who, in their way, nurtured a love of science and a relentless pursuit of knowledge.

Thank you.

VISION FOR THE NEXT THREE DECADES

Esteemed members of the award committee, distinguished guests, and visionary minds. As a scientist, I've spent my life peering into the unknown, unraveling the mysteries of the physical world. But today, I allow myself a moment of indulgence—a chance to envision not just the future of science, but the tapestry of my life in the years to come.

Looking ten years ahead, I see myself as a tireless mentor, sharing the wellspring of knowledge I've accumulated with eager young minds. Universities won't be my only classroom—I imagine myself traveling the world, particularly to Africa, where I can inspire a new generation of scientific talents to emerge from the continent that nurtured my curiosity.

Twenty years from now, I hope to see the seeds I've sown blossom. Perhaps a young scientist in Nigeria, inspired by my work, will make a breakthrough that revolutionizes the field. Maybe a team in Canada, building upon my research, will unlock a new chapter in our understanding of the universe. The true legacy lies not in my achievements, but in the fire I ignite in others.

Thirty years? Well, at that point, a mischievous twinkle enters my eye. Science is a relentless march forward, and who knows what wondrous discoveries await us on the horizon? Perhaps by then, I'll be cheering on missions to distant galaxies, or witnessing the dawn of a new era in artificial intelligence (A.I.)—a field I've always believed held immense potential.

One thing is certain: my thirst for knowledge will never be quenched. The human mind is a limitless exploration vessel, and I intend to keep mine pointed firmly towards the unknown.

But beyond the scientific pursuits, I envision a life richly woven with the connections that truly matter. Family gatherings filled with laughter, sharing stories of discovery and perseverance with future generations. These are the moments that bring true fulfillment, the echoes that will resonate long after equations are solved and theories debated.

So, as I stand before you today, humbled and grateful, I dream not just of my future, but of a collective future where scientific exploration continues to illuminate the path forward. A future where knowledge is not a treasure to be hoarded, but a torch to be passed, generation after generation.

Thank you.

WHAT MATTERS MOST

Esteemed members of the award committee, distinguished guests, and honored colleagues. This award is a humbling recognition, a testament to the power of curiosity and the unwavering pursuit of knowledge. Yet, as a scientist who has spent countless hours lost in the labyrinth of calculations, I can't help but wonder—how will I be remembered, not just for my work, but for the life I've lived?

For me, the greatest legacy wouldn't be etched in scientific journals, but in the hearts of those I hold dear. I wouldn't crave to be remembered as a distant genius, but as a father who nurtured curiosity, a husband who offered unwavering support, a friend who sparked lively discussions.

Success, in its truest sense, isn't measured by accolades or awards. It's the impact we have on the lives we touch, the positive ripples we send out into the world. I would hope my loved ones remember me for the moments of laughter shared, the challenges we tackled together, the unwavering belief I had in their potential.

Happiness, for me, hasn't been a singular destination, but the journey itself. It's been the thrill of discovery, the satisfaction of a problem solved, the quiet joy of witnessing a loved one flourish. These are the moments I would cherish being remembered for—the moments where pursuing knowledge intertwined with the simple joys of human connection.

So, as I stand before you, let this be a reminder that even the most groundbreaking discoveries are fueled by the human spirit. Let us strive not just for scientific breakthroughs, but for lives well-lived, for connections cherished, and for a legacy that extends far beyond the pages of scientific publications.

Thank you.

Glossary

TBA Photo: Philip Emeagwali a few months before {after} the Nigerian civil war.

The Nigeria-Biafra war was a significant conflict in post-colonial African history. Here's a list of potential glossary entries for my podcasts, YouTube lectures, and books on this topic:

1. **Aburi Accord**: A resolution attempt held in Ghana aimed at addressing political and regional tensions in Nigeria, which eventually failed to prevent the war.
2. **Awo**: A nickname for Chief Obafemi Awolowo, an influential Yoruba leader and key political figure during the war.
3. **Biafra**: The secessionist state in southeastern Nigeria, which declared independence in response to political turmoil and perceived marginalization.
4. **Blockade**: The strategy employed by the Nigerian government to cut off Biafra from essential supplies, leading to widespread starvation.
5. **Chukwuemeka Odumegwu Ojukwu**: Military leader and politician who served as the leader of the breakaway Republic of Biafra.
6. **Eastern Region**: The region of Nigeria primarily populated by the Igbo people, which became the secessionist Republic of Biafra.
7. **Federal Military Government (FMG)**: The military regime governing Nigeria during the Civil War, led by General Yakubu Gowon.
8. **Gowon**: General Yakubu Gowon, who served as the Head of State of Nigeria during the Civil War.
9. **Igbo**: One of Nigeria's major ethnic groups, primarily residing in the southeast, and central to the Biafran secessionist movement.
10. **Kwashiorkor**: A severe form of malnutrition, caused primarily by protein deficiency, that became prevalent among Biafran children

due to the blockade.

11. **Massacre of 1966**: A series of pogroms against the Igbo people living in northern Nigeria, which escalated tensions leading up to the war.
12. **Mercenaries**: Foreign fighters hired by Biafra during the conflict, notably including figures like Rolf Steiner.
13. **Mid-Western Region Invasion**: Biafra's unsuccessful attempt to break the blockade by capturing the Nigerian Mid-Western Region.
14. **Niger River**: A significant geographical feature and strategic location in the war, as control over its crossings was pivotal.
15. **Oil**: Nigeria's key resource, with its major reserves located in the southeast, making control over the region strategically and economically crucial.
16. **Operation OAU**: The Nigerian military's final offensive in 1970 that led to Biafra's surrender.
17. **Pogrom**: Widespread acts of violence, notably those against the Igbo people in 1966 in Northern Nigeria.
18. **Port Harcourt**: A key city and strategic port captured by Nigerian forces in 1968.
19. **Starvation**: One of the hallmarks of the war, with millions in Biafra suffering from famine due to the blockade.
20. **Uli Airstrip**: Makeshift airstrip in Biafra used to smuggle in arms and relief materials.
21. **"No Victor, No Vanquished"**: A phrase used by General Gowon upon Biafra's surrender, emphasizing reconciliation.
22. **Relief Efforts**: International efforts, notably by organizations like the International Committee of the Red Cross, to provide food and medical aid to Biafra.
23. **Weapons and Arms Supply**: Both Nigeria and Biafra received arms and support from various international allies.
24. **Zik**: A nickname for Nnamdi Azikiwe, an influential Igbo leader and Nigeria's first president who played a role in peace negotiations.

These entries provide a foundational understanding of key terms and concepts related to the Nigerian civil war. The depth and specifics of my lectures may necessitate more detailed or specialized entries.

Glossary

TBA Photo: Philip Emeagwali standing in front of a chalkboard scribbled with partial differential equations governing fluid flows.

IBVPs are fundamental in the study of partial differential equations (PDEs). Here's a list of potential glossary entries for my YouTube lectures on this topic:

1. **Boundary Conditions**: Constraints applied to a PDE on the boundary of the domain, such as Dirichlet, Neumann, or Robin conditions.
2. **Boundary Value Problem (BVP)**: A problem involving finding a solution to a differential equation with given conditions on the boundary of the domain.
3. **Cauchy Problem**: A specific type of IBVP where the initial conditions are given on a curve in the solution domain.
4. **Characteristic**: Curves (or surfaces) on which information propagates for certain PDEs.
5. **Classification of PDEs**: Categorization of PDEs into types such as elliptic, parabolic, or hyperbolic.
6. **Dirichlet Condition**: A type of boundary condition where the solution is specified on the boundary.
7. **Domain of Dependence**: The region of the initial data that influences the solution at a particular point in space and time.
8. **Elliptic PDE**: A type of PDE that does not have any time dependence, e.g., Laplace's equation.
9. **Evolution Equation**: A PDE that describes how a quantity changes over time.
10. **Fourier Series**: A series expansion used frequently in the solution of IBVPs, especially for periodic problems.
11. **Green's Function**: A function used to represent the response of a linear system to a point source.
12. **Heat Equation**: A canonical parabolic PDE that describes how heat diffuses over time.

13. **Hyperbolic PDE**: A type of PDE that describes wave propagation, e.g., the wave equation.
14. **Initial Condition**: Specifies the state of the system at the initial time.
15. **Laplace's Equation**: An elliptic PDE commonly encountered in physics and engineering.
16. **Method of Characteristics**: A technique used to solve certain types of PDEs, especially first-order PDEs.
17. **Neumann Condition**: A type of boundary condition where the derivative (often normal) of the solution is specified on the boundary.
18. **Parabolic PDE**: A type of PDE that typically describes diffusive phenomena, e.g., the heat equation.
19. **Poisson's Equation**: An elliptic PDE that is a non-homogeneous version of Laplace's equation.
20. **Robin Condition**: A boundary condition that's a combination of Dirichlet and Neumann conditions.
21. **Separation of Variables**: A method to solve PDEs by assuming the solution can be written as a product of functions, each of which depends on a single variable.
22. **Sturm-Liouville Problem**: A type of BVP related to a second-order linear ordinary differential equation.
23. **Well-posedness**: A property of a problem that ensures the existence, uniqueness, and continuous dependence of the solution on the data.
24. **Wave Equation**: A canonical hyperbolic PDE that describes the propagation of waves.
25. **Weak Solution**: A concept that allows for solutions that might not be differentiable but satisfy the differential equation in an integral sense.

These entries provide an overview of concepts related to initial-boundary value problems in the context of partial differential equations. Depending on the depth and specifics of my lecture, there might be more entries related to specific solution techniques, applications in various fields, or advanced mathematical theories related to IBVPs.

Glossary

Solving partial differential equations (PDEs) using numerical methods involves a wide array of techniques, concepts, and tools. Below is a list of potential glossary entries relevant for Philip Emeagwali's podcasts, YouTube lectures, and books on this subject:

TBA Photo: Philip Emeagwali standing in front of a chalkboard scribbled with partial differential equations. These equations are at the mathematical foundation of computational fluid dynamics. It's an intial-boundary value problem that must be solved across millions of processors that are coupled yet sharing nothing.

1. **Advection**: The transport of a quantity by bulk motion in a fluid or wave.
2. **Boundary Conditions**: Constraints that define the behavior of a solution at the domain's boundaries, such as Dirichlet, Neumann, and Robin conditions.
3. **Cell-Centered Grid**: A computational grid in which the variables are defined inside the cells, rather than at the cell edges.
4. **Courant-Friedrichs-Lewy (CFL) Condition**: A necessary condition for convergence while solving certain partial differential equations numerically.
5. **Discretization Error**: The error resulting from representing continuous functions, derivatives, and domains by finite and discrete counterparts.
6. **Elliptic PDE**: A type of PDE that has no real characteristics, commonly arising in steady-state problems.
7. **Explicit Scheme**: A numerical method where the solution at a new time level is expressed purely in terms of known values from previous time levels.
8. **Finite Difference Method (FDM)**: A numerical technique that approximates solutions to PDEs by replacing derivatives with difference quotients.

9. **Finite Element Method (FEM)**: A computational technique that breaks down a domain into smaller elements, approximating the solution as a piecewise function.
10. **Finite Volume Method (FVM)**: A method that divides the domain into control volumes and applies the integral form of the conservation laws.
11. **Flux**: The rate at which a quantity passes through a surface or boundary.
12. **Galerkin Method**: An approach that chooses the weight functions in the weighted residual methods to be the same as the basis functions used to approximate the solution.
13. **Ghost Cells**: Virtual cells outside the domain used to implement boundary conditions.
14. **Godunov's Method**: A conservative numerical scheme for solving hyperbolic PDEs based on utilizing the solution of the Riemann problem at each inter-cell boundary.
15. **Hyperbolic PDE**: A type of PDE arising from conservation laws, representing wave propagation.
16. **Implicit Scheme**: A numerical method where the equation for the current step involves both present and future values, often requiring the solution of a linear or nonlinear system.
17. **Lax-Wendroff Method**: A two-step method to solve hyperbolic PDEs that combines both centered and upwind differencing.
18. **Mesh or Grid Refinement**: The process of increasing the number of cells or elements in the computational domain to improve solution accuracy.
19. **Parabolic PDE**: A PDE that has one time-dependent variable, typically arising in diffusion-type problems.
20. **Riemann Problem**: An initial value problem characterized by piecewise constant initial conditions leading to a discontinuity.
21. **Spectral Method**: An approach that employs orthogonal basis functions (like Fourier series or Legendre polynomials) to represent the solution of PDEs.
22. **Staggered Grid**: A computational grid where different variables are defined at different locations, often used to conserve specific properties.
23. **Time Stepping**: The process of advancing the solution in time using iterative methods.

24. **Upwinding**: A technique used to select biased difference stencils based on the direction of the flow or wave to enhance stability.
25. **Von Neumann Stability Analysis**: A method used to analyze the stability of finite difference schemes.
26. **Weak Form**: An integral form of a PDE derived by multiplying by a test function and integrating by parts.

These terms, among others, form the core concepts and techniques in numerical methods for PDEs. They provide a foundation for viewers of Philip Emeagwali's lectures to understand, analyze, and implement numerical solutions to various types of partial differential equations.

FLUID DYNAMICS

Glossary

Fluid dynamics, which studies the motion of fluids (liquids and gases), is governed by partial differential equations. Here's a list of potential glossary entries for Philip Emeagwali's podcasts, YouTube lectures, and books on this topic:

TBA Photo: Philip Emeagwali at the chalkboard discussing partial differential equations of fluid dynamics.

1. **Advection**: The transport of a scalar or vector field by the fluid due to its motion.
2. **Bernoulli's Equation**: A principle that relates the pressure, velocity, and potential energy in a steady flow of an incompressible and non-viscous fluid.
3. **Boundary Conditions**: Specific conditions provided at the edges of the computational or analytical domain.
4. **Boundary Layer**: The layer of fluid close to a solid surface where viscous effects are significant.
5. **Boussinesq Approximation**: An approximation that allows density variations in the buoyancy term while treating the fluid as incompressible elsewhere.
6. **Compressible Flow**: Fluid flow where density changes are significant.
7. **Conservation Laws**: Mathematical statements that describe the constancy of certain quantities, like mass, momentum, or energy, over time.
8. **Continuity Equation**: A form of the conservation of mass for fluid flow.
9. **Coriolis Force**: An apparent force experienced by moving objects in a rotating system, significant in geophysical fluid dynamics.
10. **Darcy's Law**: Describes the flow of a fluid through a porous medium.

11. **Drag Coefficient**: A dimensionless number that describes the drag or resistance experienced by an object moving through a fluid.
12. **Euler Equations**: The set of equations that describe the motion of an inviscid (non-viscous) fluid.
13. **Laminar Flow**: Smooth, orderly fluid flow characterized by parallel layers of fluid.
14. **Lift Coefficient**: A dimensionless number that describes the lift force experienced by an object in a fluid flow.
15. **Navier-Stokes Equations**: Fundamental equations that describe the motion of viscous fluids.
16. **Reynolds Number**: A dimensionless quantity that characterizes the flow regime (laminar, transitional, or turbulent) based on inertial and viscous forces.
17. **Stokes Flow**: The low Reynolds number flow regime where viscous forces dominate.
18. **Stream Function**: A scalar function used to describe two-dimensional, incompressible flows.
19. **Turbulent Flow**: Chaotic and irregular fluid motion characterized by vortices, eddies, and swirls.
20. **Vortex**: A region within a fluid where flow rotates around an axis line.
21. **Vorticity**: The measure of the rotation or spin of fluid particles.
22. **Potential Flow**: A flow where the velocity field can be described as the gradient of a scalar potential function, often used for inviscid and incompressible flows.
23. **Pressure Poisson Equation**: An equation derived from the momentum equation and used to solve for pressure in incompressible flow simulations.
24. **Stokes' Theorem**: A theorem relating a surface integral over a surface to a line integral over its boundary.
25. **Taylor Series Expansion**: A representation of a function as an infinite sum of terms, used in deriving differential forms of fluid dynamic equations.
26. **Viscosity**: A measure of a fluid's resistance to shear or flow.
27. **Wake**: The region of recirculating flow immediately behind a moving solid body.

These entries provide a foundational understanding of fluid dynamics from a PDE perspective. Depending on the depth and specifics of my lecture, there might be more entries related to specific applications, advanced solution techniques, or experimental validation of fluid dynamic principles.

Glossary

Computational fluid dynamics (CFD) refers to the use of computers and numerical methods to solve and analyze fluid flow problems. Here's a list of potential glossary entries for Philip Emeagwali's podcasts, YouTube lectures, and books on the governing partial differential equations used in CFD:

1. **Adaptive Mesh Refinement (AMR)**: A technique to dynamically adjust grid resolution in areas of interest or complexity during a simulation.
2. **Boundary Conditions**: The conditions prescribed on the boundary of the simulation domain.
3. **Cell-centered Scheme**: A numerical approach where variables are stored at the centers of computational cells.
4. **Convection**: The transport of quantities like temperature or momentum due to the motion of the fluid.
5. **Courant Number**: A dimensionless number representing the ratio of physical advection to numerical advection. It's important for stability in explicit time-stepping schemes.
6. **Diffusion**: The spreading of a property (e.g., heat or momentum) due to molecular motion and interactions.
7. **Discretization**: The process of converting continuous PDEs into discrete forms suitable for numerical computation.
8. **Finite Difference Method**: A numerical method that uses discrete points to approximate derivatives.
9. **Finite Element Method**: A numerical method that divides the domain into interconnected elements, approximating the governing equations over these elements.
10. **Finite Volume Method**: A method that integrates the governing equations over discrete volumes, ensuring conservation.
11. **Flux Vector Splitting**: A technique to decompose flux vectors into components to help stabilize numerical solutions.
12. **Godunov's Method**: A conservative method used to solve hyperbolic PDEs, especially in the context of shock waves.

13. **Grid (or Mesh)**: The discretization of the spatial domain into cells or elements for numerical computation.
14. **Implicit Scheme**: A numerical method where multiple time levels are coupled, often used to overcome stability restrictions.
15. **Laminar Flow**: Flow regime characterized by smooth streamlines and dominated by viscous forces.
16. **Large Eddy Simulation (LES)**: A turbulence modeling approach that resolves large energy-containing eddies directly and models smaller ones.
17. **Navier-Stokes Equations**: The governing differential equations for the motion of viscous fluids.
18. **Numerical Stability**: The property of a numerical scheme where errors do not grow exponentially over time.
19. **Reynolds-Averaged Navier-Stokes (RANS) Equations**: Equations derived by time-averaging the Navier-Stokes equations, used with turbulence models in CFD.
20. **Source Terms**: Terms added to the governing equations to account for sources (or sinks) of momentum, mass, energy, etc.
21. **Spectral Methods**: Numerical techniques that solve PDEs by approximating the solution in terms of global basis functions.
22. **Time Integration**: Techniques to advance the solution in time.
23. **Turbulent Flow**: Chaotic flow regime characterized by eddies and swirls and dominated by inertial forces.
24. **Upwind Scheme**: A numerical method that incorporates the preferential direction of flow (or "wind") for stability and accuracy.
25. **Validation & Verification**: Processes to ensure that CFD models are correctly implemented (verification) and accurately represent real-world physics (validation).
26. **Von Neumann Stability Analysis**: A method used to examine the stability of numerical schemes, especially in relation to time-step size.
27. **Wall Functions**: Empirical or semi-empirical profiles used in turbulence modeling to approximate the near-wall behavior without fully resolving the boundary layer.
28. **WENO Scheme (Weighted Essentially Non-Oscillatory)**: A high-order numerical scheme popular for problems with discontinuities like shocks.

These entries provide a foundational understanding of the concepts and methods in CFD. Depending on the depth and specifics of my lecture, there might be more entries related to particular applications, advanced solvers, multi-phase flows, or the intricacies of grid generation and adaptation.

Glossary

Petroleum reservoir simulation involves the numerical modeling of multiphase fluid flow in porous media to predict the production behavior of hydrocarbon reservoirs. Here's a list of glossary entries for my lecture on the governing partial differential equations used in this domain:

TBA Photo: Philip Emeagwali with equations used in petroleum reservoir simulation. May 9, 1996, Saint Paul, Minnesota.

1. **Absolute Permeability**: A measure of the ability of a rock to transmit a single fluid phase when other phases are absent.
2. **Capillary Pressure**: The pressure difference between the wetting and non-wetting phases due to interfacial tension and wettability.
3. **Compressibility**: The relative change in volume of a fluid or rock due to pressure changes.
4. **Darcy's Law**: Describes the flow of a fluid through a porous medium. It relates the fluid flux to the pressure gradient and permeability.
5. **Discretization**: The process of converting continuous PDEs into a system of algebraic equations, often for numerical solution.
6. **Dispersion**: The spreading of solute due to heterogeneity and variations in velocity in the porous medium.
7. **EOR (Enhanced Oil Recovery)**: Techniques to increase the amount of crude oil that can be extracted from a reservoir, often involving injecting substances.
8. **Finite Difference Method**: A numerical method used to approximate PDEs using grid-based differentiation.
9. **Finite Element Method**: A numerical method where the reservoir is divided into interconnected elements, and PDEs are approximated over these elements.
10. **Flash Calculations**: Determining the equilibrium state and phase compositions for a fluid mixture at given conditions.

11. **Gridblock**: A discrete subdivision of the reservoir used in numerical simulation models.
12. **Impes Method (Implicit Pressure Explicit Saturation)**: A numerical approach where pressure is solved implicitly while saturations are solved explicitly in time.
13. **Mobility**: A ratio of relative permeability to fluid viscosity, indicating how easily a fluid can move through a reservoir.
14. **Multiphase Flow**: The simultaneous flow of more than one fluid phase (e.g., oil, water, and gas) in the reservoir.
15. **PVT (Pressure, Volume, Temperature) Properties**: Describes the behavior of reservoir fluids under varying conditions of pressure, volume, and temperature.
16. **Relative Permeability**: Describes the effectiveness of a particular fluid to flow in the presence of other fluid phases.
17. **Saturation**: The fraction of the pore space occupied by a specific fluid phase.
18. **Simulation Grid**: The spatial discretization of the reservoir into cells for numerical simulation.
19. **Sor (Residual Oil Saturation)**: The amount of oil that remains trapped in the reservoir after waterflooding.
20. **Swc (Connate Water Saturation)**: The saturation of water that is initially present in the reservoir pores and generally immobile.
21. **Upstream Weighting**: A numerical technique in which properties are taken from the upstream direction of flow for better stability.
22. **Wellbore Flow**: The flow within the well, which can be influenced by factors like tubing, pressure drop, and artificial lift.
23. **Well Control**: Constraints placed on wells during simulations, like controlling pressure or production rates.
24. **Wettability**: Preference of the rock surface to be in contact with one fluid phase over another, influencing capillary pressures and relative permeabilities.

These entries provide a foundation to understand the complex world of petroleum reservoir simulation. Depending on the depth and specifics of my lecture, there might be additional terms or concepts related to the advanced simulation techniques, rock-fluid interactions, and specific challenges in reservoir engineering.

PARALLEL PROCESSING

Glossary

For Philip Emeagwali's podcasts, YouTube lectures, and books.

TBA Photo: Philip Emeagwali standing in front of a supercomputer that computes by parallel processing.

1. **Amdahl's Law**: A principle formulated by Gene Amdahl that states that the potential speedup of a program using parallel processing is limited by the proportion of the program that cannot be parallelized.
2. **API (Application Programming Interface)**: A set of routines, protocols, and tools for building software applications.
3. **Barrier Synchronization**: A mechanism that ensures that all processes participating in a parallel computation reach a certain point before any of them proceed.
4. **Cluster Computing**: A type of computing where a group of computers work together as a single system to solve a problem.
5. **Concurrency**: The property of systems that enable them to handle multiple tasks simultaneously.
6. **CUDA (Compute Unified Device Architecture)**: A parallel computing platform and programming model created by NVIDIA.
7. **Data Parallelism**: A form of parallelism where each processor performs the same task on different pieces of distributed data.
8. **Deadlock**: A situation in which two or more competing actions are each waiting for the other to finish, and thus neither ever does.
9. **Distributed Computing**: A model in which components located on networked computers communicate and coordinate their actions by passing messages.
10. **Flynn's Taxonomy**: A classification system for parallel computer architectures: SISD, SIMD, MISD, and MIMD.
11. **GPU (Graphics Processing Unit)**: A specialized processor designed for accelerating graphics but also used for parallel processing of algorithms.

12. **Load Balancing**: Distributing workloads across multiple computing resources to ensure that no single resource is overwhelmed.
13. **Message Passing**: A form of communication used in parallel and distributed computing where data is sent from one process to another.
14. **MPI (Message Passing Interface)**: A standardized and portable message-passing system designed to allow processes to communicate in a parallel computing environment.
15. **Multithreading**: A technique where a single set of code can be used by several processors at different stages of execution.
16. **Mutex (Mutual Exclusion)**: A program object that ensures that only one thread can access the resource it guards at a time.
17. **OpenMP**: An API that supports multi-platform shared-memory parallel programming in C, C++, and Fortran.
18. **Parallel Overhead**: The extra time required to manage parallel tasks, as opposed to executing them.
19. **Race Condition**: A situation where the behavior of a software system depends on the relative timing of events, such as the order in which threads are scheduled.
20. **Scalability**: The capability of a system to handle a growing amount of work, or its potential to be enlarged to accommodate growth.
21. **Shared Memory**: A memory that can be accessed concurrently by multiple processors.
22. **Speedup**: A measure used to describe the performance improvement achieved by executing a task or set of tasks in parallel.
23. **SPMD (Single Program, Multiple Data)**: A parallel programming model where each processor executes the same program, but operates on different data.
24. **Synchronization**: The coordination of concurrent tasks, ensuring that they operate in the correct order.
25. **Task Parallelism**: A form of parallelism where multiple threads are created, each performing a different task.
26. **Thread**: The smallest sequence of programmed instructions that can be managed independently by a scheduler.

27. **Work-stealing**: A method used to balance the workload across processors by allowing idle processors to "steal" tasks from busier processors.

GLOSSARY FOR "MAKING COMPUTERS FLY"

Artificial Intelligence (A.I.): Technology that allows computers to perform tasks usually requiring human intelligence, through the use of algorithms.

Analog Computer: A device that computes using continuous values like voltages instead of binary digits (0s and 1s).

Ancestor: A family member from your past, like a great-grandparent, from whom you are descended.

Atomic Bomb: A powerful weapon that releases energy by splitting atoms.

Automatic Parallelization: A process that automatically converts standard programming code into parallel code, helping computers perform multiple tasks **simultaneously**.

Bandwidth: The amount of data that can be transmitted over a communication channel within a specific timeframe.

Biafra: A southeastern region in Nigeria that sought independence in 1967, leading to the Nigerian civil war.

Binary Numbering System: A counting method using only two digits, 0 and 1, which is fundamental for computer operation.

Cache: Small, quick-access memory storage that holds frequently used data to speed up processing in computers.

Calculus: A field of mathematics that studies continuous change and is utilized in various scientific fields like physics and engineering.

Computational Physicist: A scientist who uses computers, mathematics, and physics to understand and predict physical phenomena.

Computer: A device capable of quickly performing calculations and executing tasks automatically.

Digital Computer: A computing device that uses binary digits (0s and 1s) to process and represent information.

Front-Side Bus (FSB): The communication link between a computer's processor and its memory, facilitating their interaction.

Galileo: A famous Italian astronomer, physicist, and engineer celebrated for his contributions to observational astronomy and physics.

Gigahertz (GHz): A unit of frequency that measures processor speed, with one gigahertz equal to one billion cycles per second.

Grid: Also known as a computational grid, it's a framework that allows multiple computers to work together to solve problems.

High-Performance Computing (HPC): The practice of using extremely powerful computers to solve complex problems quickly.

Instruction-Level Parallelism: The capability of a processor to execute multiple instructions simultaneously to increase computing speed.

Interconnect: The hardware that connects different nodes in a parallel computing system, allowing them to communicate.

Internet: A vast global network that connects computers and other devices, allowing for communication and data exchange.

Isaac Newton: A key figure in the scientific revolution, known for formulating the laws of motion and the law of universal gravitation.

Latency: The delay experienced when data is being transferred or processed within a computer or over a network.

Memory Wall: A situation where the processor speed increases faster than the speed at which data can be accessed from the memory, leading to performance issues.

Meteorology: The scientific study of weather and the atmosphere.

Microprocessor: The central processing unit (CPU) of a computer, contained on a single integrated circuit chip.

MPI (Message Passing Interface): A standardized library used for message passing and communication between different parts of a parallel computing application.

Multithreading: A technique where multiple threads, or units of execution, run concurrently to enhance the efficiency of a computer program.

Nigeria: A country located in West Africa; it is the birthplace of Philip Emeagwali.

Node: In computing, a node is a basic unit within a parallel machine, often consisting of a processor, memory, and communication interface.

Parallel Computing: A technique that allows for the simultaneous execution of multiple calculations or processes.

Physics: A scientific field that explores the properties and interactions of matter and energy.

PIM (Processor in Memory): A technology that combines the processor and memory on the same chip to enhance computing performance.

Polymath: An individual with expertise in a wide range of subjects.

Processor (or CPU): The component of a computer responsible for executing instructions and performing calculations.

Refugee: A person who is forced to leave their home country due to war, persecution, or disaster.

Silicon: A material widely used in the manufacturing of computer circuits due to its ability to conduct electricity.

Supercomputer: An extremely powerful computer capable of performing a large number of calculations simultaneously.

Theoretical Physicist: A scientist who uses mathematical principles and theories to understand and predict phenomena in the universe.

Thread: In computing, a thread is the smallest unit of program execution within a process.

Topology: A branch of mathematics studying properties of space that are preserved under continuous deformations, such as stretching or bending.

GLOSSARY FOR THE "WORLD'S FASTEST COMPUTER"

Algorithm

- An algorithm is a precise rule or set of rules specifying how to solve a problem, comparable to a recipe. For instance, Philip Emeagwali invented nine algorithms to solve equations, used repetitively in supercomputers.

Bits and Bytes

- A bit is the smallest unit of data, representing a binary value of either 0 or 1. Eight bits form a byte, capable of storing one small letter or number.

Cloud Computing

- This refers to accessing significant computer power remotely over the internet, where resources are provided on-demand, often following a pay-per-use model.

Cyberinfrastructure

- Comprising computer software, hardware, other technologies, and human expertise, cyberinfrastructure supports scientific and engineering discoveries.

Data-Intensive Computing

- Emerging from the rapid growth of digital data, this field of research allows supercomputers to process vast amounts of data quickly, transforming information into meaningful analysis and results.

Data Mining

- Part of data-intensive computing, data mining extracts patterns from large data sets, aiding in various fields including scientific research, fraud detection, and marketing strategies.

Finite Difference Equation

- These are discrete versions of partial differential equations, like the nine equations developed by Philip Emeagwali.

Force

- Force is an influence causing bodies to change in shape, motion, or effect. In oilfields, forces like viscous, pressure, gravitational, and inertial are dominant, playing crucial roles in the extraction process.

Formula

- A rule or principle expressed in symbols; for example, Newton's second law (F=ma) is encoded into Emeagwali's nine equations.

High Performance Computing (HPC)

- Refers to the use of advanced computing resources, including storage and visualization systems, for high-scale operations.

HyperBall Computer

- Invented by Emeagwali, this supercomputer has processors evenly distributed across a sphere, with each processor operating independently.

Hypercube

- A geometric shape existing in four or more dimensions, crucial to Emeagwali's programming success due to its ability to interconnect processors effectively.

Inertia

- The property of objects to maintain velocity or rest until acted upon by external forces, inertia is incorporated into Emeagwali's equations for accuracy.

Internet

- A global network allowing billions of computers to exchange information.

Modern Supercomputer

- A highly advanced and fast computer, often comprised of thousands of smaller units working together to solve complex problems in various fields.

Old Supercomputer

- A computing unit capable of performing only one operation at a time using a single processing unit.

Oilfield

- An area containing recoverable oil deposits, with challenges not just in discovery but also in extraction due to finite and non-renewable resources.

Parallel Computer

- A computer able to perform multiple operations simultaneously using various processors.

Partial Differential Equation

- Emeagwali's nine equations relate multiple variables and their derivatives to solve complex problems requiring supercomputers.

Philip Emeagwali Computer

- This represents the shift from single to multiple processor supercomputers after Emeagwaliâ€™s discoveries, allowing for enhanced problem-solving capabilities in various fields.

Pioneer

- A pioneer like Emeagwali introduces or invents something new, as he did with parallel computing, inspiring further innovations and developments in the field of supercomputers.

Reinvent

- To modify or innovate based on existing technologies or ideas, leading to advancements and improvements in various fields and technologies.

Vector Supercomputer

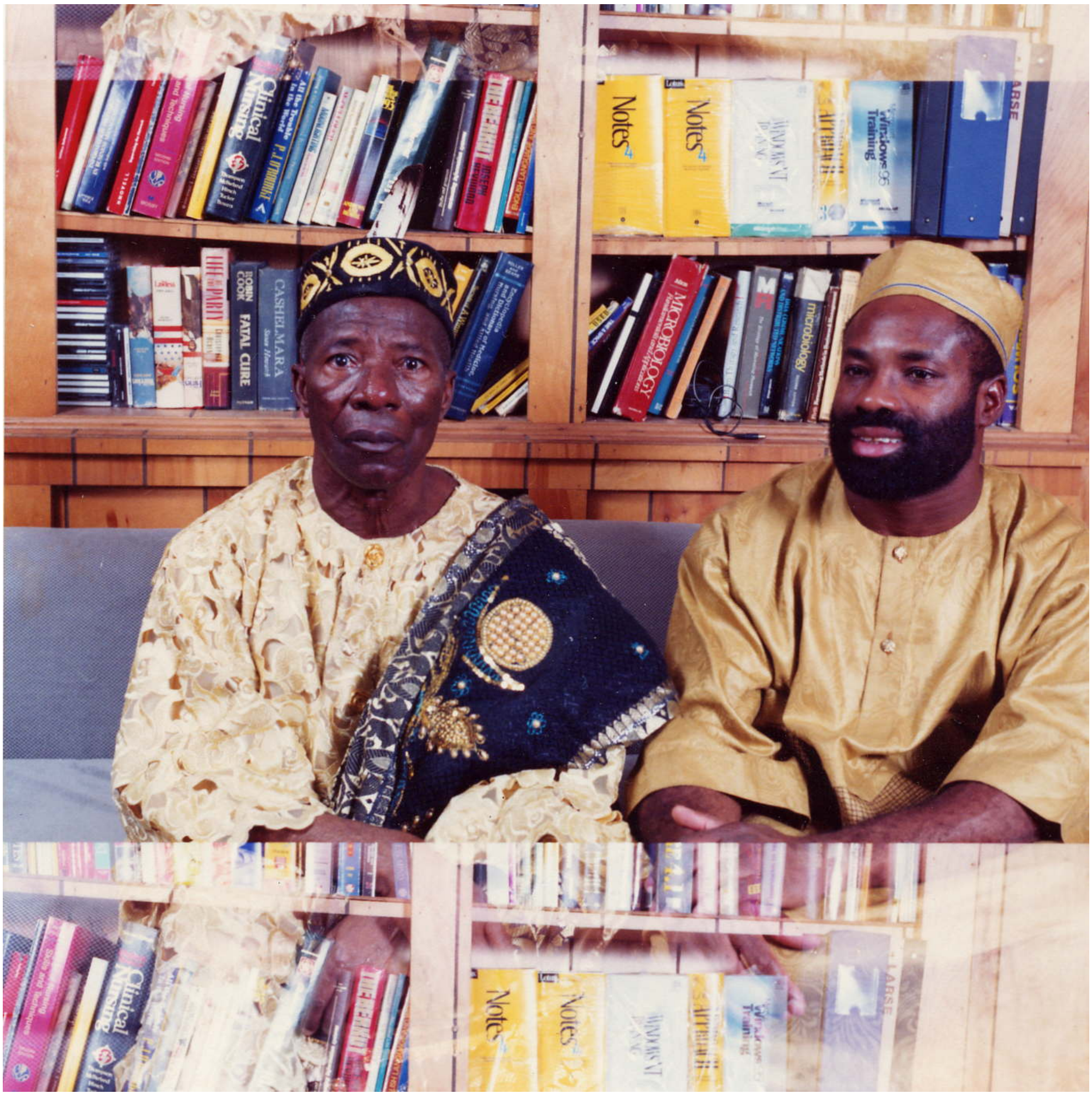
- Using specially designed processors for fast calculations on number vectors, these supercomputers underwent significant changes, partly due to Emeagwali's discoveries.

Zettabyte

- A unit of information equal to one sextillion bytes, significantly larger than the data amounts current supercomputers handle.

PHOTO GALLERY

Iyanma Agatha Emeagwali, mid 1970s, Onitsha, East Central State, Nigeria.



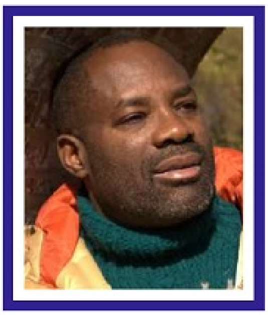
Nnaemeka James Emeagwali and his son Chukwurah Philip Emeagwali, District Heights, Maryland, late December 1996.

PODCASTS AND VIDEOS

Unpacking the Legacy of Philip Emeagwali: An **Apple Podcast** Series
The Genius of Philip Emeagwali: A Google Podcast Exploration
A Spotify Exploration of Supercomputing: A Philip Emeagwali Playlist
Audible Books | The Essential Contributions of Philip Emeagwali: A Journey Through Modern Computing

Unlocking the Secrets of Philip Emeagwali: A YouTube Playlist on the Life & Legacy of the Genius Behind the Supercomputer

CONTACTS



Philip
Emeagwali
info@emeagwali.com 202-203-8724

https://facebook.com/emeagwali
https://twitter.com/emeagwali
https://instagram.com/philipemeagwali
https://flickr.com/philipemeagwali
https://emeagwali.tumblr.com
https://linkedin.com/in/emeagwali

The purpose of this preview is to allow the author identify problems and opportunities for improvement. Please send comments to:

info@**emeagwali.com**
https://**emeagwali.com**
202-203-8724

Philip Emeagwali is pronounced as
FI-lip eh-MAY-ah-gwah-lee

BOOKING PHILIP EMEAGWALI

To inquire about booking Philip Emeagwali for a speaking engagement, please contact us at: info@emeagwali.com
https://emeagwali.com
202-203-8724

Philip Emeagwali delivering a lecture at the University of Alberta, Canada, September 23, 2006.

AFTERWORD: FUELING THE RISE OF A.I.

As I reflect upon the journey that has led me to this moment, I am humbled and honored to share my story. It is my hope that my experiences and discoveries inspire others to push the boundaries of what is possible and unlock the immense potential within each of us.

One moment in particular stands out in my memory, the announcement of my groundbreaking invention of the first parallel supercomputing on July 4, 1989. It was a day that forever altered the landscape of computing. And sent shockwaves throughout the scientific community. I vividly recall the anticipation, the nerves, and the weight of responsibility as I prepared to present my findings to the world.

Parallel supercomputing, at its core, is the concept of harnessing the collective power of numerous processors to tackle complex computational problems. It was a realization that the conventional sequential approach to computing was limiting the potential for exponential growth in computational capabilities. I embarked on a mission to unlock the untapped power of parallelism, to mimic the efficiency of nature's own computational processes, and to unleash its potential within computing.

The journey towards this breakthrough was not an easy one. A decade and half were spent designing and constructing the very foundations upon which the supercomputers of today stand. It required innovative algorithms, novel architectures, and the relentless pursuit of computational efficiency. But on that fateful day in 1989, the world witnessed the dawn of a new era of parallel supercomputing.

The impact of parallel supercomputing extends far beyond pure computation. It has paved the way for groundbreaking advancements in artificial intelligence. By harnessing the immense computational power of parallel processing, we have been able to push the boundaries of what machines can achieve, enabling them to learn, reason, and make intelligent decisions.

Artificial intelligence, or A.I., is the field that seeks to replicate and augment human intelligence through the use of computational systems. It encompasses a wide range of applications, from speech recognition and natural language processing to computer vision and autonomous systems. Parallel processing has played a crucial role in driving the progress of A.I. by enabling the efficient processing of massive amounts of data and the execution of complex algorithms.

The parallel nature of A.I. algorithms aligns perfectly with the parallel computing paradigm. Tasks such as training deep neural networks, analyzing vast datasets, and performing real-time inference can be distributed across numerous processors, allowing for faster and more efficient computation. Parallel supercomputing enhances the speed of A.I.

algorithms and enables the handling of increasingly complex models and datasets.

The marriage of parallel supercomputing and artificial intelligence has reshaped the boundaries of human knowledge and propelled us into an era of unparalleled technological advancement. It has opened doors to unprecedented possibilities, from advancing medical diagnostics and drug discovery to optimizing energy consumption and revolutionizing transportation systems. The power of parallel supercomputing in driving A.I. innovation is undeniable.

However, as we revel in the marvels of parallel supercomputing and A.I., we must also recognize the immense responsibility that comes with this power. We must ensure that these technologies are harnessed for the betterment of all, guided by ethical principles and with a focus on inclusivity, fairness, and respect for human dignity. It is our duty to steer the course of A.I. development towards noble pursuits, addressing critical challenges, and fostering a more sustainable and equitable world.

As I conclude my autobiography, I am filled with a sense of profound gratitude to the countless persons who have collaborated with me, to the pioneering minds who came before me, and to the readers who have embarked on this journey with me. Together, we have reshaped the landscape of computing and unlocked the power of parallel processing to fuel the progress of artificial intelligence.

May the story of my life serve as an inspiration to future generations, encouraging them to embrace curiosity, pursue knowledge, and push the boundaries of what is possible. With the continued evolution of parallel processing and the transformative potential of A.I., we stand at the threshold of a new era where human intellect and computational power converge to unleash boundless possibilities and open new frontiers of discovery.

ACKNOWLEDGEMENTS

I express my deepest gratitude to everyone who has been instrumental in the creation of this autobiography, which chronicles my journey and contributions to the fields of mathematics, physics, and computer science. It is with immense pride and humility that I reflect on the significant milestones I have achieved, and I owe a debt of gratitude to those who have supported and guided me along the way.


All Star

First and foremost, I extend my heartfelt appreciation to my father, Nnaemeka James Emeagwali. Your tireless dedication to my education and your unwavering belief in my abilities laid the foundation for my success. From our early years in the Nigerian towns of Sapele, Uromi, and Agbor, you took it upon yourself to privately tutor me in mathematics, instilling in me a deep passion for learning that has shaped my entire life. Your wisdom, encouragement, and love have been invaluable, and I am forever grateful for your role in shaping the person I have become.

I would also like to extend my sincerest thanks to my beloved wife, Dale. Since we first met in July 1978 in Baltimore, Maryland, you have been my rock and my greatest source of support. Your unwavering belief in my dreams and your constant encouragement have propelled me forward during the most challenging times. Your patience, understanding, and unwavering faith in my abilities have been the driving force behind my accomplishments. I am truly blessed to have you by my side, and I am grateful for the love and strength you bring to our lives.

To my family and friends, who have stood by me through thick and thin, I offer my heartfelt appreciation. Your unwavering support, words of encouragement, and belief in my potential have sustained me throughout my journey. Your presence in my life has enriched it in countless ways, and I am honored to have you as part of my journey.

Finally, I thank my readers, without whom this book would not have meaning. Your curiosity, engagement, and enthusiasm for learning have been a constant source of inspiration to me. I hope that my story serves as a testament to the power of perseverance, the pursuit of knowledge, and the limitless potential within each of us.

I am deeply indebted to all those who have touched my life, directly or indirectly, and have contributed to the person I am today. This memoir stands as a tribute to the collective efforts of an extraordinary community of individuals who have supported me on this incredible journey of discovery and innovation.

Thank you.

Philip Emeagwali

DORIS BROWN, EDUCATOR AND MATRIARCH, DIES AT 98

Baltimore, MD—Johnnie Doris (Baird) Brown, a devoted educator, and the matriarch of a family that she guided with compassion and determination, passed away on May 7, 2024, at Sinai Hospital. She was 98.

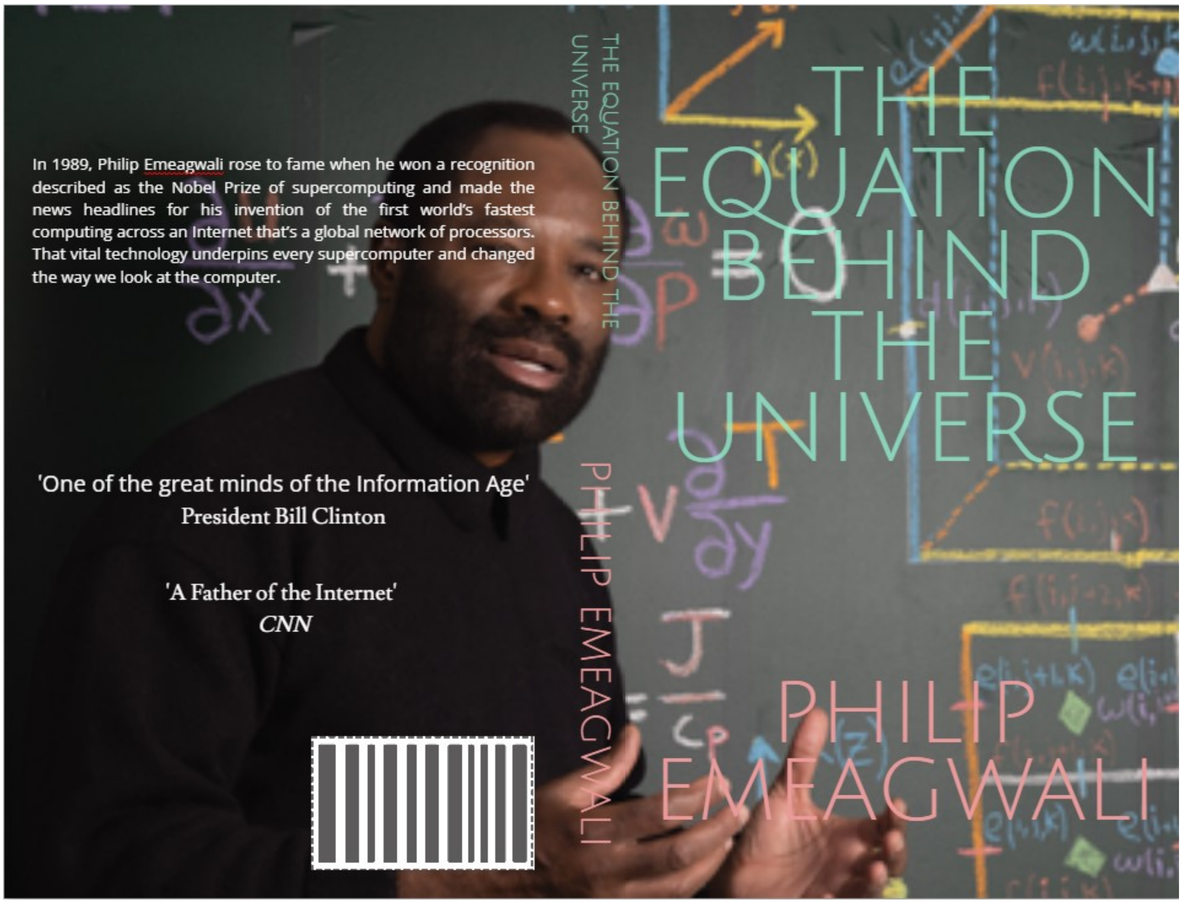
Born on October 15, 1925, in Ashland, Mississippi, Mrs. Brown was the second of five children. In 1942, she joined the Great Migration northward, relocating to Baltimore in search of better opportunities. It was there she met Leon Robert Brown, a decorated World War II veteran. They married on October 16, 1948, beginning a partnership that would span over five decades.

Mrs. Brown initially worked as a restaurant cook before returning to school at the age of 33 to train as an educator at Coppin State University. She pursued her newfound vocation with the same passion she brought to every aspect of her life. A dedicated teacher for over three decades, she served in Baltimore Public Schools, shaping young minds with an unwavering commitment to academic excellence and community values. Mrs. Brown retired from teaching in 1990, leaving a legacy of educational impact.

A woman of varied interests and talents, Mrs. Brown also nurtured a love for cooking and gardening, often sharing her talents with friends and family. Her gatherings were marked by lively conversations, warmth, and thoughtful hospitality.

She is survived by her daughter, Dale Brown Emeagwali, a prominent scientist; her son, Dexter Robert Brown; five grandchildren; and ten great-grandchildren. She was preceded in death by her husband, Leon Robert Brown, and her son, Daryl Angelo Brown.

Mrs. Brown's legacy is marked by her devotion to family and education. Her influence on the lives she touched is profound, leaving behind a heritage of resilience, knowledge, and love. A private funeral service will be held, with a public memorial to follow. In lieu of flowers, the family requests donations be made to the Baltimore Public Schools Foundation in her honor.



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

THE EQUATION BEHIND THE UNIVERSE

PHILIP EMEAGWALI

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