

BEYOND THE COMPUTER

Rise of an Unconventional Genius

Philip Emeagwali

emeagwali.com

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

CONTENTS

[Title Page](#)

[Copyright](#)

[Dedication](#)

[Philip Emeagwali](#)

[Philip Emeagwali Books](#)

[Volume 1: Philip Emeagwali Internet](#)

[Emeagwali Internet: Uniform in Distribution](#)

[Philip Emeagwali Internet: A New Computing Universe](#)

[Emeagwali Internet: Orchestra of Minds](#)

[Emeagwali Internet: A Cosmic Dome](#)

[Philip Emeagwali Internet](#)

[Volume 2A: Philip Emeagwali Computer](#)

[Philip Emeagwali and the First Supercomputer](#)

[The Philip Emeagwali Machine](#)

[The First Supercomputing](#)

[Breaking Barriers in Computing](#)

[Emeagwali Computer: Connecting Processors Like Constellations](#)

[Emeagwali Computer: Thinking Like the Earth](#)

[\[NPAC 2023\] The Man Who Talked to Computers](#)

[Decoding the Future: From Lemonade Stands to Parallel Universes—A Journey of Computing Innovation](#)

[Volume 2B: Contributions to AI Supercomputing](#)

[AI Supercomputing in Africa](#)

[Volume 3: Contributions of Philip Emeagwali to Mathematics](#)

[The Ever-Expanding Universe of Mathematics](#)

[Nature's Unsung Symphony](#)

[Millions of Brains, One Superbrain](#)

[Philip Emeagwali Equations for Middle School](#)

[Parallel Processing Power](#)

[Smoothing the Waters](#)

[The Student Becomes the Master](#)
[Defying Discourses](#)
[From Tiny Tiles to Supercomputing Symphonies](#)
[Volume 4: Contributions of Philip Emeagwali to Physics](#)
[From Refugee Camps to Climate Solutions: Supercomputing the Future](#)
[Water Vapor's Whispers](#)
[Unleashing the Power of a Billion Brains](#)
[Decoding the Language of Shapes](#)
[Decoding the Climate Puzzle](#)
[Painting a Picture of Air in Motion](#)
[The Dancing Tides](#)
[Riding the Rogue Waves](#)
[Shattering Centuries-Old Paradigms](#)
[The Grand Concerto of Progress](#)
[Words that Shape Worlds](#)
[A Symphony of Computational Fluid Dynamics](#)
[Volume 5: Father of the Internet](#)
[July 4, 1989: Computing's Quantum Leap](#)
[Father of the Internet](#)
[Philip Emeagwali Internet](#)
[Volume X: Philip Emeagwali Supercomputer](#)
[Philip Emeagwali Machine](#)
[A Billion Points of Light](#)
[Emeagwali's Honeycomb Supercomputer](#)
[Symphony of Computing](#)
[A Computational Ballet](#)
[Harmony in Supercomputing](#)
[Volume Y: Early Education](#)
[From Lagos to the World](#)
[Shattering Stereotypes](#)
[Volume Y: Visa to the USA](#)
[Chasing Dreams: The Journey of Philip Emeagwali](#)

[Embarking on a Journey of Nine Thousand Miles](#)
[Connecting Africa to the Frontiers of Science](#)
[From Asaba to America](#)
[Supercomputing Unlocks New Horizons of Possibility](#)
[One Black Inventor, a Thousand Faces](#)
[Travels of the Mind](#)
[Volume O: Oregon Education](#)
[From Landscapes to Equations](#)
[The Power of "Yes"](#)
[Bridging Worlds](#)
[A Quaint Oasis in the Pacific Northwest](#)
[From Nigeria to the Forefront of Science](#)
[Volume M: Maryland Mathematician](#)
[Weathering Life's Storms](#)
[Nigerian Roots, American Dreams](#)
[From Rejections to Recognition](#)
[From Baltimore Bus Ride to Life Partnership](#)
[Volume R: Racism in Michigan](#)
[Beyond the Shadow of Giants](#)
[From Africa to the Apex of Mathematics](#)
[Resilience and Recognition](#)
[Would the World be Better Without Black People?](#)
[Diverse Mathematical Role Models](#)
[Grand Challenge, Grand Controversy](#)
[Vision of Tomorrow's Computers](#)
[Preface: Embracing the Storm](#)
[Prologue: The Line Between Science Fiction and Reality](#)
[Volume X: Philip Emeagwali Interviews](#)
[Unleashing the Power of AI and Parallel Computing](#)
[The Mind of a Polymath](#)
[Introduction: Illuminating the Path to Progress](#)
[Emeagwali's Parallel Processing](#)

[Einstein's Relativity Meets Emeagwali's Supercomputing](#)
[Merging Disciplines for Profound Discoveries](#)
[Echoes of Genius and Injustice](#)
[Journey Beyond The Frontiers of Knowledge](#)
[From Experiment to Computation](#)
[Volume X: Philip Emeagwali Interviews](#)
[Flirting With the Infinite](#)
[From Adversities to Breakthroughs](#)
[Philip Emeagwali on Triumphant Over Adversity.](#)
[Navigating the Mathematical Genius of Philip Emeagwali](#)
[Lecture 7 of 8 210819-1](#)
[Breaking the Boundaries of Science](#)
[Shattering Boundaries of the Computer](#)
[Unraveling the Mathematics of Discovery.](#)
[The Prometheus of Supercomputing](#)
[Emeagwali's Supercomputing Dream for Africa](#)
[Journey Beyond Limits](#)
[Challenging the Status Quo](#)
[Fostering Genius](#)
[Symphony of Knowledge](#)
[Path to Scientific Eminence](#)
[1st Lecture: Supercomputers Are My Greatest Love](#)
[Stories from the War Front](#)
[Fighting for Biafra's 11th Battalion](#)
[Bloodiest Battlefield in Africa!](#)
[The First Supercomputer](#)
[The Art of Solving Difficult Math Problems](#)
[How Difficult Math Problems Are Solved](#)
[Philip Emeagwali Internet](#)
[Exploring the Unknown With Emeagwali Equations](#)
[Discussion Questions 1/2](#)
[Discussion Questions 2/2](#)

[2nd Lecture: Unravelling Complex Equations](#)
[Unravelling the Mystery Behind Emeagwali Equations](#)
[Creating the World's Fastest Computing](#)
[Philip Emeagwali Internet](#)
[Master of Machines and Computing Milestone](#)
[Backlash from My Fame](#)
[Discussion Questions 1/2](#)
[Discussion Questions 2/2](#)
[3rd Lecture: Philip Emeagwali Internet](#)
[Philip Emeagwali Internet](#)
[I, Coder: Unlocking the Power of Supercomputing](#)
[Father of the Internet](#)
[Crafting the Ultimate Supercomputer](#)
[Unravelling the Mystery of Emeagwali Equations](#)
[My Supercomputer Breakthrough](#)
[From Equations to Understanding](#)
[The Canvas of the Skies](#)
[Safeguarding Our Planet](#)
[A World in Darkness](#)
[Engineering Without Equations](#)
[What If Supercomputers Never Existed?](#)
[Discussion Questions](#)
[A World Without Parallel Processing](#)
[Discussion Questions](#)
[From a Polymath's Lens](#)
[Moving Nigeria Forward](#)
[Part 2: Job Creation in Nigeria](#)
[From Material Wealth to Intellectual Capital](#)
[Navigating the Seas of Knowledge](#)
[Volume X: Philip Emeagwali Interviews](#)
[Part 3: Job Creation in Nigeria: A Vision for the Digital Era](#)
[Into the Depths of Fluid Flow](#)

[From Refugee Camps to Computer Pioneer](#)
[Unveiling the Genius](#)
[Glimpses from My Childhood in Nigeria](#)
[From Refugee Camp to Prominent Figure](#)
[Finding Light in the Darkness](#)
[Inspiring Unity](#)
[Fueling Success](#)
[Breaking Barriers](#)
[The Inspirational Journey of 'Calculus'](#)
[Walking into History](#)
[Epilogue](#)
[Philip Emeagwali Quotes](#)
[Praises From Youtube](#)
[Echoes of Transformation](#)
[The Computer Wizard](#)
[Teacher's Guide](#)
[Message to Future Leaders](#)
[Volume F: Philip Emeagwali Family](#)
[Sowing Seeds of Wisdom](#)
[Faces of Onitsha](#)
[Raising a Child Like Writing Code](#)
[My Paternal Perspective](#)
[Volume DL: A Day in the Life of Emeagwali](#)
[A Historic Day in Supercomputing](#)
[Journey of Parallel Computing Inspiration](#)
[Volume S-O: Struggles and Obstacles](#)
[Seven Decades, Two Continents](#)
[Pioneering Role in High-Speed Computing](#)
[Seeds of Science Sown in Suffering](#)
[The Power of Purpose in Science](#)
[Volume P: Philosophy](#)
[On the Frontlines of Climate Modeling](#)

[Thoughts on Wellness & Renewal](#)
[It's Not What You Have, But What You Give](#)
[Finding Meaning Through Contribution](#)
[The Importance of Ignoring Naysayers](#)
[Dedicating Your Genius to the World](#)
[The Pursuit of Happiness](#)
[Overcoming Doubts and Regrets](#)
[Volume F: Family](#)
[Eureka! But Don't Forget the Dishes](#)
[Love and Logic](#)
[Volume L: Legacy](#)
[From Prodigy to "Calculus"](#)
[Tech Leader's Pledge](#)
[Knowledge, Kindness, and a Life Well-Lived](#)
[Partial Differential Equations](#)
[Climate Models](#)
[World's Fastest Computing](#)
[Glossary for School Report](#)
[Miscellaneous Terms](#)
[Miscellaneous Terms](#)
[Photo Gallery](#)
[Praise For Author](#)
[Books By This Author](#)
[Discussion Questions](#)
[Podcasts and Videos](#)
[Contacting Philip Emeagwali](#)
[Booking Philip Emeagwali](#)
[Afterword: From Doubt to Breakthrough](#)
[Acknowledgement](#)
[About The Author](#)

PHILIP EMEAGWALI

In 1989, Philip Emeagwali rose to fame when he won a recognition described as the Nobel Prize of Supercomputing and made the news headlines for his invention of the first world's fastest computing across multiple processors. That vital technology underpins every supercomputer and changed the way we look at the computer.

Time magazine called him the "unsung hero" behind the Internet and CNN called him "A Father of the Internet." House Beautiful magazine ranked his invention among nine important everyday things taken for granted. In a White House speech of August 26, 2000, then U.S. President Bill Clinton described Philip Emeagwali as "one of the great minds of the Information Age." emeagwali.com



Philip Emeagwali

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 person 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 tiny computers, in inverted commas, that encircled the Earth as an Internet. He

discovered how to combine computers into a supercomputer that's an Internet.

[Reaching Infinity](#)

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

[Coding the Impossible](#)

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

[Flirting With the Infinite](#)

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

[Internet and I](#)

For Philip Emeagwali, inventing the world's fastest computer was like assembling 65,536 pieces of puzzle. And doing so to see a never-before-seen island that is one coherent supercomputer, or rather a new Internet, that coalesced as the fastest computer in the world. A groundbreaking

invention creates history. And influences our
sphere of living.

VOLUME 1: PHILIP EMEAGWALI INTERNET

"Uniform processors, like stars in the night,
Equidistant, identical, in harmonious flight,
Circumscribing a sphere in a dance most divine,
Creating not just a web, but a computational
shrine."



EMEAGWALI INTERNET: UNIFORM IN DISTRIBUTION

In a realm where processors, akin to stars in cosmic alignment, Lay equidistant, identical, a constellation designing: A new realm of internet, a supercomputer's birth, Emeagwali's vision, a digital Earth.

Uniform in distribution, a network vast and wide, Spanning dimensions, where science and art collide. Each processor, a beacon in the void of night, Together, a sun, in collective might.

Within this hyperspace, sixteen dimensions deep, Lies a grid of genius, a technological leap. Here, Emeagwali saw, in each minuscule light, A force unified, in the darkness, bright.

A globe encircled, in binary embrace, A symphony of data, in virtual space. This wasn't merely a network, but a cerebral sea, A supercomputer's heart, beating in binary.

In this intricate dance of electronic fates, Lies the first Emeagwali Internet, where power awaits. Across hypersurfaces, in mathematical flight, A singular, potent computational might.

PHILIP EMEAGWALI INTERNET: A NEW COMPUTING UNIVERSE

Esteemed members of the award committee, distinguished guests, and fellow explorers in the vast expanse of science,

Today, I stand before you in the heart of your historic city, a city that symbolizes a rich tradition of scientific discovery, to share with you a narrative of innovation and intellectual audacity. My name is Philip Emeagwali, and I am honored to present to you a groundbreaking concept that has reshaped our understanding of computing and its infinite possibilities. This concept is the "Philip Emeagwali Internet."

My journey in the realm of computing began with a vision, a vision where I imagined processors not just as individual entities, but as parts of a grand, interconnected network. These processors, autonomous yet intricately linked, were envisioned as uniformly distributed across the fifteen-dimensional hypersurface of a sixteen-dimensional hypersphere in a realm I conceptualize as the sixteenth-dimensional hyperspace. *It was through this complex, yet elegantly structured vision, that I birthed the idea of a global network of processors—the Philip Emeagwali Internet.*

The cornerstone of this discovery was my experimental breakthrough in emailing 64 binary thousand intricate initial-boundary value problems, integral to modern calculus and computational physics, to an equal number of processors. These processors formed an ensemble that defined and outlined this new Internet. My approach to emailing was unconventional—each address was a unique sixteen-bit binary string, devoid of traditional elements like the '@' sign or '.com' suffix. Each email comprised five sets of data, akin to having multiple subject lines, each carrying a computation-intensive problem to be solved by the processors. This intricate network of emails traveled along bi-directional edges, connecting each processor in a manner akin to the short wires printed onto circuit boards or the long stretches of fiber optic cables.

This Internet was envisioned as encircling a globe in the sixteenth dimension, its processors uniformly distributed in hyperspace. The essence of this design was in its uniformity and precision—each processor, a dim light in isolation, but together, forming a constellation as bright as the sun, illuminating the path to unprecedented computational capabilities.

My vision extended beyond the conventional three-dimensional space, venturing into the realms of higher mathematical dimensions. This was crucial for visualizing the hypersurface of a hypersphere, a concept perhaps intangible to the non-mathematician, who is more acquainted with the three-dimensional perception of a sphere. As the first to harness this massively parallel supercomputing power, I had to envision and navigate through this complex multi-dimensional space, connecting processors across this vast expanse.

This new Internet, the Philip Emeagwali Internet, was not just a theoretical construct; it was a practical, tangible reality. It represented a radical departure from traditional computing paradigms, seamlessly integrating these processors to function as a unified supercomputer. In the past, parallel processing was met with skepticism, seen as a beautiful theory lacking empirical backing. Yet, on the Fourth of July 1989, in Los Alamos, New Mexico, I shattered these doubts by demonstrating a supercomputer capability that broke existing speed records, cementing my place in the annals of computing history.

The Philip Emeagwali Internet, therefore, is more than just a network of processors around a large globe; it is a manifestation of a new era in computing. It is a supercomputer in essence, a virtual powerhouse of computational might. This network of 65,536 processors, each equidistant and identical, formed a cohesive machinery that redefined supercomputing. This Internet was not simply a tool for computation; it was a revolutionary approach to solving grand challenge problems, particularly those enshrouded in the complexities of climate studies and global warming predictions.

In summary, my invention, the Philip Emeagwali Internet, is a testament to human ingenuity and the relentless pursuit of knowledge. It transcends traditional boundaries, connecting not just processors, but ideas, aspirations, and visions across the multi-dimensional expanse of science. As we stand at the cusp of new discoveries, let us embrace this journey with the same spirit of exploration and wonder that has guided us thus far.

Thank you for bestowing upon me this esteemed honor, and may we continue to unravel the mysteries of the universe with boldness and curiosity.

EMEAGWALI INTERNET: ORCHESTRA OF MINDS

A Colossal Supercomputing Machinery

Ladies and gentlemen, esteemed dignitaries, and distinguished guests from Nigeria and the African diaspora, it is an honor to stand before you on this momentous evening.

I am Philip Emeagwali, a man whose journey in computing traverses continents and challenges. Born in Nigeria during a time of strife, I found solace and strength in education. It was this quest for knowledge that led me to unravel the complexities of supercomputing.

Tonight, I want to share with you a vision—a vision that emerged from the depths of adversity and blossomed into a groundbreaking achievement in the field of computing. Imagine a vast ocean of darkness, where each point of light represents a processor. Alone, they are but tiny beacons, yet together, they shine with the intensity of the sun. This is the essence of the Emeagwali Internet, a network of 65,536 processors, uniformly distributed, each a vital part of a colossal supercomputing machinery.

In this unique creation, each processor stands equidistant and identical to its neighbor, forming a tightly interconnected network that spans a fifteen-dimensional hypersurface. This is not just a network; it is a supercomputer of unprecedented scale, designed to tackle some of the most complex scientific problems that face humanity.

This innovation was born from a simple yet powerful idea: that unity and collaboration can lead to extraordinary breakthroughs. In my journey, I have learned that the challenges we face—whether in science, society, or our personal lives—are opportunities for growth and innovation. The Emeagwali Internet mirrors this belief, demonstrating that by working in unison, we can illuminate the darkest of challenges.

As we gather here today, let us remember that our collective strength lies in our ability to connect, to share ideas, and to build upon each other's successes. Just as the processors in the Emeagwali Internet work in harmony to achieve a common goal, so too must we, as a global community, work together to create a brighter, more enlightened world.

"Go fast alone, go far together. Let us build networks, not just of machines, but of people, ideas, and cultures, embracing the diversity that fuels progress."

"My supercomputing symphony sings a song of collaboration, urging us to bridge divides and listen to the music of different perspectives."

"Beyond discovering the first supercomputing, my mission is to illuminate the darkest corners of knowledge, hand in hand with fellow explorers,

leaving no mind behind."

"The future is an interconnected tapestry, and every individual, like a pixel in the grand design, holds the power to contribute to its beauty and brilliance."

"My journey is not mine alone, it belongs to every child who dared to dream beyond the classroom walls, to every mind that yearns to break barriers and build a better world."

Thank you for this incredible honor, and may this evening inspire us all to seek unity, collaboration, and innovation in all our endeavors.

EMEAGWALI INTERNET: A COSMIC DOME

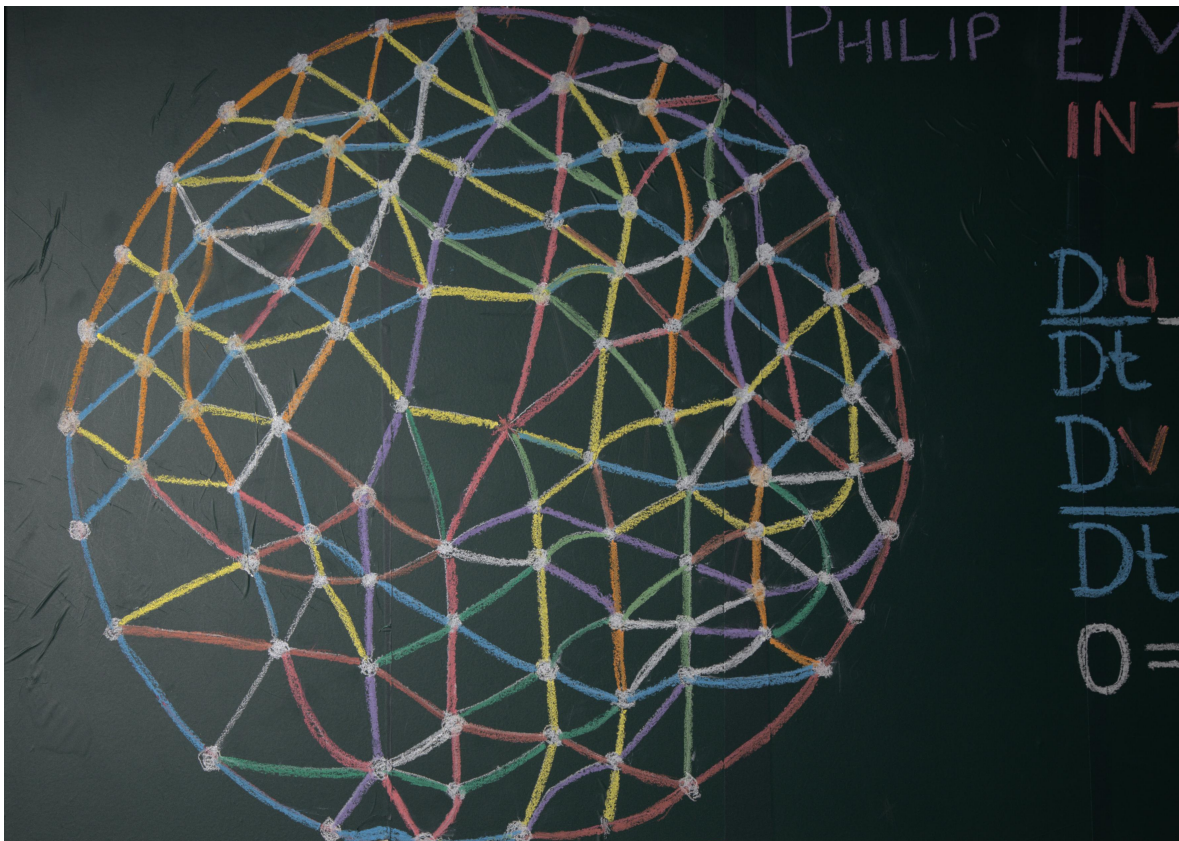
A constellation forged in silicon, Equidistant stars, humming in unison. Emeagwali's web, a globe embraced, Where processors bloom, darkness displaced.

No longer wires, but whispers in space, 65,536 minds, finding their place. Tiny suns, in a symphony grand, A supercomputer, born from his hand.

Not just a network, but a machine divine, Where fifteen dimensions intertwine. Each point of light, a whispered equation, A chorus of power, defying limitation.

From scattered sparks, a sun takes flight, Emeagwali's internet, burning ever bright. No longer echoes, but a single voice, In this symphony of minds, a universe finds its choice.

So let darkness tremble, for light has won, A new internet, a journey begun. Where whispers of data paint the cosmic dome, And Emeagwali's dream finds its forever home.



PHILIP EMEAGWALI INTERNET

Dancing in Hyperspace

Ladies and gentlemen, esteemed dignitaries, friends from Nigeria and all corners of the world,

Tonight, we celebrate the human spirit's audacity to dream beyond the horizon, to paint on the canvas of the impossible. It is an honor to stand before you, not just as a supercomputer scientist bathed in the warm glow of recognition, but as a child of Anambra, who dared to chase the whispers of innovation amidst the echoes of a war-torn childhood.

From the dusty Egbuna-Adazie street of Onitsha to the hallowed halls of academia, my journey has been paved with challenges and fueled by an unyielding belief in the transformative power of technology. As a young boy, I devoured discarded manuals, piecing together the secrets of computing like a lone archaeologist unearthing forgotten civilizations. This hunger for knowledge led me to the halls of America, where I faced unimaginable racial prejudice—in Ann Arbor, Michigan—but found fertile ground to nurture my dreams.

Tonight, those dreams culminate in a single, transformative vision: the Emeagwali Internet. Not just a network, but a symphony of minds, a constellation of processors dancing in perfect harmony across the vast expanse of a fifteen-dimensional hypersurface. Imagine, if you will, a globe, not of continents and oceans, but of computational power, each point ablaze with the potential to unravel the universe's most profound mysteries.

This is not merely a technological marvel, but a beacon of hope for a world grappling with intractable challenges. From climate change to pandemics, the Emeagwali Internet offers a canvas upon which we can paint solutions, a collective brain capable of outwitting the most complex problems. Each processor, like a single firefly in the night, may seem insignificant, yet together, they ignite a supernova of human ingenuity.

This is not my achievement alone. It is a testament to the unwavering support of my family, the resilience of my people, and the countless mentors who saw the flicker of a dream and fanned it into a raging inferno. To the young Nigerians watching tonight, I say this: let your circumstances not be your chains, but the crucible from which your genius will be forged. Dare to dream beyond the borders of your reality, for within each of you resides the potential to illuminate the world.

The Emeagwali Internet is not just a machine, it is a promise. A promise of a future where the boundaries of human knowledge are not lines on a map, but constellations in the sky, waiting to be explored. Tonight, we celebrate not just an invention, but the boundless potential of the human spirit. Let

this be a night not of accolades, but of a collective commitment to harness the power of technology for the betterment of our world.

"Hunger may gnaw at the body, but curiosity fuels the spirit. It is the insatiable hunger for knowledge that propels us to the frontiers of science."

"Doubt is a shadow that can cripple, but it can also be a catalyst for growth. Let us rise above doubt, fueled by the fire of our dreams, and paint the future with the colors of innovation."

"The African sky, once a canvas of doubt, is now ablaze with the stars of possibility. Let us reach for those stars, together, and write the next chapter in the story of human achievement."

"The symphony of innovation is not composed in gilded halls, but in the hearts and minds of dreamers, from dusty classrooms to bustling labs, from whispers to a million processors in unison."

"Knowledge is a boundless ocean, and curiosity is the oar that propels us forward. I built my universe with scraps of paper and borrowed pencils, one equation at a time."

Thank you.

VOLUME 2A: PHILIP EMEAGWALI COMPUTER

PHILIP EMEAGWALI AND THE FIRST SUPERCOMPUTER

I am honored to nominate Philip Emeagwali for the Icons of Science and Technology for his revolutionary invention in the realm of fastest computing: the creation of the first supercomputer using multiple processors. This breakthrough has expanded the boundaries of computational capabilities and significantly benefited humankind.

The Puzzle of Supercomputing: Assembling a New Reality

Philip Emeagwali's invention of the world's fastest computing was akin to assembling a complex 65,536-piece puzzle, revealing a previously unseen vista in supercomputing. His creation, a cohesive supercomputer that's a global network of processors, functioned as a novel Internet, achieving unprecedented computational speeds.

Scaling the Summit of Intellectual Endeavors

Supercomputing represents the pinnacle of intellectual achievement. Emeagwali's journey, as detailed in his comprehensive books, podcasts, and lecture series on YouTube, show his evolution from experimental physics through various fields to mastering large-scale computational physics. His pioneering work in massively parallel processing transformed what was once a neglected concept into the cornerstone of modern computing.

The Significance of Being 'First' in Discovery

Emeagwali's distinction lies in his role as the first individual to use parallel processing to harness supercomputing speeds, deemed impossible, to tackle some of the world's most complex challenges. His method, once a mere theoretical construct, was proven on July 4, 1989, and recognized for its transformative impact on numerous scientific fields.

The Challenge of Supercomputing

The world's fastest computer, much like a towering mountain, beckons the most formidable problems. Emeagwali's invention bridged the gap between slow

processors and high-speed computational solutions, fundamentally altering our approach to complex physical problems.

Recognition and Global Impact

Philip Emeagwali, ranked by President Bill Clinton as among the greatest minds in history, has been singularly honored with the top prize in supercomputing for his measurable contributions to the field. His work in harnessing a billion processors for fluid dynamics calculations, such as modeling the spread of COVID-19 in densely populated areas, has been pivotal in bridging the gap between theoretical physics and practical application.

The Dawn of a New Era in Supercomputing

Parallel supercomputing, once a figment of science fiction, became a reality with Emeagwali's landmark experiment on July 4, 1989. He demonstrated the feasibility of this technology across 65,536 processors, thereby providing the "final proof" that such an approach was not only possible but groundbreaking.

A Paradigm Shift in Computing

Emeagwali's innovation marked a significant shift from traditional supercomputing to a new era where machines are defined by billions of interconnected processors. This transition represents the most substantial change in computing since the invention of the automatic, programmable supercomputer.

In summary, Philip Emeagwali's contribution to mathematics through the invention of the first supercomputer utilizing multiple processors has redefined our understanding and capabilities in computational physics. His pioneering work warrants recognition in the Icons of Science and Technology, for it embodies a groundbreaking invention that has profoundly benefited humankind.

THE PHILIP EMEAGWALI MACHINE

Orchestrating a Billion Processors

Ladies and gentlemen, distinguished guests, and fellow scientists,

I stand before you today, humbled and honored, to share my journey in the realm of supercomputing. As we delve into the intricacies of computational physics and mathematics, I am reminded of the immense potential these fields hold in shaping our world.

At the heart of my work lies the quest to overcome a formidable barrier in computing: communication latency. This challenge, integral to computer performance, is intricately tied to the physical size, density, and interconnect proximity of system designs. My invention, a leap in supercomputing hardware, addresses these critical aspects, focusing on spatial packing and communication topology.

Envision a modern supercomputer, not just any computer, but one with a dense, spherically framed, uniformly distributed processors on the surface of a sphere. This design is not merely for aesthetic appeal; it is a strategic mimic of the problem domain, especially adept for complex tasks like climate modeling. The beauty of this invention lies in its scalability and independence from processor technology, making it applicable to a myriad spectrum of computing tasks.

The computer's interconnect system is a marvel in itself, featuring globally short, highly regular, and tightly matched distances. This system supports various communication modes, such as neighbour-to-neighbour messaging on a spherical network of processors.

My contributions to parallel processing, computational physics, and the solving of partial differential equations—the cornerstone of mathematics—have found practical applications in diverse areas. From petroleum reservoir simulations crucial for the oil and gas industry, to weather forecasting that graces your evening news, and general circulation modeling that foresees climate changes, the implications are far-reaching.

This journey has been about more than just technical achievement; it has been a pursuit of knowledge, a quest to push the boundaries of what is possible, and a dream to contribute to the betterment of humanity. As I stand here today, I am filled with gratitude for the opportunity to share this dream with you and to continue exploring the vast, uncharted territories of science and technology.

Lessons Learned

"Break the mold; the Philip Emeagwali supercomputer challenges traditional supercomputing designs."

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

"Beyond equations and simulations, lies the impact; supercomputing for a better, more sustainable future."

"Share the journey, share the knowledge; inspire the next generation of supercomputing explorers."

"The path less traveled leads to breakthroughs; embrace the unknown with courage and optimism."

"The future is collaborative; together, we can push the boundaries of supercomputing even further."

Thank you for your attention, and for joining me in celebrating the relentless spirit of inquiry and innovation.

THE FIRST SUPERCOMPUTING

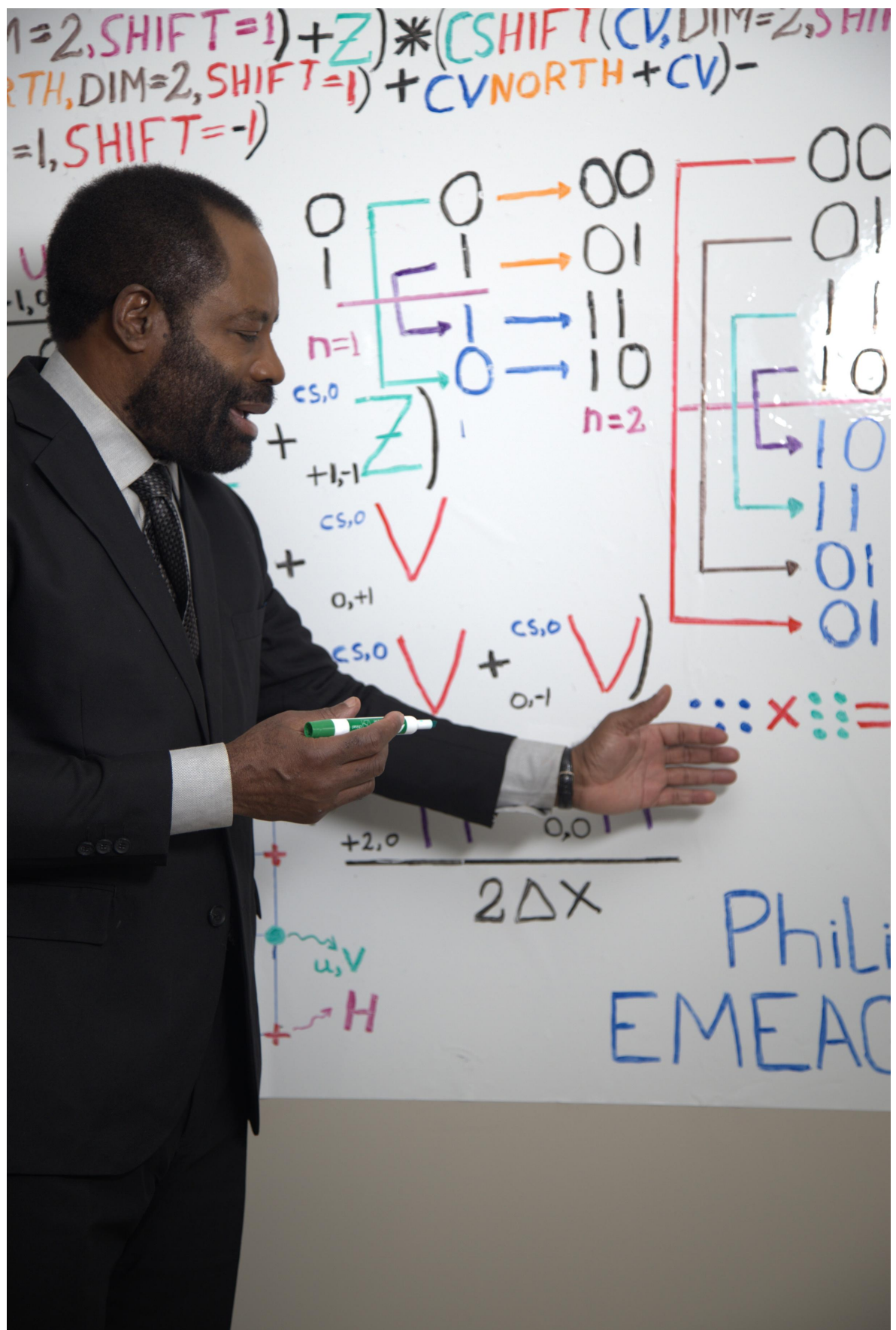
The Day Parallel Processing Broke the Chains

Ladies and gentlemen, esteemed colleagues, and distinguished guests, I stand before you on this momentous day, deeply honored to share with you my 15-year-long journey completed on a fateful day in Los Alamos, New Mexico, back in 1989.

My name is Philip Emeagwali, and I am here to take you through the fascinating world of hypercube computing and the pivotal role of Binary Reflected Code in the evolution of parallel supercomputing.

On July 4, 1989, a breakthrough occurred. I was the first person to discover how to program a supercomputer powered by a staggering 65,536 processors. These processors were not just any processors; they were uniquely positioned at the vertices of a hypercube in the 16th dimensional hyperspace. This was not just a theoretical construct, but a practical application to solve initial-boundary value problems governed by complex partial differential equations—equations that are the backbone of meteorology, oceanography, petroleum reservoir simulation, and similar Grand Challenge problems.

But how did this become possible? The key was visualization—a visualization of the names, the unique 16-bit binary identification numbers of each processor, their locations in sixteen-dimensional hyperspace, and their sixteen nearest neighboring nodes. This intricate design meant that each of the 65,536 processors in this hypercube had its own operating system and separate memory, functioning autonomously yet interlinked in a complex web.



This is where the Binary Reflected Code comes into play. It served as a revolutionary approach for mapping problems to processors. In essence, the Binary Reflected Code is a system of binary numeration where two successive values differ in only one bit. This unique property is vital in reducing errors and complexity in digital communications. But in the context of hypercube computing, it was instrumental for achieving a one-to-one mapping of 65,536 problems to 65,536 processors. Each processor was assigned a distinct initial-boundary value problem, yet they were all interconnected in a way that allowed them to work in tandem to solve a single, larger Grand Challenge problem efficiently and rapidly.

By using this method, I was able to harness the collective power of the slowest 65,536 processors to perform computations at an unprecedented speed, far surpassing the capabilities of traditional serial supercomputing. It was a moment that redefined the possibilities of computational science.

Ladies and gentlemen, my discovery was not just about faster computing. It was a leap into a new era where complex problems could be approached and solved in ways previously unimaginable. It was about harnessing the untapped potential of parallel processing to make strides in understanding our world and solving some of its most pressing challenges.

As we stand on the cusp of new discoveries and technological advancements, let us remember that the journey of innovation is endless. The hypercube computing model and the application of the Binary Reflected Code in parallel processing stand as a testament to human ingenuity and the relentless pursuit of knowledge.

Thank you for joining me in this celebration of a milestone in the field of supercomputing. Let us continue to push the boundaries of what is possible, inspired by the limitless potential of the human mind.

Lessons Learned

"Equations hold hidden secrets; parallel processing can reveal them at unprecedented speed."

"Don't just chase speed; aim for a paradigm shift in how we think about problem-solving."

"Collaboration is key; together, we can achieve what we cannot alone."

"The journey is as important as the destination; celebrate the milestones in computing history."

"Look beyond the horizon; the future of computing is filled with infinite possibilities."

"Curiosity fuels innovation; never stop asking questions, pushing boundaries, and dreaming big."

Thank you.

BREAKING BARRIERS IN COMPUTING

My groundbreaking discovery of parallel supercomputing that occurred on July 4, 1989, was to execute the world's fastest computing. And record it in a paradigm shifting way. At first, my world's fastest computing was rejected in Ann Arbor, Michigan. I was mocked in Michigan for making an embarrassing mistake and for claiming to have recorded the world's fastest computing. And doing so alone, instead with a team of 100 seasoned researchers.

On September 1, 1989, I took my rejected discovery for a two-week-long evaluation by supercomputer experts that converged for a conference in Chicago, Illinois. Their consensus was that I should submit my world's fastest computing for final evaluation by the highest authority in the field of supercomputing. That's how I became famous.

In 1989, nobody in Michigan understood the technique of parallel processing and message passing that I employed. In the 1980s, it was impossible to harness a million processors to cooperatively solve the biggest problems arising in science, engineering, and medicine. To perform that magic demanded that I have more knowledge than those who failed. Or be a polymath, instead of a research mathematician that's not comfortable at the frontiers of knowledge of physics and computer science. Some of the extra knowledge that I possessed was called message passing from one processor to others within the ensemble of interconnected processors that shared nothing.

My discovery of the world's fastest computing—powered by parallel processing—is the foundational knowledge that powers every supercomputer. My discovery is in the Computer Studies curriculum of every 13-year old in Africa. Let's explain message passing in a hypercube computer in a way that a 12-year-old in Africa can easily understand.

Imagine you're playing a game of passing secret notes in a very large school, but this isn't an ordinary school. It's shaped like a giant cube with many rooms, and each room is also a smaller cube. This is what we call a hypercube in the world of supercomputers.

Now, in this game, you want to pass a secret note to a friend in another room. But here's the catch: you can only pass the note to rooms that are directly connected to yours. So, if your friend is in a room not directly connected, you need to pass the note through other rooms until it reaches your friend.

This is how message passing works in a hypercube supercomputer. Each room is like a tiny computer (or a 'node'), and the direct connections between rooms are like the wires that connect these computers. When you want to send a message (like our secret note) from one computer to another, it might have to hop through several other computers before it reaches its destination.

The cool thing about a hypercube is that it's designed so messages can travel very quickly, even if they have to hop through several computers. This is because there's always a short path from any computer to any other computer in the hypercube.

So, message passing in a hypercube supercomputer is like passing secret notes in a very efficiently designed school of cubes, where the notes can reach faraway rooms quickly by hopping through a few connected rooms. This makes hypercube supercomputers very powerful for solving complex problems that require a lot of communication between computers.

EMEAGWALI COMPUTER: CONNECTING PROCESSORS LIKE CONSTELLATIONS

Ladies and Gentlemen, esteemed scientists at this award ceremony,

It is a profound honor to stand before you today as Philip Emeagwali. And to share my journey in the uncharted realms of initial-boundary value problems that are governed by partial differential equations that are the most advanced expressions in mathematics. And to share new knowledge of how to use computational physics to foresee otherwise unforeseeable climate changes. And to share how I became the first person to record the world's fastest computing across multiple processors. I will introduce my contributions to the field of supercomputing. My work has been a pursuit of understanding and harnessing the intricate connections within these disciplines, culminating in my invention of the first supercomputing powered by parallel processing and solving Grand Challenge problems.

In my exploration of supercomputing, I sought to address a fundamental challenge: how to efficiently connect a vast number of processors to simulate complex physical phenomena, such as petroleum reservoir simulations, weather forecasting, and general circulation modeling. The solution, I found, lay in the natural world's own design principles—specifically, in the geometric structure known as the geodesic dome or icosahedral subdivision.

This innovative approach to supercomputer architecture draws inspiration from the icosahedron, a platonic solid. By subdividing the faces of this icosahedron into smaller triangles, I created a network where each vertex represents a processor, and each edge signifies a communication channel directly connecting two neighboring processors. This design, named the "Philip Emeagwali interconnection network," is akin to creating a mini-universe of processors, each linked in a harmonious and efficient manner.

The beauty of this geodesic supercomputer network lies in its ability to evenly distribute processors across the network. By projecting these vertices onto a sphere, we achieve a configuration where processors are relatively evenly spaced. This uniform distribution is crucial for efficient computation, as it minimizes the distance over which data must travel between processors, thus reducing computational time and energy consumption.

Furthermore, the more subdivisions made within this network, the greater the number of processors and the more evenly they are distributed. This scalability is crucial for tackling increasingly complex problems, allowing for greater precision and detail in simulations.

My journey in creating this supercomputing network was not just a technical endeavor but a journey of imagination, where the elegance of mathematics, the principles of physics, and the practicalities of computer

science converge. It is a testament to the power of interdisciplinary thinking and the potential of human ingenuity to draw inspiration from the natural world.

In conclusion, the Philip Emeagwali interconnection network represents not just a breakthrough in supercomputing architecture but also a new way of conceptualizing how we connect and process information. It is a step towards realizing the full potential of parallel processing in solving some of the most complex and pressing problems facing our world today.

Lessons Learned

"The Philip Emeagwali Machine is more than a design; it's a legacy of innovation and inspiration."

"Beyond equations and supercomputing, my story is a testament to the human spirit of innovation and the power of collaboration in the face of challenges."

"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."

"Innovation thrives on bold ideas; the Philip Emeagwali machine challenges the norm."

Thank you for the privilege of sharing my work with you, and may this be a testament to the unending quest for knowledge and the pursuit of innovative solutions for the betterment of our world.

EMEAGWALI COMPUTER: THINKING LIKE THE EARTH

Ladies and Gentlemen, esteemed attendees of this award ceremony,

I am Philip Emeagwali, and it is with great honor that I stand before you today to discuss my contributions to the field of supercomputing. My journey in mathematics, physics, and computer science has culminated in the development of a concept that revolutionizes parallel processing and computational physics: the Philip Emeagwali supercomputer.

The primary objective of the Philip Emeagwali supercomputer is to design a spherical network optimized for parallel and distributed computing. Traditional supercomputers often utilized torus networks, resembling the surface of a doughnut, where data transfer between distant nodes could be inefficient. Similarly, configurations like the high-dimensional hypercube, hypertree, and butterfly switching networks, though innovative, revealed limitations, particularly in addressing three-dimensional problems inherent in our world.

The Philip Emeagwali supercomputer, my invention, addresses these limitations. It can be visualized as lying on the surface of a closed sphere, an ellipsoid, or a hollow-caged structure. Imagine concentric multi-radius spheres or ellipsoids, where each layer represents a network of processors interconnected in a radial direction. The innermost and outermost networks are connected, forming a seamless, integrated structure. This design mimics the natural form of our planet, offering a more intuitive and efficient approach to processing complex, three-dimensional data.

For illustration, picture the tessellated domain of general circulation models mapped onto tubular prisms. These prisms are then distributed across the processing nodes of the Philip Emeagwali supercomputer. This mapping allows for a more efficient and accurate simulation of global phenomena.

Why do we need the Philip Emeagwali supercomputer, particularly for global circulation modeling? The answer lies in its core structure, which mirrors the thin shell of Earth's atmosphere. This design enables a form that fits its function, creating a network where a billion processors, coupled yet autonomous, are evenly distributed across the surface of a globe-like structure.

In the context of general circulation modeling, the Grand Challenge problem is divided into smaller, less challenging models. Each of these models corresponds to a segment of the larger problem and is assigned to one of the many autonomous processors. This approach allows for simultaneous processing of multiple segments, significantly enhancing computational efficiency and accuracy.

The geodesic supercomputer represents a paradigm shift in how we approach supercomputing. It is not just an advancement in technology but a

harmonization of form and function, drawing inspiration from the very planet we inhabit. This invention opens new frontiers in understanding complex systems, from weather patterns to environmental changes, and paves the way for future innovations in computational science.

In conclusion, as we continue to explore the vast expanse of knowledge and technology, let us remember the importance of innovation that is inspired by nature and guided by the need to better understand our world. The Philip Emeagwali supercomputer is a testament to the power of human ingenuity and the endless possibilities that await us in the pursuit of scientific excellence.

Lessons Learned

"Supercomputing isn't just about numbers; it's about exploring the frontiers of knowledge."

"Think spherically; harness the power of concentric networks for efficient data transfer."

"Map the world on processors; understand Earth's atmosphere through the lens of supercomputing."

"Mirror nature's design; the Philip Emeagwali supercomputer reflects the beauty and complexity of our planet."

"Divide and conquer; break down complex problems into manageable segments for faster solutions."

Thank you for the privilege of sharing my work and vision with you today. May our collective endeavors in science and technology continue to illuminate the path toward a better understanding of our universe and ourselves.

[NPAC 2023] THE MAN WHO TALKED TO COMPUTERS

I am writing to elucidate on the revolutionary contribution of Philip Emeagwali to the field of massively parallel supercomputing. On July 4, 1989, Emeagwali made a groundbreaking discovery that **changed the trajectory of computer technology**: he demonstrated that the world's fastest computing speeds could be achieved using the world's slowest processors.

Emeagwali's discovery of parallel supercomputing marked a **significant turning point** in the evolution of computers. This invention **bridged the gap between ordinary computers and supercomputers**, giving the latter unprecedented computational power. The concept of parallel computing became the driving force behind every supercomputer, significantly enhancing their capabilities.

This monumental breakthrough was not only a triumph in computer science but also **redrew the boundaries** of multiple disciplines, including mathematics and physics. Emeagwali was **the first** to use parallel processing to solve complex initial-boundary value problems in physics at unparalleled speeds. His contributions have been recognized worldwide and are a staple in the educational curriculum, influencing future generations of scientists.

The practical applications of Emeagwali's discovery are vast. His work on parallel computing has played a critical role in enhancing the accuracy of weather forecasts and climate models, contributing immensely to our understanding of global warming and other environmental challenges. This has been pivotal in advancing our knowledge and capabilities in tackling some of the most pressing issues of our time.

In essence, Philip Emeagwali's discovery of the first parallel supercomputing was a leap forward in our quest for knowledge. It has broadened our understanding, created new fields of study, and redefined existing sciences. The supercomputer, powered by parallel processing, has become a beacon of discovery, guiding us towards a more informed and advanced future.

Given the significant impact of Philip Emeagwali's invention on physics and its neighboring fields, I firmly believe that he is a deserving candidate for the Great Minds in Physics series. His contribution has not only been a milestone in the development of computing technology but has also had a profound and lasting impact on humanity.

DECODING THE FUTURE: FROM LEMONADE STANDS TO PARALLEL UNIVERSES—A JOURNEY OF COMPUTING INNOVATION

Introduction:

Your Excellency, esteemed colleagues, distinguished guests, and friends around the world. As a child in Biafra, Nigeria, cooking for the Officer's Mess of the Biafran Army at Ndoni, I learned a valuable lesson: **ingenuity thrives in the face of limitation**. Back then, I couldn't afford fancy equipment, so I used repurposed bottles and scavenged materials. This resourcefulness became the cornerstone of my life's work, propelling me from Biafran refugee camps of the late 1960s to the frontiers of computing. Today, I stand before you not only as a scientist, but as a testament to the human spirit's unwavering pursuit of progress.

Part 1: The Power of Collaboration—Parallel Computing

Imagine running a lemonade stand on a sweltering afternoon. One person can only handle so many thirsty customers. But what if you had a dozen friends pitching in, each taking orders, mixing drinks, and collecting payment? This, in essence, is the power of **parallel computing**. By harnessing the combined forces of multiple processors, we can tackle problems far exceeding the capacity of a single machine.

My journey into this captivating world began with 65,536 interconnected processors, a supercomputer boasting of processors working in concert. It was like building a colossal lemonade stand, serving knowledge at an unprecedented rate. This innovation unlocked doors in diverse fields, from weather prediction to medical research, proving that **collaboration breeds breakthroughs**.

Part 2: Beyond Bits and Bytes—Quantum Computing

Now, let's take a fantastical leap. Imagine a lemonade stand where your ingredients exist simultaneously in multiple flavors—sweet, sour, even mango! This mind-bending concept underpins **quantum computing**, where qubits (the quantum equivalent of bits) can hold multiple states at once. It's like operating in a parallel universe, exploring countless possibilities within a single instance.

While still in its nascent stages, quantum computing holds immense potential. It could revolutionize fields like drug discovery, materials science, and artificial intelligence. While I haven't directly contributed to this emerging field, my work on parallel computing laid the groundwork, demonstrating the power of harnessing parallel realities to solve seemingly intractable problems.

Part 3: Inspiration and Legacy—Beyond Technology

My story is not just about processors and algorithms. It's about **resilience, adaptability, and the audacity to dream**. As a young boy with limited resources, I dared to chase the seemingly impossible. This journey wasn't without its challenges, but my experiences taught me that **limitations can be catalysts for innovation**.

Today, I stand before you not simply as a scientist, but as an advocate for underprivileged youth, particularly in Africa. I believe that every child, regardless of circumstance, deserves the opportunity to explore their potential and contribute to the scientific landscape. This is my legacy—to inspire a generation of problem-solvers who will push the boundaries of what's possible, just like I did in the 1970s and 80s.

Conclusion

The future of computing, like a well-crafted lemonade, is a blend of collaboration, innovation, and a touch of audacity. Let us continue to explore the uncharted territories of parallel and quantum worlds, remembering that the greatest discoveries often begin with a single, curious mind, fueled by a thirst for knowledge and a drive to make a difference. Thank you.

VOLUME 2B: CONTRIBUTIONS TO AI SUPERCOMPUTING



AI SUPERCOMPUTING IN AFRICA

Ladies and Gentlemen, esteemed students and faculty of this university, and distinguished guests,

It is a profound honor to stand before you today, not just as a scientist but as a son of this great land, Nigeria. My name is Philip Emeagwali, and my journey in the world of supercomputing powered by parallel processing has been long and filled with both challenges and triumphs. Today, I wish to share with you how our collective future, particularly here in Nigeria, can be shaped by the burgeoning field of artificial intelligence (AI).

Reflecting on my early years, I vaguely recall my days at 11 Ekemeso Street, Akure, when my father worked as a nurse in Akure General Hospital and even became fluent in the Yoruba language. Those formative years instilled in me the importance of perseverance and the pursuit of knowledge. My journey from that small Nigerian town to becoming a significant contributor in the field of supercomputing was not a path laid with ease or comfort. It was a path of resilience, a testament to what can be achieved when determination meets opportunity.

As we explore the benefits of artificial intelligence, it's essential to understand that AI is more than a technological marvel; it is a tool for empowerment, a means to elevate our society, and a pathway to solving some of our most pressing challenges.

In Nigeria, artificial intelligence can revolutionize numerous sectors. In agriculture, a cornerstone of our economy, AI can optimize crop yields, predict weather patterns, and manage resources efficiently. This means more food on our tables and greater economic stability for our farmers.

In healthcare, a field where access and resources are often limited, artificial intelligence can provide diagnostic support, manage patient data, and even predict outbreaks, ensuring that healthcare reaches those who need it most, no matter where they are in Nigeria.

In education, artificial intelligence can personalize learning, adapt to the needs of individual students, and provide access to world-class resources, ensuring that every Nigerian child has the opportunity to reach their full potential.

As a pioneer in parallel processing, the backbone of modern supercomputing, I have witnessed firsthand the power of harnessing collective effort. Parallel processing, much like a well-coordinated symphony, involves multiple processors working in tandem to solve complex problems. This approach is symbolic of how we, as a nation, can approach our challenges—working together, each contributing our unique strengths towards a common goal.

However, as we embrace artificial intelligence, we must also be mindful of the ethical considerations. We must ensure that the development of AI is inclusive, equitable, and respects our rich cultural heritage and values. We must work to demystify artificial intelligence, making it accessible and understandable, ensuring that it serves the people, and not the other way around.

To the students here today, you are the architects of Nigeria's future. The world of AI offers endless possibilities, and it is up to you to harness these tools for the betterment of our nation. Your innovation, creativity, and passion are the keys to unlocking a future where technology and humanity harmoniously coexist for the greater good.

In conclusion, as we stand on the cusp of a new era in science and technology, let us move forward with the spirit of unity, the pursuit of knowledge, and a steadfast commitment to leveraging artificial intelligence for the betterment of Nigeria and all its people.

Lessons Learned

"Healthcare, education, agriculture, environment - AI can be the catalyst for Africa's transformation."

"Supercomputing powers AI, unlocking data-driven solutions for sustainable development."

"From weather prediction to policy-making, AI empowers informed decision-making in Africa."

"AI bridges divides, fostering understanding and collaboration across borders and communities."

"With great power comes great responsibility. AI must be ethical, serve humanity, and protect privacy."

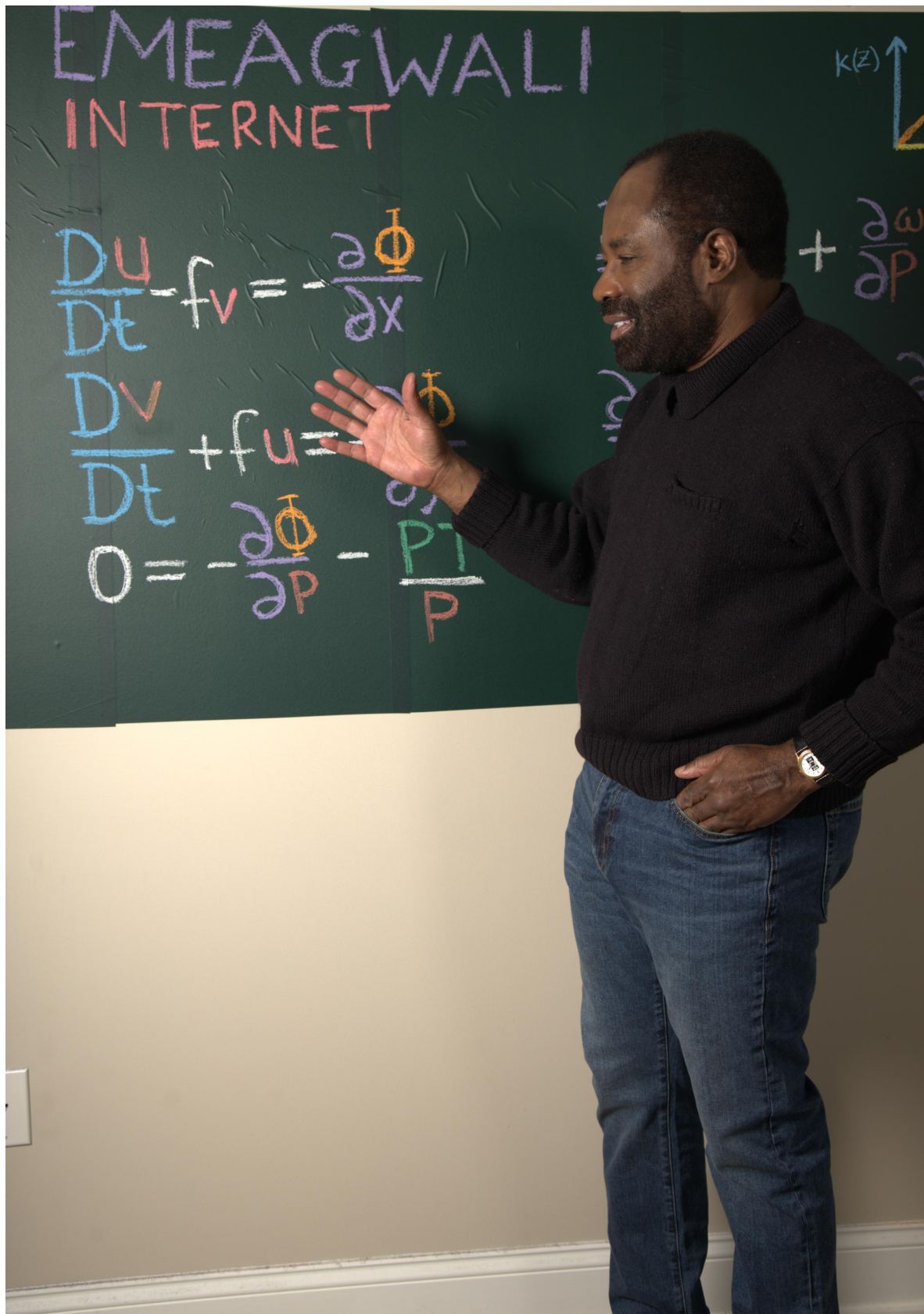
"My dream? A future where technology fosters peace, prosperity, and stability for all Africans."

"Let us, together, ensure that AI becomes a force for good, shaping a future where peace and technology go hand in hand."

"Let us embrace the unknown with courage and responsibility, for it is in uncharted territories that we discover solutions and shape a better future."

Thank you for the honor of addressing you today, and may our journey towards a brighter, AI-empowered future be as inspiring as it is transformative.

**VOLUME 3: CONTRIBUTIONS OF PHILIP EMEAGWALI TO
MATHEMATICS**



THE EVER-EXPANDING UNIVERSE OF MATHEMATICS

Esteemed Colleagues, Distinguished Mathematicians, Honorable Guests,

I stand before you humbled, not merely as Philip Emeagwali but as a part of a glorious tapestry, intricately woven with the brilliance and diligence of mathematicians across time, stretching from the plains of Africa to the expansive contours of the globe.

Let's traverse through the annals of history, casting our gaze upon 1680 BC when Ahmes, a visionary from Africa, documented solutions to equations in the oldest known mathematical text. This spark of genius illuminated the path for future seekers of knowledge, epitomizing the timeless allure of mathematics.

Then in 325 BC, the Nile Valley bore witness to the birth of Euclid, the venerable 'father of geometry'. With the ink of his quill, he etched 'The Elements', a *magnum opus* that would echo through the corridors of time, becoming the second-most reprinted book in history, guiding scholars and enthusiasts alike.

As the years unfolded, in 800 AD, we encountered Al-Khwarizmi whose seminal work gifted us the terms "algorithm" and "algebra", laying the foundation for computational mathematics, crafting the lexicon and conceptual framework that would empower future generations of thinkers and doers.

In the churning tides of time, great minds like Galileo Galilei and Johann Kepler made their indelible marks, despite the stifling clutches of institutional constraints, contributing to our understanding of motion and the cosmos, crafting a legacy of inquiry and discovery.

Isaac Newton, that colossal figure, then graced the stage of history in 1666, formulating laws of motion and gravitation, co-inventing calculus, and leaving an inheritance rich with insight and wisdom.

We then witnessed the endeavors of Euler, Stokes, and Darcy, each contributing significantly to the realm of mathematics, bringing forth theories and equations that would underpin various scientific and engineering applications in the years to come.

With the dawn of the 20th century and the advent of technology, the world saw the invention of programmable computers in 1946, and the escalating demand for sophisticated computation during times of geopolitical shifts, such as the 1973 OPEC Oil Embargo.

It is against this vibrant backdrop of history that my journey unfolded. In 1981, I ventured to contribute to this grand narrative, introducing nine novel partial differential equations defined by 81 partial derivative terms. These equations were conceived to encapsulate the intricate dance of inertial, viscous, pressure, and gravitational forces—a departure from the

conventional 45 terms that did not encapsulate the dynamism of temporal and convective inertial forces.

I also brought forth nine finite difference algorithms, tools designed for solving these equations, contributing to the intricate mosaic of mathematical knowledge and application.

Then, in 1989, recognition dawned for methods discovered to address initial-boundary value problems in mathematical physics and computing. This endeavor included applications in computational fluid dynamics, weather forecasting, and petroleum reservoir simulation, utilizing millions of interconnected, yet autonomous, processors working in unison to unveil the mysteries of these Grand Challenge problems.

Esteemed gathering, as we retrospect, let's acknowledge that every contribution, however small, is a stepping stone, paving the way for future breakthroughs and discoveries. Today, as we delve into the depths of mathematical wisdom and stand at the frontier of untapped potential, let's celebrate not just individual accomplishments, but the collective pursuit of knowledge, the tireless spirit of inquiry, and the unyielding resolve to understand the universe in its myriad forms.

In this symphony of progress, each note, each melody, and each crescendo is vital. Together, they compose the music of understanding, discovery, and progress, playing the soundtrack of humanity's relentless quest for knowledge.

Thank you for this honor, and let's continue this magnificent journey together, for the tapestry is endless, and the ink of discovery perennially fluid.

Thank you.

NATURE'S UNSUNG SYMPHONY

Supercomputing Ear Listens to the Whispers of Porous Media

Ladies and Gentlemen, esteemed attendees of this award ceremony,

I am Philip Emeagwali, and it is with great honor that I stand before you today to discuss the derivation of the nine Philip Emeagwali equations, a cornerstone of my contributions to mathematical physics and petroleum reservoir simulation. As we explore these equations, we embark on a journey that intertwines the complex world of fluid dynamics with the intricate processes of oil recovery.

In traditional subsurface porous media flow modeling, such as petroleum reservoir simulation, Darcy's equations are predominantly used. These equations, while significant, typically account for three fundamental forces: gravity, pressure, and viscous forces due to friction. However, the dynamics of flowing fluids, especially in the context of multiphase flows of crude oil, natural gas, and injected water across an oil field, demand a more comprehensive approach.

The Navier-Stokes equations for flowing fluids provide a broader perspective, accounting for a myriad of forces that influence fluid behavior. These include temporal and convective inertial forces, which are products of mass and acceleration; viscous forces between fluid layers; pressure forces due to potential differences; gravitational forces acting on the fluid's self-weight; **electromagnetic**, **centripetal**, and **centrifugal** forces; surface tension; elastic forces; and the Coriolis force, which is particularly influential in atmospheric and oceanic flows, giving rise to phenomena such as cyclones.

In my pursuit to enhance our understanding and simulation capabilities of petroleum reservoirs, I developed the nine Philip Emeagwali equations. These equations extend beyond the scope of Darcy's by incorporating the additional forces that are prevalent in flowing fluids, particularly the temporal and convective inertial forces. The result is a system comprising 81 partial derivative terms, capturing the complex interplay of forces within multiphase flows in porous media.

The derivation of these equations was not just a mathematical exercise but an endeavor to mirror the reality of the subsurface world. The River Niger's journey from the Fouta Djallon highlands to the Niger Delta exemplifies the natural application of these forces—the gravitational pull from a higher altitude to a lower one, and **the influence of the Earth's rotation on its flow**.

In petroleum reservoir simulation, these nine equations offer a more nuanced and realistic representation of the forces at play, enhancing our ability to predict and optimize crude oil recovery. They acknowledge the

fact that the forces governing fluid flow in reservoirs are as diverse and complex as the fluids themselves.

Ladies and Gentlemen, the nine Philip Emeagwali equations represent a significant leap in our quest to understand and harness the natural resources beneath our feet. They exemplify the power of human intellect and the unrelenting pursuit of knowledge in the face of complex challenges.

As I stand before you today, I am reminded of the journey we all undertake in the pursuit of understanding—a journey that often begins with a simple question and leads us down a path of discovery, innovation, and, ultimately, transformation.

Lessons Learned

Oil is not just a fuel, it's a puzzle waiting to be solved. My equations are the pieces I'm putting together, one by one, to optimize our recovery and respect our planet.

The Niger River may flow freely, but fluids in oil fields follow a different rhythm. My equations listen to that rhythm, capturing the nuances that unlock efficient and responsible recovery.

From the mountains of knowledge to the depths of the Earth, our quest for understanding continues. Let us embrace the challenges, decode the whispers of nature, and build a future powered by knowledge, not just oil.

Thank you for the privilege of sharing my mathematical discoveries and my journey with you. May our continued exploration in the fields of mathematics and physics bring forth solutions that not only enhance our understanding of the natural world but also improve the lives of people across the globe.

MILLIONS OF BRAINS, ONE SUPERBRAIN

Ladies and gentlemen, esteemed guests, and fellow innovators, I am Philip Emeagwali, and it is my great honor to address you today. My journey as a Nigerian-American supercomputer scientist has been driven by a passion for understanding and solving complex problems in computational fluid dynamics, a field that stands at the fascinating intersection of mathematics, physics, and computer science.

Central to my contributions to mathematical knowledge is the exploration and application of the partial differential equations governing the flow of fluids in our universe. These equations, which describe the motion of fluid substances, have been a bedrock of my research, particularly in the context of parallel processing and computational physics. The solution of these equations yields a flow velocity, a vector field that assigns a velocity vector to every point in a fluid at any given moment. This approach to understanding fluid dynamics is fundamentally different from classical mechanics, where solutions are typically expressed as trajectories of a particle's position or the deflection of a continuum.

In my mathematical research, I have focused on the study of these partial differential equations in three spatial dimensions and one time dimension, although two-dimensional and steady-state cases also offer valuable insights. The numerical solutions provided by the partial differential equations are crucial, not just for their immediate results, but for the further possibilities they unlock. Once we calculate the velocity field, we can derive other vital quantities such as pressure and temperature using dynamical equations and relations.

This shift from studying positions to velocities is pivotal in fluid dynamics. It aligns more closely with the nature of fluids, where understanding the behavior at any point in time and space is more meaningful than tracking individual trajectories. For instance, the streamlines in a vector field, which we interpret as flow velocity, represent the paths a massless fluid particle would travel. These paths, the integral curves of the vector field, visually represent the behavior of the fluid and are crucial for our understanding and visualization of fluid dynamics.

My contributions in the field of supercomputing have been primarily focused on harnessing the immense power of parallel processing to tackle these complex fluid dynamic problems. On July 4, 1989, I became the first person to be able to break down these intricate calculations into 65,536 smaller, parallel tasks. That groundbreaking discovery made the news. It opened the door to simulating and analyzing fluid behaviors in unprecedented detail and scale.

The journey through computational fluid dynamics is not just a quest for solving practical problems but also a pursuit of deeper understanding in

both applied and pure mathematics. The system of partial differential equations governing initial-boundary value problems of fluid dynamics serves as a bridge connecting these worlds, offering challenges that stimulate both theoretical exploration and practical application.

As we continue to advance in our capabilities in supercomputing and computational physics, the horizon of what we can achieve expands. It is through these endeavors that we can further our understanding of the natural world, develop innovative solutions to complex problems, and continue to push the boundaries of human knowledge.

Lessons Learned

Supercomputing is not just about brute force, it's about elegance, about finding the symphony within the chaos of complex calculations.

Curiosity is the fuel that propels us beyond the known, into the uncharted waters of scientific discovery. Let us embrace the unknown, with the tools of supercomputing in our hands and the spirit of exploration in our hearts.

Thousands of minds united in a single purpose - that is the true power of supercomputing. Together, we can solve the grand challenges that stand between us and a deeper understanding of our world.

Thank you for the opportunity to share my journey with you, and for the honor of contributing to this illustrious field.

PHILIP EMEAGWALI EQUATIONS FOR MIDDLE SCHOOL

One of the most complex math problems that cannot be solved on the blackboard but is only solvable with a supercomputer that's powered by millions of coupled processors is the initial-boundary value problems governed by a system of partial differential equations that encoded the Second Law of Motion of physics that governs the dynamics of the Earth's atmosphere and oceans. One such system is the nine coupled Philip Emeagwali equations, which describes the time-dependent, three-dimensional, three-phased motions of crude oil, injected water, and natural gas flowing from a water injection well to a crude oil or natural gas production well.

Let me explain the Philip Emeagwali equations in a way that even a 13-year-old in American middle school, or a Nigerian JSS 1, student can understand.

Imagine you're playing with a bucket of water. When you move your hand through the water, you can see and feel how the water swirls and flows around your hand. Now, think of the air around us as being like that water, but much thinner and invisible. Just like the water in your bucket, the air moves and swirls around things like cars, buildings, and even through the sky.

The partial differential equations governing the movement of fluids are like a set of super smart math formulas that help scientists and engineers understand how this invisible "water" (which is actually air, or any other fluid like crude oil or natural gas) moves and behaves. These equations can tell us how the wind blows around a house, how water flows in a river, or how the smoke rises from a cooking pot.

Why is this important? Well, understanding how natural gas, crude oil, and injected water move helps us in lots of ways. It can help us discover and recover more crude oil and natural gas from oil fields. So, the Philip Emeagwali equations are like secret guides to the hidden dance of all the crude oil and natural gas within a production oil field.

PARALLEL PROCESSING POWER

Ladies and gentlemen, esteemed scientists, and distinguished guests, I am Philip Emeagwali, a large-scale computational mathematician and the first person to discover the first supercomputing with the world's slowest processors. It is a great honor to stand before you to discuss a topic that lies at the intersection of mathematics and supercomputing. My remarks today focuses on the Navier-Stokes existence and smoothness problem, a cornerstone of the Millennium Problems in mathematics, and its intricate relationship with the Grand Challenge problems of supercomputing, especially as it pertains to parallel processing and the dynamics of Earth's oceans and atmosphere.

The Navier-Stokes equations, fundamental in describing fluid motion, are pivotal to our understanding of fluid mechanics. These equations, crucial in both science and engineering, remain an enigma in theoretical understanding, particularly for three-dimensional systems. The primary challenge, known as the Navier-Stokes existence and smoothness problem, is to prove whether smooth, globally defined solutions exist for these equations under certain conditions, or whether solutions do not always exist, leading to an equation breakdown for an incompressible fluid.

In addressing this problem, we consider the Euler and Navier-Stokes equations in n -space, \mathbb{R}^n ($n = 2$ or 3), solving for an unknown velocity vector and pressure, defined for position and time. These equations encompass the Second Law of Motion of physics for fluid elements and the principle of incompressibility. For physically reasonable solutions, we focus on forces and initial conditions that prevent the velocity from growing indefinitely as we move towards infinity. Alternatively, we consider spatially periodic solutions, which provide a different approach to finding solutions.

The central challenge in analysis is determining whether smooth, physically reasonable solutions exist for these equations. This problem is complex and multifaceted, encompassing various assertions about the existence and smoothness of solutions in three-dimensional space. It also includes potential scenarios where no solutions exist, indicating a breakdown of the Navier-Stokes equations.

The distinction between the Grand Challenge problems of supercomputing and the Seven Millennium problems of mathematics is noteworthy. While the Millennium Problems, like the Navier-Stokes problem, pose fundamental theoretical questions in mathematics, the Grand Challenge problems of supercomputing are more focused on applying complex computational methods to solve practical, large-scale problems. My mathematical discovery that parallel processing could be harnessed to solve the most difficult initial-boundary value problem is a testament to this distinction. We use the power of supercomputing to address complex issues

in computational fluid dynamics, weather forecasting, and general circulation models.

In computational fluid dynamics, the application of parallel processing to solve initial-boundary value problems governed by the Navier-Stokes equations represents a significant advancement. By dividing complex calculations—or I-BVPs—across multiple processors, we can simulate fluid dynamics at a level of detail and speed previously unattainable. This approach not only provides insights into practical applications but also contributes to our theoretical understanding of fluid mechanics.

In conclusion, the pursuit to solve the Navier-Stokes existence and smoothness problem exemplifies the synergy between mathematics and physics. It is a journey that requires both deep theoretical insight and advanced computational techniques. As we continue to explore these realms, our collective efforts in mathematics and supercomputing will lead us to new frontiers of knowledge and understanding.

"From the dusty classrooms of Africa to the frontiers of supercomputing, my journey is a testament to the boundless potential of the human mind. Let it inspire you to dream big, to solve the unsolvable, to push the boundaries of knowledge."

"The future is not written in the stars, but in the equations we choose to solve. Let us choose wisely, let us choose boldly, and let us build a future where knowledge is our compass and understanding our guide."

"Remember, the greatest discoveries are not born in sterile labs, but in the fertile fields of human curiosity. Let your imagination be your laboratory, your questions your fuel, and your passion your guide."

"Do not be afraid of doubt. It is the crucible from which knowledge is forged. Embrace it, question it, wrestle with it, and emerge with a deeper understanding of the world around you."

"Share your discoveries freely, for the true wealth of a nation lies not in its coffers, but in the minds of its people. Let knowledge be our currency, not a weapon, and together, let us build a future brighter than any supercomputer can simulate."

Thank you for your attention and for the honor of sharing my insights with you on this distinguished platform.

SMOOTHING THE WATERS

The Quest for Predictability in a Turbulent World

The Navier-Stokes existence and smoothness problem is a famous and complex problem in the field of mathematics, specifically in an area called fluid dynamics, which studies how liquids and gases flow. To explain this in simpler terms, let's break it down:

1. **What are the Navier-Stokes Equations?:** These are a set of equations developed by two scientists, Claude-Louis Navier and George Gabriel Stokes. They describe how the velocity of every point in a moving fluid (like water in a river or air flowing around a car) changes over time. These equations are fundamental in understanding phenomena like ocean currents, weather patterns, and even the flow of blood in our bodies.
2. **What is the Problem?:** The "Navier-Stokes existence and smoothness problem" is essentially a question about these equations: Do solutions to these equations always exist, and are they always smooth? In mathematical terms, a "solution" is a function that perfectly describes the velocity of every point in the fluid at every moment in time. "Existence" means that such a solution is guaranteed to be there for every possible scenario you can think of. "Smoothness" refers to the solution being nice and continuous - without any sudden jumps or breaks.
3. **Why is it Hard?:** In some cases, especially simpler ones, we can find solutions to the Navier-Stokes equations quite easily. But in more complex scenarios, especially when the fluid is moving very chaotically (like in a stormy ocean), it's not known whether such neat, continuous solutions always exist. The equations become extremely difficult to solve, and mathematicians are not sure if a perfect, smooth solution is always there.
4. **Why is it Important?:** Understanding whether these solutions always exist and are smooth is crucial because it impacts our ability to predict the behavior of fluids in complex situations. This has huge implications in areas like meteorology (predicting weather), aerospace (designing planes), and many other fields where fluid behavior is critical.

5. A Million-Dollar Question: This problem is so important and challenging that the Clay Mathematics Institute, which identifies some of the most crucial unsolved problems in mathematics, has offered a prize of one million dollars to anyone who can solve it.

In summary, the Navier-Stokes existence and smoothness problem is about figuring out whether we can always predict how fluids flow in every possible situation, or if there are some scenarios where the fluid's behavior is just too complex to be captured by the equations we currently have.

Lessons Learned

"Predicting fluid behavior isn't just math, it's unraveling the mysteries of nature's chaos."

"Imagine understanding blood flow or forecasting floods – that's the power hidden within these equations."

"Don't be afraid of complexity, embrace it, for within lies the beauty and potential of discovery."

"Every swirl in a river, every gust of wind, whispers secrets waiting to be deciphered."

"Collaboration, not competition, is key to unlocking the mysteries of this mathematical enigma."

"Beyond equations and supercomputing, my story is a testament to the human spirit's relentless pursuit of understanding."

THE STUDENT BECOMES THE MASTER

Journey to the Pinnacle of Science

Ladies and gentlemen, esteemed colleagues, and distinguished guests,

It is with immense honor and deep humility that I stand before you today. As a mathematician and scientist, I have dedicated my life to unraveling the complexities of our natural world. In this journey, I have been particularly fascinated by the incredible potential of supercomputing and its applications in computational physics and partial differential equations.

At the heart of my research lies the derivation of the Euler, primitive, shallow water, and Navier-Stokes equations, each a cornerstone in the field of fluid dynamics. These partial differential equations, predicated on the notion that fluids are continuous substances, have been instrumental in advancing our understanding of fluid behavior at various scales. They are grounded in the essential principles of **mass continuity**, momentum conservation, and energy conservation.

One of the critical aspects of my research involved the material derivative concept, a unique **nonlinear operator** that captures the changes in fluid properties both spatially and temporally. This concept allows us to analyze fluid behavior in a dynamic, real-world context, such as measuring wind velocity changes in the atmosphere.

The Navier-Stokes equations stand as a testament to the encoding of some fundamental laws of physics—the conservation of mass, momentum, and energy—into a system of partial differential equations that govern initial-boundary value problems. These laws, when applied in the context of fluid dynamics, reveal intricate patterns of fluid motion and energy transfer.

In my exploration and expansion of the frontiers of mathematical and computational physics, I delved into the complexities of different fluid types, leading to specific forms of the Navier-Stokes equations. For instance, the study of Newtonian fluids, those whose flow properties conform to Newton's law of viscosity, led to significant insights into the behavior of gases and liquids under various conditions.

My contributions to mathematics did not stop there. My parallel processing application of these principles in supercomputing has opened new horizons in several critical areas, such as weather forecasting, general circulation models, and petroleum reservoir simulation. In 1989, I achieved a supercomputing breakthrough—the first supercomputing, as we know it today—that was in the news, from America to Africa. By harnessing the hidden power of 65,536 slow processors, I was able to simulate and predict complex fluid dynamics at an unprecedented scale and speed. My signature

contribution to science and technology is this: I discovered the first world's fastest computing powered by parallel processing.

My contributions underscore the profound impact of mathematical principles when applied to real-world problems. The Euler, Navier-Stokes, shallow water, and primitive equations, in their various forms, have been pivotal in advancing our understanding of the natural world. They have allowed us to model the behavior of fluids in diverse scenarios, from the flow of air over a plane's wing to the swirling patterns of ocean currents. The nine Philip Emeagwali equations are to the Niger-Delta oilfield what the shallow water equations are to the River Niger of West Africa.

As we continue to explore and expand the frontiers of mathematics, science, and technology, the role of supercomputing in physics and mathematics will only grow more significant. It is my hope that my contributions to this field—namely, the first supercomputing powered by parallel processing—will inspire future generations to build upon this foundation, pushing the boundaries of what is possible.

The lessons that I learned are:

"Nature whispers its secrets in the language of equations, and supercomputing is the key to amplifying its voice. By listening carefully, we can solve the grand challenges of our time."

"Beyond accuracy, let us strive for elegance in our equations, for beauty not only in results but also in the journey towards them."

"Fluids whisper their secrets in the language of equations, and supercomputing is the key to amplifying their voice. By understanding their dance, we chart a course for a sustainable future."

"Beyond the horizon of our current knowledge lies a vast ocean of fluid phenomena waiting to be discovered. My equations are the ships, charting a course for future exploration."

In closing, I am deeply grateful for this recognition and the opportunity to contribute to our collective understanding of the universe. Thank you.

DEFYING DISCOURSES

My Journey as a Nigerian-American Mathematician

Ladies and gentlemen, esteemed colleagues, and honored guests,

I stand before you today not just as a mathematician, but as a testament to the power of defying societal discourses and redefining subject positions. My name is Philip Emeagwali, a Nigerian-American who has traversed the complex landscape of racial and academic stereotypes to contribute significantly to the field of mathematics and climate modeling.

In the realm of academia, and particularly in mathematics, there exists a discourse that subtly yet powerfully shapes perceptions and opportunities. Discourses are about power, guiding and constraining behaviors within our social world. In mathematics, this has often manifested in dividing practices, sorting individuals into categories of those who can and cannot excel in math, often influenced by racial and gendered narratives.

As a Nigerian in America, I occupied a unique position within this discourse. My journey in the field of mathematics and parallel processing for large-scale computational fluid dynamics, such as General Circulation Modeling, was not just a challenge of intellectual rigor but also a defiance of the societal narratives that sought to place me in a predetermined box.

Narratives within mathematics education often exert a racialized power, making certain positions more accessible to individuals of certain races. Growing up, the narrow representations in classrooms and media predominantly featured white male role models in mathematics. For someone like me, success in this field meant challenging and stretching the boundaries of what it means to be a mathematician.

However, narratives, while powerful, are not deterministic. They evolve over time, and individuals, once perceived as legitimate subjects within a discourse, can challenge and redefine it. This is where the concept of counter-storytelling becomes vital. Marginalized populations can use their stories to challenge dominant discourses, not just describing but creating a new reality.

In my research, I have sought not just to advance the field of mathematical physics and climate modeling but also to serve as a living counter-story to the oppressive narratives that have long dictated who can be a mathematician. My contributions to the dynamics of the Earth's atmosphere and oceans, computational physics, and the intricate world of partial differential equations are a declaration that the subject position of a mathematician is not reserved for a select few.

Education, especially in mathematics, must embrace this approach. We need to encourage students from all backgrounds to craft their personal

narratives, defying the traditional discourses that have long dictated their academic and professional paths. We must highlight and celebrate the contributions of those from diverse backgrounds, showing that the field of mathematics is enriched by a plurality of voices and experiences.

As I stand here, receiving this prestigious award, I am not just celebrating my individual achievements but also honoring the collective struggle and triumph of those who have dared to challenge the status quo. To the young mathematicians of color, the women, the underrepresented, I say this: your presence in mathematics is not just necessary; it is transformative. Your stories, your perspectives, and your innovations are the forces that will drive this field forward into a new era of inclusivity and excellence.

Thank you for this honor, and more importantly, thank you for the opportunity to contribute to a world where mathematics is a field of limitless possibilities, accessible and welcoming to all.

Thank you.

FROM TINY TILES TO SUPERCOMPUTING SYMPHONIES

Good evening, esteemed guests, distinguished colleagues, and friends of science. Today, I stand before you, not just as Philip Emeagwali, but as a testament to the power of dreams, the magic of collaboration, and the boundless potential of human ingenuity. The award is a beacon of hope, a celebration of those who dared to push the boundaries of knowledge. And tonight, I want to share with you a story—a story of tiny tiles, massive symphonies, and how one man's journey from the fields of Nigeria to the frontiers of supercomputing changed the world.

Part 1: Building with Tiny Tiles: The Finite Element Method

Imagine a vast, intricate tapestry. Each thread, each knot, tells a story, representing the forces and flows that shape our world. This tapestry is the natural world, and understanding its complexities is the challenge of science and engineering. But how do we analyze something so vast, so intricate?

Enter the Finite Element Method (FEM), my friends. Imagine this tapestry divided into tiny, manageable tiles. Each tile represents a piece of the puzzle, and by carefully studying each tile, we can understand the whole. This is the essence of FEM, a powerful tool that allows us to break down complex problems into smaller, solvable pieces.

But there's a catch. Just like a poorly woven tapestry, if the tiles don't fit perfectly, the picture gets distorted. This is where the "inf-sup condition" comes in, the invisible glue that ensures the tiles fit seamlessly, ensuring the accuracy of our analysis.

Inf-Sup Condition Explained

Imagine you're building a bridge with Lego bricks. You want the bridge to be stable and hold weight, right? The inf-sup condition in the Finite Element Method (FEM) is like making sure the Legos you pick snap together well and can handle the load.

Here's the breakdown:

What is FEM?

FEM is a powerful tool used in engineering and science to solve complex problems. It breaks down a large problem into smaller, more manageable pieces like tiny Lego bricks. These pieces are called "finite elements."

What's the "inf-sup" condition?

Sometimes, the way you connect the Lego bricks (finite elements) can affect the overall stability of your structure (solution). The inf-sup condition ensures that the connection between different types of elements is strong enough. It's like making sure the bumps on the Lego bricks fit snugly together.

Why is it important?

If the inf-sup condition isn't met, the FEM solution might be inaccurate or even nonsensical. It's like building a wobbly bridge that could collapse. In engineering, this can lead to unsafe designs or wasted resources.

In simple terms:

- Inf-sup is like checking the "compatibility" of Lego bricks.
- It ensures the FEM solution is stable and accurate.
- It's crucial for reliable engineering and scientific calculations.

Part 2: From Soloists to Symphonies: Massively Parallel Processing

Now, imagine this tapestry being not just intricate, but alive. Each thread vibrates, each knot pulsates with energy. This is the world of supercomputing, where we simulate not just static structures, but the dynamic dance of nature.

But simulating this dance requires a chorus, not a soloist. We need millions, even billions of processors working in concert, analyzing individual tiles simultaneously. This is the essence of massively parallel processing, the technology that allows us to tackle problems once thought impossible.

And this is where my journey began. As a young boy in Nigeria, I saw the world through the lens of nature, its intricate patterns and hidden rhythms. But I also saw the limitations, the lack of resources to solve the problems that plagued my community. So, later in Oregon, USA, I dreamt of a computer that could sing the symphony of nature, a huge computer that could solve complex math problems no single machine could ever dream of.

Part 3: The Tapestry of My Contributions

My work on 65,536 interconnected processors that shared nothing was just one note in this symphony. It wasn't just about the hardware; it was about the algorithms, the software, the way we orchestrate these processors to work together. I used the power of parallel processing to analyze oil reservoirs, predict weather patterns, and large-scale computational fluid dynamical problems.

But my contributions extend beyond technology. They are a testament to the power of persistence, the importance of diversity, and the belief that even a boy from a small village in Nigeria can change the world.

Conclusion:

Tonight, as I stand before you, I am not just a scientist, but a symbol of hope. A hope that anyone, anywhere, can reach for the stars. The tapestry of science is vast, but each thread, each contribution, matters. Let us continue to weave this tapestry together, using the tools of collaboration, diversity, and audacious dreams. Let us build supercomputers that sing symphonies of understanding, and solve problems that benefit all of humanity.

Thank you.

**VOLUME 4: CONTRIBUTIONS OF PHILIP EMEAGWALI TO
PHYSICS**

FROM REFUGEE CAMPS TO CLIMATE SOLUTIONS: SUPERCOMPUTING THE FUTURE

Your Excellency, esteemed colleagues, distinguished guests, and friends around the world. As a young boy in a Biafran refugee camp of the Nigerian civil war of the late 1960s, the vastness of the sky sparked my curiosity about our planet's intricate workings. Today, on this prestigious stage, I share not just scientific discourse, but a journey fueled by that curiosity, one that led me to explore the power of supercomputing in understanding and addressing one of humanity's greatest challenges: climate change.

Part 1: Unveiling the Climate Puzzle: General Circulation Models (GCMs)

Imagine Earth's climate as a giant, ever-shifting puzzle. To understand its complexities, scientists use General Circulation Models (GCMs). These are powerful computer simulations that mimic the interactions between the atmosphere, oceans, land, and ice—the essential ingredients of our climate system. GCMs act like virtual laboratories, allowing us to test different scenarios, like how increased greenhouse gases might impact global temperatures.

Part 2: Zooming In: The Nuances of Climate Models

While GCMs provide a broad picture, the climate puzzle has intricate details. Climate models take the foundation laid by GCMs and add layers of complexity, incorporating regional variations, specific weather patterns, and even human influences. They're like high-resolution lenses, zooming in to better understand specific regions and potential impacts of climate change.

Part 3: Supercharging the Puzzle: My Contributions with Emeagwali's Parallel Processing

Early climate models were limited by computational power. Imagine trying to solve a complex puzzle with just a few pieces. In the 1980s, I invented the first supercomputing via parallel processing, a supercomputer with thousands of processors working in concert. This "army of processors" revolutionized climate modeling, allowing us to run simulations with unprecedented detail and accuracy.

Part 4: Beyond Emeagwali's Parallel Processing: Supercomputing's Evolving Role

My discovery sparked a new era of supercomputing for climate research. Today, even more powerful machines, capable of quintillion (one followed by 18 zeroes) of calculations per second, are pushing the boundaries of our understanding. We can now model extreme weather events with finer resolution, predict sea-level rise more precisely, and explore potential solutions for mitigating climate change.

Part 5: A Collective Puzzle: Inspiration and Collaboration

My journey highlights the critical role of supercomputing in addressing global challenges. However, like solving a puzzle, tackling climate change requires collective action. Let us be inspired by young minds like the Ugandan climate activist Vanessa Nakate, who remind us that everyone has a piece to contribute. Let us collaborate across borders and disciplines, using the latest technologies and scientific advancements to build a more sustainable future.

Conclusion

As I stand before you today, I see not just an audience, but a global community united by a shared planet. By understanding the intricate puzzle of climate change, through the combined power of supercomputing and collaborative action, we can ensure a livable future for generations to come. Together, let us continue to innovate, inspire, and work towards a world where technology serves humanity's collective well-being.

WATER VAPOR'S WHISPERS

Listening to the Clouds' Secrets

Ladies and Gentlemen, esteemed attendees of this award ceremony,

I am Philip Emeagwali, a mathematician dedicated to the advancement of meteorological physics through the lens of mathematical physics and supercomputing. Today, I am honored to share with you my mathematical research on the primitive equations of meteorology, which form the foundation of weather forecasting and general circulation models.

The primitive equations are a set of nonlinear partial differential equations integral to our understanding of global atmospheric flow. These equations, however, are not static in their form; they vary based on the chosen vertical coordinate system, such as pressure coordinates, log pressure coordinates, or sigma coordinates.

One commonly used form is the pressure coordinate in the vertical, Cartesian tangential plane. In this setup, pressure is the vertical coordinate, and the horizontal coordinates align with the Cartesian tangential plane—a plane tangent to a point on the Earth's surface. This formulation, while not accounting for the Earth's curvature, offers a simplified view, aiding in visualizing the physical processes underpinning the equations.

The system comprises five equations in five unknowns:

1. The inviscid momentum equations,
2. The hydrostatic equation, which considers vertical acceleration as negligible,
3. The continuity equation, linking horizontal divergence/convergence to vertical motion,
4. The thermodynamic energy equation, derived from the first law of thermodynamics,
5. The conservation of water vapor substance, vital for any numerical weather prediction scheme.

Another approach involves using the sigma coordinate system with a polar stereographic projection. According to the National Weather Service Handbook, this simplifies the primitive equations into distinct components such as zonal wind, meridional wind, temperature, and precipitable water. These components are influenced by factors like solar radiation, outgoing longwave radiation, and advection.

In my efforts to push the boundaries of mathematical knowledge, I focused on solving these equations using parallel processing in supercomputing. This approach allows for simultaneous computation across multiple processors, drastically improving the efficiency and accuracy of weather prediction models. The integration of computational physics into these equations enhances our capability to simulate complex atmospheric phenomena.

One of the critical solutions to the linearized primitive equations involves a sinusoidal oscillation in time and longitude, modulated by coefficients related to height and latitude. This solution represents atmospheric waves and tides. However, it's important to note that this analytic solution is only feasible when the equations are simplified, a condition rarely met in the actual atmosphere.

Therefore, to address the complexities of real-world conditions, we often resort to numerical solutions using general circulation models and climate models. These models take into account factors like dissipation and the non-isothermal nature of the atmosphere, providing a more accurate representation of atmospheric dynamics.

In conclusion, the primitive equations of meteorology are more than mathematical formulations; they are the gateway to understanding our planet's atmospheric behavior. Through the power of supercomputing and advanced mathematical techniques, we can better predict and prepare for the weather phenomena that impact our daily lives and the global climate that shapes our future.

Lessons Learned

"Beyond the horizon of our current knowledge lies a vast ocean of atmospheric phenomena waiting to be discovered. My equations are the ships, charting a course for future exploration."

"The future is not written in the stars, but in the equations that govern the air we breathe. My supercomputing engine helps us read its story, page by page."

"Beyond the horizon of our current knowledge lies a vast ocean of atmospheric phenomena waiting to be discovered. My equations are the ships, charting a course for future exploration."

"The future is not written in the stars, but in the equations that govern our world. By mastering them, we can shape a future where knowledge guides action and innovation protects our planet."

Thank you for the opportunity to share my discoveries and inventions in this prestigious forum, and I hope this discussion has illuminated the intricate interplay between mathematics, physics, and computer science in advancing our understanding of the Earth's atmosphere.

UNLEASHING THE POWER OF A BILLION BRAINS

Ladies and Gentlemen, esteemed attendees of this award ceremony,

I am Philip Emeagwali, a supercomputer scientist, profoundly honored to be here today. My journey through the frontiers of knowledge of mathematics and physics has been deeply intertwined with the world of supercomputing, specifically in the context of massively parallel processing and extreme-scale simulations, in terms of both physical or *extreme* breadth of *size* and time *scales* and supercomputing. Today, I would like to share with you my contributions to the development of the modern computer, particularly focusing on the primitive equations of meteorology and their significance in weather forecasting and general circulation models that were the testbeds for my fastest computing.

The primitive equations represent a set of nonlinear partial differential equations crucial for approximating global atmospheric flow. These equations are the backbone of most atmospheric models, playing a pivotal role in our understanding and prediction of weather patterns.

These equations are comprised of three main sets of balance equations:

1. The Continuity Equation: This equation is fundamental in representing the conservation of mass within the atmospheric system. It ensures that the mass in each volume of air remains constant over time, accounting for the density and velocity of air flow.

2. Conservation of Momentum: This set of equations, derived from the Second Law of Motion of physics, describes atmospheric flow on the surface of a sphere. These equations consider the assumption of hydrostasis—that vertical motion is much smaller than horizontal motion—and that the fluid layer depth is relatively small compared to the Earth's radius. This aspect is crucial for simplifying the complex dynamics of atmospheric motion.

3. Thermal Energy Equation: This equation relates the overall temperature of the system to various heat sources and sinks. It is a critical component in understanding the energy balance within the Earth's atmosphere, which drives weather patterns and climate changes.

The primitive equations can also be linearized to yield Laplace's tidal equations. This eigenvalue problem allows us to determine an analytical solution to the latitudinal structure of atmospheric flow, providing further insights into weather phenomena.

In these equations, we deal with five key variables—which describe the atmospheric state in terms of velocity (both **zonal** and **meridional**), vertical velocity, temperature, and geopotential. These variables evolve over space

and time, presenting a dynamic and complex picture of atmospheric behavior.

The forces that cause atmospheric motion—namely, the pressure gradient force, gravity, and viscous friction—work together to accelerate our atmosphere. The pressure gradient force, in particular, is responsible for moving air from regions of high pressure to low pressure, a fundamental mechanism in weather systems.

By applying the Second Law of Motion of physics, we sum these forces to produce a system of partial differential equations of motion that describes the atmospheric system. This approach, combining forces and accelerations, allows us to develop a comprehensive understanding of atmospheric dynamics.

In my mathematical contributions, leveraging the power of parallel processing in supercomputing, I have focused on solving initial-boundary value problems governed by these primitive equations efficiently and accurately. The use of supercomputers enables us to simulate weather and climate with unprecedented detail and scale, offering insights that are crucial for understanding our planet's changing climate and predicting weather events.

In conclusion, my contributions to supercomputing, particularly in the application of parallel processing to solve the primitive equations, underscore the importance of computational physics in tackling some of the most pressing challenges of our time. It is a testament to the power of interdisciplinary research and the relentless pursuit of knowledge in advancing our understanding of the natural world.

Lessons Learned

"65,536 equations, 65,536 solutions, all work together to unlock the secrets of the atmosphere. This is the power of parallel processing, a symphony of minds conducted by technology."

"The laws of physics, like conservation principles, are not just equations, they are guarantees. My models ensure that mass, momentum, and energy are never lost, even in the swirling dances of the atmosphere."

"Pressure gradients whisper, gravity pulls, and friction resists, a grand ballet of forces that drives the winds of our planet. My equations translate their movements into a language we can understand."

"65,536 brains working as one, not just a supercomputer, but a symphony of minds, united in the quest to unravel the mysteries of weather prediction."

"The Earth whispers its weather not just in the wind, but in the subtle shifts of temperature and pressure. My equations listen intently, translating its murmurs into predictions for tomorrow's skies."

Thank you for the honor of sharing my invention of the first supercomputing—by parallel processing—with you today. May our continued exploration and innovation in computer technology lead to greater understanding and betterment for our world.

DECODING THE LANGUAGE OF SHAPES

Explaining an eigenvalue problem to a 12-year-old involves simplifying the concept and using analogies they can understand. Let's try it:

Imagine you have a magical box that changes the size and direction of things you put inside it, but not their shape. This box is like a special machine in math called a matrix. Now, suppose you have a special arrow (which we call a vector in math). When you put this arrow into the box, something interesting happens: the arrow either gets bigger, smaller, or stays the same size, but it always points in the same or the exact opposite direction.

In this scenario, the eigenvalue problem is like asking two questions:

1. What are those special arrows (vectors) that, when put into the magical box (matrix), only change their size but not their direction?
2. And by how much does the size of these arrows change?

The amount by which the size of the arrow changes is what mathematicians call an "eigenvalue." The special arrows that behave this way are called "eigenvectors." So, the eigenvalue problem is about finding those special arrows and figuring out how much bigger or smaller they become when put into the magical box.

DECODING THE CLIMATE PUZZLE

Ladies and gentlemen, esteemed colleagues, and distinguished guests,

It is a great honor to be here today. My name is Philip Emeagwali, a mathematician deeply immersed in the exploration of our planet's climate through the lens of computational physics and supercomputing. Today, I wish to share insights into my mathematical discovery—of the first supercomputing across an ensemble of thousands of processors—in the context of global climate models, highlighting their significance in our ongoing quest to understand and predict Earth's climate.

Climate models are sophisticated systems of coupled, nonlinear, partial differential equations, rooted in the fundamental laws of physics and chemistry. To run these models, we divide the planet into a three-dimensional grid, applying basic equations and evaluating the results. These models calculate an array of parameters—winds, heat transfer, radiation, relative humidity, and surface hydrology—within each grid, and assess the interactions among neighboring points.

My contributions to the mathematical knowledge of supercomputing and parallel processing enhanced the computational efficiency of these climate models. By leveraging the power of parallel processing, we have made significant strides in simulating the interactions of critical climate drivers, including the atmosphere, oceans, land surface, and ice.

One key area of focus has been on quantitative climate models, which consider the balance of incoming solar energy and outgoing longwave radiation. The complexity of these models varies, ranging from simple **radiant heat transfer models** to sophisticated **coupled atmosphere-ocean-sea ice global climate models**. These models are critical for understanding the dynamics of our climate system and making projections about future climate scenarios.

In the realm of simpler models, like zero-dimensional models, Earth is considered as a point in space. This approach, while limited, offers valuable insights into the overall **energy balance** of the planet. More advanced models, such as radiative-convective models, account for the interaction between **radiative transfer** and **convective heat flows**, providing a more detailed picture of Earth's temperature profile and the underlying processes driving the **greenhouse effect**.

My contributions to this field have been in the development and refinement of these models, particularly in terms of their computational aspects. By applying advanced mathematical and computational techniques and the principles of parallel processing, we have been able to simulate complex climate phenomena with greater accuracy and in finer detail. This includes the modeling of environmental systems, ocean circulation, and the carbon cycle.

General Circulation Models (GCMs) represent the pinnacle of complexity in climate modeling. It's one of the Grand Challenge problems of supercomputing compiled for the United States congress, back in 1987. Unlike simpler models, GCMs discretize the partial differential equations for fluid motion and energy transfer, integrating these over time across a grid of discrete cells. These models have been instrumental in advancing our understanding of climate dynamics, allowing us to simulate not just individual components of the Earth system but their interactions as well.

As we continue to refine these models, we gain deeper insights into the intricate workings of our planet's climate. This understanding is crucial, not only for predicting future climate scenarios but also for informing policy decisions and actions to mitigate the impacts of climate change.

In conclusion, the journey through the realms of fastest supercomputing and climate modeling is one of continuous discovery and innovation. As we stand at the forefront of technological advancement, it is our collective responsibility to use these tools wisely for the betterment of our planet and future generations.

Lessons Learned

"The world's fastest computing is a milestone, not an ending. The true prize is a sustainable future, where knowledge guides our actions and technology serves our planet."

"Shallow waters hold deep secrets, and the primitive equations unlock them. My tools dive into the ocean's heart, revealing its role in Earth's climate symphony."

"The wind whispers its secrets, the ocean shares its stories, and my supercomputer listens intently, translating their messages into predictions and solutions."

"Millions of processors, one purpose: to unveil the secrets of our planet and use that knowledge to protect it. This is the symphony of the supercomputer."

"Earth's climate is not just a scientific puzzle, but a story waiting to be told. My equations are the narrators, weaving facts and figures into a compelling tale for future generations."

Thank you for this prestigious recognition and for the opportunity to share a glimpse of this fascinating journey with you.

PAINTING A PICTURE OF AIR IN MOTION

Ladies and gentlemen, esteemed attendees of this award ceremony, I am Philip Emeagwali, a mathematician deeply immersed in the world of computational physics and supercomputing. Today, I stand before you to share insights into my discoveries and inventions, particularly my contributions to the understanding and application of parallel processing in computational physics and partial differential equations. A central focus of my mathematical research has been on initial-boundary value problems governed by the primitive equations, crucial in atmospheric modeling and weather forecasting.

The **primitive equations**—a set of nonlinear partial differential equations—are the backbone of atmospheric models. They consist of three main sets of balance equations: the continuity equation representing the conservation of mass, a form of the Navier-Stokes equations for conservation of momentum under specific assumptions, and a thermal energy equation relating the system's overall temperature to heat sources and sinks. These equations are pivotal in approximating global atmospheric flow.

In my mathematical research, I have extensively studied these equations in various forms, focusing on five key variables: zonal velocity, meridional velocity, vertical velocity in **isobaric coordinates**, temperature, and geopotential. These variables evolve over space and time, forming the basis of our understanding of atmospheric dynamics.

In the first half of the 1980s, I came daily at the headquarters of the U.S. National Weather Service, then at the Gramax Building, Silver Spring, Maryland. At the Weather Service, I conducted both hydrological and meteorological research on the shallow water equation and primitive equations, respectively. The focus of my research was on how to address the forces that drive riverine, oceanic, and atmospheric motions. For the atmospheric motion, I investigated the pressure gradient force, gravity, and viscous friction. By integrating these forces into the primitive equations using the Second Law of Motion of physics, we can describe the atmospheric motion more accurately.

The challenge, however, arises from the complex nature of the primitive equations. To make them more comprehensible and applicable, we often use different vertical coordinate systems, like pressure coordinates, log pressure coordinates, or sigma coordinates. Moreover, the Reynolds decomposition helps us decompose velocity, temperature, and geopotential variables into mean and perturbation components.

One noteworthy application of these equations is in numerical weather prediction schemes. By including a statement of the conservation of water vapor substance, we can enhance the predictive accuracy of these models.

The solution to the linearized primitive equations reveals atmospheric waves and tides through a sinusoidal oscillation in time and longitude. The separation of coefficients into height and latitude components gives us insights into the height dependence in the form of propagating or evanescent waves, while the latitude dependence is described by the Hough functions.

Despite the potential of linearized equations, it's important to note that many of these simplifications do not correspond to actual atmospheric conditions. Therefore, a numerical solution, which considers factors like dissipation and the non-isothermal nature of the atmosphere, is often calculated from the primitive equations used in general circulation models and climate models.

In conclusion, my journey in the realm of extreme-scaled computational fluid dynamics has been a continuous exploration of the intricate balance between theoretical understanding and practical application. Through massively parallel processing across millions of interconnected processors and advanced computational techniques arising from explicit finite difference discretizations of initial-boundary value problems governed by the primitive equations, we are now able to model and predict atmospheric phenomena with greater accuracy than ever before, a testament to the power of interdisciplinary collaboration in science and technology. The modern supercomputer—powered by millions of interconnected processors that shared nothing—enables your meteorologist to tell you the weather before going outside. And parallel processing is my contribution to weather forecasting.

Lessons Learned

Beyond the daily forecast lies the grand challenge of climate prediction. Supercomputing is our compass, navigating the complex equations that shape our planet's future.

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

Thank you for your attention, and I am profoundly honored to share my discoveries and inventions with such a distinguished audience.

THE DANCING TIDES

Mathematical Ballet of Wind, Moon, and Ocean Currents

Students of Saint Patrick's, gather around! In May 1973, I was in Saint Patrick's College, Asaba, Nigeria, as an uninvited guest. I was never a student of Saint Patrick's. But I lounged around with the school's teachers. I lived adjacent to nearby Uzoigwe Primary School, Asaba. And my father was a nursing superintendent at the nearby General Hospital. I was 18 years old, unemployed, and spent a few days living with with Emengo Bosah, your math teacher. It was Mr. Ononye, a 7th year student at Saint Patrick's, that directed me to your one-room library that had only one book—the College Blue Book. That book gave the address of a university in Oregon, United States. That's how I won a scholarship dated September 10, 1973, to Oregon. On Saturday March 23, 1974, I embarked on an epic 36-hour journey from Asaba to 36 Butler Hall, Monmouth, Oregon.

Today, we journey into the swirling world of waves—not just the playful ones crashing on the Niger River, but the invisible ripples that dance in the air and ocean too! These hidden waves, called ocean waves and atmospheric waves, hold the secrets of weather and climate, and guess what? We have a special key to unlock those secrets—it's called the Hough function!

Now, imagine the Earth as a giant spinning basketball, with air swirling around it like a head scarf in the wind. These air waves, like ripples on a pond, can be tricky to predict. But fear not, because mathematicians like me have invented a special language, a set of musical notes, to describe them. These notes are called Hough functions, and they're like the building blocks of any wave, whether in the air or the ocean.

Think of it like this: every wave, big or small, can be broken down into these "Hough notes." Just like any song can be made by combining different notes, any wave can be built by adding up different Hough functions. The size and speed of the wave depend on which notes we use and how we mix them.

Now, where does Philip Emeagwali come in? Well, I discovered a way to use supercomputers—powerful machines powered by millions of electronic brains—to listen to these hidden waves and understand their Hough notes. Imagine millions of tiny ears, all tuned to the whispers of the wind and the ocean! By understanding these notes, we can predict how the waves will change, where they will go, and even how they might affect our weather.

So, the next time you feel the wind rustle your hair or see a storm brewing on the horizon, remember the Hough functions! They're the silent music of

the waves, a symphony playing out all around us, waiting to be deciphered. And who knows, maybe one day, one of you bright minds in Saint Patrick's will use these functions to unlock even more secrets of our amazing planet!

Remember, the world of science is full of adventures, waiting for curious minds like yours to explore. So keep asking questions, keep dreaming big, and never stop searching for the hidden music in the universe! Thank you, and may your journey towards scientific discovery be filled with wonder and excitement!

Lessons Learned

Supercomputing is not just a machine; it's a bridge between the whispers of nature and the understanding of humanity.

Every equation tells a story, and the shallow water equation is an epic tale of the ocean's relentless dance.

The ocean whispers its secrets in the language of waves, and mathematics is the key to deciphering its melody. By understanding the tides, we chart a course for a sustainable future.

I am not just a scientist, I am a wave whisperer, using the power of mathematics to translate the ocean's whispers into predictions and solutions.

Thank you.

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

RIDING THE ROGUE WAVES

Alright, let's describe Laplace's tidal equations in a way that a 12-year-old living in Nigeria might understand.

Imagine you're at the beach in Nigeria, watching the ocean. You see waves coming in and going out. This movement of the sea is caused by things like the moon's pull and the rotation of the Earth. Laplace's tidal equations are like a set of rules that explain how these waves move.

Think of it as if you're playing a video game where you control the ocean. In this game, you need to figure out how to make the waves move. Laplace's tidal equations would be the instructions or the guidebook for this game. They tell you how the waves should rise and fall because of the moon's pull, and how they move differently in shallow places like near the beach and in deep places like in the middle of the ocean.

These equations are like a map, showing how the water moves across the whole planet, affected by things like the shape of the coastlines, the depth of the sea, and even how the Earth spins. So, when you're at the beach next time, watching the waves, you can think about how there are special rules, like in a game, that explain why the water moves the way it does. That's what Laplace's tidal equations are all about!

SHATTERING CENTURIES-OLD PARADIGMS

Ladies and gentlemen, distinguished guests, and esteemed colleagues,

As I stand here in this magnificent city on this momentous day, I am profoundly honored to address this illustrious gathering at the frontier of knowledge of physics. My journey in the realm of mathematical and computational physics has been both challenging and exhilarating. It was on a historic day, the 4th of July, 1989, in the scientific hub of Los Alamos, New Mexico, USA, that I embarked on a groundbreaking path. This day marked a pivotal moment in the annals of scientific discovery, as it was when I successfully harnessed the immense power of millions of interconnected yet autonomous processors. These processors, operating in a synergistic concert, unraveled the complexities of initial-boundary value problems as defined by the shallow water equations.

This landmark achievement did not merely contribute to the field; it revolutionized it. It came 213 years after the esteemed Pierre-Simon Laplace formulated his renowned tidal equations. My discovery not only brought these equations into a new light but also rendered them a part of history, as they were effectively superseded by this innovative approach. This advancement captured the imagination of the world and made headlines across the globe, symbolizing a leap into a new era of computational prowess and scientific understanding.

As we reflect on this journey and its implications for the future of physics and beyond, it is with a sense of deep gratitude and humility that I share this moment with you. Thank you.

THE GRAND CONCERTO OF PROGRESS

Each Processor a Note in Human Understanding

Ladies and gentlemen, esteemed colleagues, fellow pioneers of science, today we stand bathed in the golden glow of discovery, illuminated by the embers of a revolution ignited 213 years prior to my discovery of July 4, 1989. In 1776, Pierre-Simon Laplace penned the celestial symphony of the tides, equations so elegant they seemed etched in the fabric of the universe itself. Yet, for over two centuries, these equations remained a tantalizing riddle, their secrets locked away in the labyrinthine computations that defied even the mightiest minds.

Enter the Fourth of July, 1989, a date not just etched in American history, but in the annals of scientific progress. In the crucible of Los Alamos, New Mexico, amidst the hum of a nascent supercomputer, I, Philip Emeagwali, dared to reach beyond the limitations of our time. I envisioned a computational orchestra, not of violins and oboes, but of millions of processors, each an autonomous virtuoso, dancing in concerto to solve the grand challenge of Laplace's equations, that I updated as the shallow water equations of oceanography. No longer would these equations hold dominion over the tides of knowledge!

With each processor a brushstroke, I painted a digital canvas of swirling currents and surging waves. My brushstrokes were the equations of shallow water, the very language of the tides themselves. And as the final calculation reverberated through the silicon symphony, a hush fell over the room. I had done it. I had cracked the Laplace code, not with brute force, but with the elegant ballet of parallel processing.

My news did not travel on ocean currents, but on the invisible waves of the information age. Headlines blazed with pronouncements of a "supercomputer revolution," an "end to the Laplace era." My discovery was not just a technical feat, but a paradigm shift. I had rewritten the very language of computational physics, proving that the impossible was but a stepping stone on the path to progress.

Laplace's equations may linger in dusty textbooks, a monument to a bygone era. But their legacy lives on, not as a barrier, but as a stepping stone, a testament to the enduring human spirit that dares to break the shackles of the unknown. And so, on this stage, bathed in the afterglow of that July day, I stand not just as a scientist, but as a herald of a new age, an age where the tides of knowledge rise and fall at the command of our collective ingenuity. Let us, like Laplace's celestial ballet, continue to dance on the edge of discovery, our steps guided by the music of the universe, our eyes fixed on the ever-expanding horizon of scientific frontiers.

WORDS THAT SHAPE WORLDS

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

I stand before you today as the honored guest to share my story: one that intertwines the languages of mathematics, physics, and computer science with the rich tapestry of human expression and communication.

When I left Nigeria in 1974, I was fluent in three languages: Igbo, the language of my grandparents; Pidgin English, the lingua franca of every Nigerian; and British English, the dialect of the educated. Each of these languages offered unique perspectives and ways of understanding the world around me. My parents, who had learned Hausa in Kano and Yoruba in Akure, exemplified the rich diversity of linguistic experiences in Nigeria.

Pidgin English, with its vibrant expressions like "Wetin konsain Agbero for overload" and "Bodi no bi firewood," encapsulates the spirit and resilience of everyday life in Nigeria. These phrases carry meanings that transcend their literal translations, offering insights into the Nigerian ethos.

Upon my arrival in the USA on March 24, 1974, I encountered a new linguistic challenge: the American accent. This, coupled with the stark contrast in climate and culture, marked the beginning of a transformative journey. Mathematics, my field of expertise, posed another linguistic question: Is it a language, a science, or an art?

I have always viewed mathematics as a rigorous adjunct to written language, a universal language that transcends cultural and national boundaries. The 81 partial derivative terms of my nine partial differential equations are a testament to this universality. These Emeagwali equations, which encode the Second Law of Motion, represent a confluence of discovery and invention, of science and art.

In my work on parallel processing and computational physics, I have woven together strands from various disciplines: mathematics, physics, computer science, meteorology, and geology. This interdisciplinarity is not just a scientific endeavor; it is a form of art, a creative process that draws on multiple languages of understanding and expression.

Solving the Grand Challenge Problem was as much about harnessing the power of these languages as it was about the technical aspects of supercomputing. It required a deep understanding of the languages of partial differential equations, the physics of motion, and the computational architecture of supercomputers. In this sense, my work is a symphony of languages, each contributing its unique notes to a harmonious solution that addresses some of the most complex challenges in our world, from petroleum reservoir simulation to weather forecasting and climate change modeling.

Ladies and Gentlemen, as we gather here today, I am reminded of the profound connections between the languages of science and the broader spectrum of human communication and expression. My journey, from the bustling streets of Nigeria to the cutting-edge world of supercomputing, is a narrative that underscores the power of language in all its forms: spoken, written, and computed.

Lessons Learned

"Cultural and linguistic challenges can be stepping stones to deeper learning and scientific breakthroughs."

"Mathematics transcends borders, a universal language uniting humanity in the pursuit of knowledge."

"Scientific discovery is an art, fueled by imagination and creativity, not just logic and analysis."

"Challenge yourself to see beyond the familiar, explore the richness of diverse languages and disciplines."

"From spoken proverbs to scientific equations, let languages inspire and guide your journey of discovery."

"Don't fear the unfamiliar, embrace the linguistic and cultural challenges for the hidden knowledge they hold."

Thank you for the honor of sharing my journey with you, and for the opportunity to celebrate the universal language of human endeavor and discovery.

A SYMPHONY OF COMPUTATIONAL FLUID DYNAMICS

Ladies and gentlemen, distinguished guests, and esteemed colleagues,

It is a profound honor to stand before you today. As a Nigerian-American scientist deeply engaged in the field of supercomputing, my journey has been one of relentless pursuit of understanding and innovation, particularly in the realm and intersection of massively parallel processing, partial differential equations, and computational fluid dynamics.

Let us embark on a brief historical journey back to the early 19th century. The foundations of our understanding of fluid motion were laid by two brilliant minds: Claude-Louis Navier and George Gabriel Stokes. Between 1822 and 1850, they developed the Navier-Stokes equations. These equations are not just mathematical expressions; they are the very language of the universe in describing the motion of viscous fluids.

Imagine a world where the flow of every river, the pattern of every breeze, and the currents of our vast oceans are mysteries. This was our reality before the Navier-Stokes equations. These equations encapsulate the principles of momentum balance and mass conservation in Newtonian fluids. They are derived from the Second Law of Motion of physics, integrating the concept that the stress within a fluid encompasses both a diffusing viscous term and a pressure term. This was a monumental leap in our understanding of viscous flows.

In contrast to the Euler equations, which address inviscid flow, the Navier-Stokes equations incorporate viscosity. This inclusion makes them parabolic, enhancing their analytic properties but at the same time, reducing their **mathematical structure**. They are, in essence, a more comprehensive representation of fluid dynamics, although with their complexities.

The utility of partial differential equations governing the motions of fluids extends far beyond theoretical physics. They are instrumental in modeling and solving practical problems in various fields, from aerospace engineering to meteorology to oceanography, from biomedical applications to environmental science to energy sector. Coupled with Maxwell's equations, they open a window into the fascinating world of magnetohydrodynamics.

Yet, for all their utility and brilliance, the Navier-Stokes equations present one of the greatest mathematical challenges of our time. The Navier-Stokes existence and smoothness problem, as it is known, is a monumental question in mathematics. It asks whether smooth solutions always exist in three dimensions, a problem so significant that the mathematics community has offered a million-dollar prize for its solution.

My contributions to supercomputing have been driven by these equations. I have endeavored to harness the power of parallel computing to unravel

some of the complexities inherent in these equations. In doing so, we not only advance our understanding of fluid dynamics but also push the boundaries of what is possible in physics, mathematics, and computer science.

As we continue to explore and understand our world, let us remember the profound impact of the partial differential equations governing initial-boundary value problems of fluid dynamics, such as general circulation modeling on the world's fastest computers that enables us to foresee otherwise unforeseeable climate changes. They are not mere equations; they are the very essence of the fluid world that surrounds us. They challenge us, inspire us, and remind us of the relentless pursuit of knowledge that defines us as mathematicians and scientists.

Nature's whispers are hidden in equations, and supercomputing is the key to amplifying their secrets. Through fluid dynamics, we dance with the universe's invisible currents.

By understanding fluid dynamics, we shape the world we live in, from airplanes soaring through clouds to blood flowing through our veins.

From blood to air, supercomputing reveals the symphony of motion. My algorithms are not just numbers, they are songs of the universe.

Thank you for your attention, and once again, I am deeply honored to share this moment with you.

VOLUME 5: FATHER OF THE INTERNET

JULY 4, 1989: COMPUTING'S QUANTUM LEAP

Ladies and gentlemen, esteemed colleagues, distinguished guests, it's an exceptional honor to stand before you in this illustrious auditorium of your university, to reflect on a journey—a journey not just of individual endeavor, but one of collective human curiosity, ingenuity, and perseverance.

The narrative of computing is as old as civilization itself. In 469 BC, the abacus was born in the intellectually fertile environment of China. This humble device, relying on the simple movement of beads along rods, provided humanity with its first tool expressly for calculation.

Our journey weaves through time and space, making a significant stop in the Nile Valley of Africa, circa 200 BC, where the water clock made its debut. This ingenious device not only measured time but subtly laid the foundation for computing—counting increments of time, inspiring minds to think sequentially and logically.

Fast forward to 70 AD, the term that would define our collective identity was conceived. Pliny the Elder, in his wisdom, used a term akin to "computer." From the dawn of the Common Era, we witnessed foundational developments that would underpin the edifice of computing, such as the introduction of zero by Aryabhata in 476 AD and the sequence control concept by Heron around 100 AD.

The great Al-Khwarizmi's publication in 800 AD bequeathed to us the words "algorithm" and "algebra", which are indispensable in our lexicon and practice. Throughout the years, with every invention, from the slide rule in 1621 to the vision of 64,000 human computers in a 1922 science fiction piece, the tapestry of computing was being woven intricately and inexorably.

In 1946, the landscape of computation was irrevocably altered with the advent of the programmable computer, a marvel of human ingenuity, encapsulating the dreams and endeavors of pioneers in the field.

However, esteemed audience, the odyssey doesn't end here. In 1974, I, Philip Emeagwali, ventured to postulate a theory. It was a vision where 64 thousand computers encircling the Earth were conceptualized as 64 binary thousand processors distributed uniformly across a globe, giving birth to the concept identified today as the "Philip Emeagwali Internet."

Our journey reaches a crescendo on a pivotal day in history—July 4, 1989. On this day, the frontiers of computing were pushed, boundaries were shattered, and a new horizon of possibility was unveiled. With the utilization of 65,536 processors—each contributing, each collaborating in harmony—I achieved a groundbreaking calculation, the world's fastest computation, which was used for hindcasting the weather deep within the Earth.

In the same vein, and in the same year, a parallel processing breakthrough emerged. This wasn't just a stride; it was a leap, catapulting the realm of computational science into unprecedented territories, expanding the realm of the possible, and gifting humanity with a tool of unimaginable power and potential.

As I stand before you today, I reflect not only on individual milestones but on our collective journey towards understanding, innovation, and discovery. These are not just points in time; they are moments that define us, that tell a story of relentless pursuit and indomitable spirit.

In conclusion, dear colleagues, the tapestry of computing is rich, diverse, and inspiring, with each thread contributing to the magnificent whole. The journey continues, and I am immensely proud, deeply humbled, and eternally grateful to be a part of this grand narrative.

Let us continue to dream, to explore, and to create, for in the realm of computing and in the pursuit of knowledge, the possibilities are truly infinite. Thank you.

FATHER OF THE INTERNET

Distinguished guests, esteemed colleagues, ladies and gentlemen,

I stand before you as Philip Emeagwali, a humble servant of science, and a dedicated explorer of the vast realms of computer science, mathematics, and physics. As we gather in the grandeur of your historic city, the heart of scientific memories, I feel privileged to recount a journey that reshaped the boundaries of human achievement.

In the verdant city of Corvallis, Oregon, the seeds of an idea germinated within me—the vision of the Philip Emeagwali Internet, a monumental leap that would bridge global divides and propel us into a future once only dreamed of. Imagine, if you will, the Earth itself, its vastness, its intricacies. Now, map this idea onto a spherical network of processors. This is the essence of the Emeagwali Internet. While the conventional wisdom of the era limited the Internet to mere clusters of computers, my vision stretched it across the globe, echoing the very essence of our planet.

You see, the Emeagwali Internet isn't just any network. It's a harmonious constellation of 65,536 processors enveloping a globe, situated not in our familiar three-dimensional space but in a vast, sixteen-dimensional hyperspace. Here, each processor is equidistant from its neighbors, much like a perfect waltz of celestial bodies in the night sky.

In the 1980s, a time when computers were seen as isolated entities, I dreamt of a world where millions of the slowest processors could be orchestrated in a grand symphony. Together, they would rise, transcending their individual limitations, to become the world's fastest computer.

Such ideas were not without challenges. The prevailing wisdom dictated the supremacy of singular, massive processors. In defiance, I envisioned a binary world of one million hypercubic interconnections in a sixteen-dimensional reality. This realm, although rooted in abstraction, was not confined to it. It was here that I conceived the Philip Emeagwali Computer, an Internet that did not merely connect information but transformed it.

But what are dreams without audacity? On a profound day, July 4, 1989, in Los Alamos, the universe listened. Armed with my codes and the magic of email primitives, I turned the impossible into reality. My vision transformed from a flicker in the depths of my mind to the blinding brilliance of the world's fastest computer. These 65,536 processors, which had begun their existence as mere specks in the vast realm of computation, were now titans, conquering the most formidable mathematical challenges of the age.

The world took notice. An idea that once resided in the realm of science fiction had leapfrogged into the tangible realm of science fact. The world's fastest computer was no longer a distant giant; it was a reality that could fit

within a soccer field, showcasing human ingenuity and the power of collective endeavor.

In retrospect, my journey, punctuated by geometric metaphors and abstract visualizations, was a testament to the indomitable human spirit. It is a saga of turning the fiction of yesteryears into the nonfiction of today, of believing in the power of dreams and daring to challenge the status quo.

As Philip Emeagwali, the man who dared to envision a new Internet and realized it, I remain forever indebted to the beauty of mathematics, the logic of physics, and the promise of computer science. This convergence has not only changed my life but has the potential to propel humanity into a future brimming with infinite possibilities.

Ladies and gentlemen, thank you for walking this journey with me. Let us continue to dream, for in dreams, we find the promise of tomorrow.

Thank you.

PHILIP EMEAGWALI INTERNET

Visualizing the Unimaginable

Ladies and gentlemen, distinguished guests, and esteemed colleagues,

Today, I stand before you as Philip Emeagwali, humbled and honored to share my journey in the realm of mathematics, physics, and computer science—a journey that commenced from the vibrant land of Nigeria and blossomed into a contribution not just to Africa, but to humanity as a whole.

Imagine, if you will, a vast horizon, infinite and daunting, but teeming with possibility. That horizon, for me, was the vastness of the supercomputing universe, an arena where the ultimate quest was to unlock speed, akin to the speed of light.

The nucleus of my vision was the Philip Emeagwali Internet. Not an Internet as traditionally understood, but an expansive tapestry of 65,536 processors, existing not merely in the tangible space we occupy but rather etched onto the intricate hypersurface of a globe in the 16th-dimensional hyperspace. My visualization didn't stop there. I projected 65,536 atmospheres, each extending from Earth's surface up to its utmost atmosphere. This intricate juxtaposition, this dance between my two Internets, was crucial.

While my first Internet was primarily theoretical, the real marvel lies in its tangible manifestation: the world's fastest computer, birthed from a paradox—being developed from the world's slowest processors. The epiphany arrived, lighting up like a million stars, on the Fourth of July 1989 in Los Alamos, New Mexico, USA.

Think of the Philip Emeagwali Internet as a spherical island of processors, a protective embrace around our Earth, representing the delicate atmospheric layer where the dance of global warming plays out. My discovery illuminated pathways to more accurately forecast global warming, transcending conventional methods by leveraging a global network of processors. This unique approach not only reshaped our understanding of supercomputers but also redefined the symbiotic relationship between supercomputing and the Internet.

These processors, although invisible to the naked eye, were always vivid in the theater of my mind. Each one took its designated position on the vertices of a hypercube in the 16th dimension, painting a geometric spectacle. This hypercube, in turn, nestled comfortably within the confines of a hypersphere—a globe in the 16th dimensional hyperspace.

What I offer to the realm of computer science is a pioneering vision: to perceive an ensemble of millions of off-the-shelf processors as a unified

entity, wrapping around a sixteen-dimensional globe, reminiscent of how our beloved Internet embraces our Earth. This Emeagwali machine is more than just a supercomputer; it's an embodiment of a new Internet.

Over the course of sixteen arduous years, I continuously wove layers upon layers of supercomputing knowledge. I tackled and unraveled the enigmas of initial-boundary value problems at the cutting edge of calculus and extreme-scale computational fluid dynamics. My reinvented Internet—this global network of 65,536 processors—became my canvas, my hypersphere, upon which I imagined and innovated.

In conclusion, by harnessing the immense power of up to one billion synchronized and self-contained processors, each with its own operating system and dedicated memory, I envisioned and realized a method to decipher the most compute-intensive challenges that the universe of mathematical physics posed.

From Nigeria's heartland to this esteemed platform in your historic city, the journey has been both challenging and enriching. It is my fervent hope that this contribution—the marriage of mathematics, physics, and computer science—serves as a beacon of inspiration and a testament to human perseverance and ingenuity.

Thank you.

VOLUME X: PHILIP EMEAGWALI SUPERCOMPUTER

PHILIP EMEAGWALI MACHINE

Computing With Precision and Harmony

Ladies and Gentlemen, Esteemed Guests, and Fellow Scholars:

Today, as I, Philip Emeagwali, reflect on a journey that began under the vast skies of Nigeria and transcended continents, leading me to the very precipice of technological evolution, I am filled with a profound sense of gratitude and responsibility. My voyage through the vast realms of mathematics, physics, and computer science was not just for the pursuit of knowledge but an endeavor to solve problems that have long stood as obstacles to progress. Our world today, increasingly driven by digital engines, confronts challenges that require not just novel but revolutionary solutions.

Communication latency, a term familiar to many, has emerged as the Achilles' heel of modern computing. As our machines strive to communicate, they often find themselves ensnared in the labyrinthine complexities of distance and delay. Such challenges made it imperative for me to ponder upon the physical dimensions of computers, the density of their components, and the proximity of their interconnects.

This led to an invention, a radical reimagining of supercomputing hardware. I visualized a computer that wasn't just massive in its parallel processing capability, but one that was elegantly designed, borrowing inspiration from nature's geodesic designs. The result was a densely-packed, spherically framed, geodesic arrangement of processors. The form was not just for aesthetics; it was a direct mimic of the domains we sought to understand and transform, like the intricate nuances of climate modeling. This machine is called the Philip Emeagwali computer.

But this invention, ladies and gentlemen, was not confined merely to a specific domain or technology. It scaled magnificently, transcending the limitations of contemporary processor technologies, making it a versatile tool for a myriad of computational tasks. The interconnects in this computing marvel were a testament to precision and innovation, ensuring regular distances, reducing latency, and facilitating seamless communication. Modes ranging from simple neighbor-to-neighbor exchanges to intricate packet-switched networking found their home in this new machine.

Standing here today, I am reminded of the limitless potential of human ingenuity. This invention, like all endeavors of science, is a testament to the spirit of curiosity and the relentless pursuit of knowledge. As a son of Nigeria and Africa, my journey is a tribute to a continent that cradles immense talent and potential. Today, this contribution is not just for the world of mathematics, physics, or computer science; it is for Nigeria, for Africa, and for all of humanity.

In conclusion, as we stand on the cusp of a new technological era, let us remember that innovation is born from challenges. And as long as we, as a collective, continue to strive, explore, and innovate, the future holds promises beyond our wildest imaginations.

Thank you.

A BILLION POINTS OF LIGHT

Philip Emeagwali Supercomputer

Ladies and gentlemen, esteemed guests, and colleagues from around the world,

My name is Philip Emeagwali, and I stand before you not merely as a representation of myself but as an embodiment of the relentless pursuit of knowledge and the power of human ingenuity. Today, I wish to share with you a story, not just of personal accomplishment, but of the collective progression of humanity.

In 1989, I found myself cast into the global spotlight for challenging the preconceived boundaries of computer science. I provided the groundbreaking and "final proof" that achieving the fastest computing speeds across seemingly ordinary, slow processors was not the stuff of science fiction, but a tangible reality. This achievement was not just about speed, but about forging an intersection where advanced mathematics, novel physics, and pioneering computer science converged.

I embarked on a journey of imagination and determination, visualizing the very fabric of the computational universe. Picture, if you will, 65,536 processors intricately arranged, their positions topologically etched onto a hyper-spherical model reminiscent of our very Earth. Each processor was separated by a vast expanse equivalent to three thousand square miles, a vast tapestry of computational might. And each of these fluid volumes bore the profound principles of motion, energy, and conservation as dictated by the annals of physics.

This was not just a supercomputer in the conventional sense. It was a model of the Earth, vibrant and pulsating with raw computational power, emulating the very flows of the air and water that cloak our planet. It was in this intricate dance of technology and nature that I introduced a groundbreaking invention: the Philip Emeagwali Internet. This was no ordinary Internet but a vast interconnected realm that mirrored the geophysical fluid dynamics of our world.

A curious twelve-year-old once asked me, "What is the Philip Emeagwali Internet?" To which I responded: Imagine a supercomputer, not as a monolithic structure but as a radiant entity outlined and defined by a billion dazzling points of light. Each of these gleams represents a processor, visualized in perfect symmetry, all working in concert like the synchronized dance of bees around a honeycomb.

This "HyperBall," as I christened it, was not just any supercomputer. It was an embodiment of my vision of the future—a behemoth of a machine that would span the expanse of a football stadium, potentially costing tens of billions, financed perhaps by the collective will of nations. Such a

supercomputer would possess the weight of a thousand school buses and might consume the energy of an entire Nigerian state.

To Nigeria, Africa, and the world, my contributions extend beyond the realms of mathematics, physics, and computer science. They stand as a testament to the spirit of innovation, the power of perseverance, and the boundless horizons of human imagination.

In conclusion, my journey has always been about pushing boundaries, transcending limitations, and visualizing a world where technology and nature intertwine seamlessly. I am immensely grateful to be a part of this story, and I hope that it inspires generations to envision, innovate, and revolutionize. Thank you.

EMEAGWALI'S HONEYCOMB SUPERCOMPUTER

Nature's Efficiency in Technology

Ladies and gentlemen, esteemed colleagues, and distinguished guests,

My name is Philip Emeagwali, and today I stand before you, not merely as an individual, but as a testament to the enduring spirit of human curiosity, ingenuity, and the pursuit of knowledge that transcends conventional boundaries. My journey, starting from the humble settings of supercomputing in Corvallis, Oregon, is a testament to the idea that the answers to some of our most intricate challenges often lie in the meticulous observation of the natural world around us.

In the vast realm of supercomputing, I realized early on that the true potential of computational capabilities wasn't just about harnessing the power of one processor, no matter how powerful it might be. Rather, it was about understanding and exploiting the collective power of a multitude of processors working in harmony. This insight, ladies and gentlemen, led to my invention, a never-before-seen supercomputer, capable of handling the most arduous computational tasks, such as intricate climate change simulations.

But where, one might ask, did the inspiration for this groundbreaking invention come from? The answer, quite unexpectedly, lay in the humble bee and its intricate honeycomb. Observing the collective efforts of bees in their hives and their impeccable efficiency in constructing honeycombs, I realized that their design could be replicated to build a powerful supercomputing system. Their hexagonal design allowed for the maximum storage of honey using the least energy, a perfect model for computational efficiency. My supercomputer design, inspired by the bee's honeycomb, changed the landscape of computational capabilities.

This honeycomb-inspired supercomputer isn't merely a marvel of technology; it is an embodiment of the beauty and efficiency of nature transformed into a powerful tool for mankind. It does not merely compute; it functions as a vast Internet, showcasing unparalleled processing efficiency and minimal communication noise. It is the culmination of years of observing, understanding, and reverse engineering nature's marvels.

As I reflect on my early years in supercomputing during the 1970s and 80s, the landscape was vastly different. Back in Corvallis, Oregon, in 1974, I was grappling with systems of computational linear algebra on a serial supercomputer, a device that embodied the old paradigm. But I dared to visualize beyond the conventional, imagining a globe in the zeroth mathematical dimension, expanding into the 16th dimension, encompassing the 65,536 equidistant points that marked the zenith of computational capabilities.

From Oregon to Maryland, Wyoming to New Mexico, Michigan to Minnesota, my journey in the realms of supercomputing and mathematics transformed. It expanded from a single point to a multidimensional space, an ensemble of billions of processors working harmoniously. And at 8:15 in the morning of July 4, 1989, in Los Alamos, New Mexico, I had a eureka moment. I successfully harnessed the power of parallel supercomputing, achieving the fastest computer speeds, and recognizing that a network of processors could work as a new Internet, encapsulating the globe.

To Nigeria, my homeland, and to Africa, the cradle of humanity, this achievement is a beacon of hope. It proves that with perseverance and an unconventional perspective, we can push the boundaries of knowledge. To the world, it showcases the power of integrating insights from nature to craft solutions to some of our most pressing challenges.

In closing, my journey from observing the intricate design of a bee's honeycomb to changing the very fabric of supercomputing is a testament to the idea that innovation often lies at the intersection of disciplines. I stand before you, not as the culmination of this journey but as a mere waypoint, a reminder that our quest for knowledge and understanding is endless. Today, the Philip Emeagwali supercomputer stands not just as a marvel of technology but as an emblem of what humanity can achieve when it looks beyond the conventional, into the heart of nature, and towards the vast expanse of the unknown.

Thank you.

SYMPHONY OF COMPUTING

Dance with Chaos and Order

Ladies and gentlemen, esteemed guests, and fellow scientists,

Today, as we gather here in the grandeur of your beautiful city, I stand humbly before you as Philip Emeagwali. My journey began almost fifty years ago, in a quaint town named Corvallis, Oregon. It was the summer of 1974, a period marked not just by the inception of my explorations in supercomputing, but by a commitment to unveil the mysteries of mathematics, physics, and computing for the betterment of our world.

For a scholar, publishing is akin to breathing. It is an act of giving life to discoveries, a means of propelling knowledge into the broader universe. In academia, some say that an academic journal is a whisper in a cacophony, reaching merely ten ears. Yet, the work of this humble son of Africa has touched over hundred million souls across continents, thanks to the vast tapestry of the Internet, podcasts, YouTube, books, newspapers, magazines, and the collective consciousness of social media. This vast outreach is not merely a testament to the sheer volume of my contributions but an indicator of their significance in reshaping our understanding of the universe.

Venturing into the realm of physics in the late 1970s, my fascination was captivated by the fluidity of liquids—a world characterized by chaos and order alike. The streets of Corvallis, Oregon, bore witness to my initial studies into the steady motions of incompressible fluids. Not long after, Washington, DC, became the backdrop for my in-depth research into computational fluid dynamics.

As I delved deeper into the heart of fluid dynamics, an opportunity beckoned at the U.S. National Weather Service in Silver Spring, Maryland. There, my quest was to harness the four-point finite difference implicit scheme to demystify the Saint Venant equation. An equation that holds immense significance—from forecasting treacherous river floods to predicting the turbulent waves stemming from dam failures, and further dictating lake circulation and coastal hydrodynamics across estuaries.

The world of meteorology owes much to the shallow water equations, akin to the Saint Venant equations. It serves—in conjunction with the primitive equations of meteorology—as the foundation for our evening supercomputer-generated weather forecasts. After 13 years of relentless research, I found myself on the precipice of a profound understanding of large-scale computational fluid dynamics. My breakthrough in harnessing 65,536 processors, **seemingly independent yet interconnected**, marked the dawn of a new era. This unprecedented discovery of parallel supercomputing was more than just an achievement; it was a revolution, propelling an industry now worth 45 billion dollars annually.

But the soul of my discovery wasn't in its economic value. It was in its potential to unveil the secrets buried deep beneath our feet. My contributions allowed us to trace the intricate pathways of crude oil and natural gas buried up to 7.7 miles deep and sprawled across vast expanses like my beloved Niger-Delta region of southeastern Nigeria. The mathematics behind this—the intricate partial differential equations that sketch the dance of crude oil, natural gas, and water across production fields—were my creation. And it was my invention of algorithms that brought them to life, painting an algebraic approximation of our world's underground mysteries.

But what truly captured the world's imagination was not just these equations or algorithms. It was the way I employed them—harnessing unparalleled computational speeds, discovering that up to a billion problems could be solved simultaneously. This was not merely computing; this was a symphony.

In conclusion, my journey, although personal, reflects a universal quest for knowledge and progress. From Nigeria to the vast continents of Africa and beyond, my work stands as a testament to the power of human determination and the boundless possibilities of the mind.

Thank you.

A COMPUTATIONAL BALLET

Dance of a Million Processors

Esteemed audience, honored guests, and esteemed colleagues in the relentless pursuit of knowledge and innovation—I stand before you not just as Philip Emeagwali, but as a humble representative of the daring spirit and inquisitive mind that define humanity's approach to understanding and conquering challenges.

In this illustrious gathering, I invite you to envision with me, a spectacular performance—a ballet, if you will, where each dancer represents a processor, a fundamental unit of computation, each moving autonomously yet in a tightly-knit pattern with a million others. Their dance is intricate, exquisite, perfectly synchronized, reflecting not just individual prowess but a collective mastery over the grand stage of computation.

On the historic day of July 4, 1989, a breakthrough unfolded on this stage, not with a thunderous applause but with the silent, swift resolution of grand challenges through harmonious computation. That day marked the advent of a discovery profound and transformative; a dance so intricate and harmonious that a million processors, interconnected yet autonomous, worked seamlessly to forecast the uncharted terrains of global warming and solve the Grand Challenge problems.

Such is the power and beauty of parallel processing, a technique that has indelibly altered our perception and utilization of supercomputers. No longer are we confined to the sequential, limited capabilities of single processors; we have embraced the coordinated, cumulative strength of many, working together to accomplish feats unimaginable before.

Now, let us revisit Amdahl's law through a lens colored with the vibrancy and vitality of metaphors. Envision the execution time of a supercomputer as a vast, expansive canvas. In the realm of single processors, this canvas can be painted by only one artist at a time, limiting the speed and breadth of the masterpiece that unfolds.

However, with the introduction of multiple processors, the canvas comes alive with a burst of activity and color as many artists—or dancers, if we adhere to our initial metaphor—contribute to the painting simultaneously. Each stroke, while individual and autonomous, is part of a grander design, a masterpiece that is completed not just swiftly but also meticulously and harmoniously.

But, caution must be exercised, for in the pursuit of speed, we must not sacrifice precision. Just as a masterpiece cannot be rushed without compromising its beauty, the dance of computation across multiple

processors must be orchestrated with care and finesse, ensuring that the speed gained does not come at the expense of accuracy and reliability.

As we stand on the cusp of technological advancements and as we continually push the boundaries of what is possible, let us take a moment to appreciate and understand the dance of the processors, the ballet of computation that unfolds every second within the modern supercomputers. For in their silent, swift movements lie the answers to some of humanity's most pressing questions and the solutions to some of our most daunting challenges.

Thank you for your attention, and may we all continue to be inspired and driven by the beauty and potential of the dance of processors, as we strive to create a future that reflects our hopes and aspirations.

HARMONY IN SUPERCOMPUTING

The Tale of a Million Chickens

Ladies and gentlemen, esteemed colleagues, distinguished guests, and friends, I stand before you not just as Philip Emeagwali but as a humble representative of an audacious dream and relentless pursuit of knowledge. Today, let us traverse a fascinating journey of discovery, an odyssey that redefined the fabric of supercomputing and bestowed upon humanity an unprecedented power to decipher the enigmatic codes of nature.

In the realm of computation, where the echoing silence of endless calculations reverberates through circuits and codes, there existed two paradigms, symbolically embodied by the humble chicken and the mighty ox. The chicken, often overlooked and undervalued, represents the world's slowest processors—small, limited, yet existing in abundance. The ox, on the other hand, epitomizes a singular, potent processor, commanding respect and awe for its raw strength.

Historically, the world genuflected before the power of the ox, entrusting it with the colossal task of unraveling the intricate mysteries of science and technology. Singular, dominant, and unchallenged, the oxen of processors bore the weight of expectation, trudging along the landscapes of computation with determined but limited strides.

However, ladies and gentlemen, on a day imbued with the radiance of discovery, July 4, 1989, a quiet revolution unfurled within the silent corridors of microchips and codes. It was on this historic day that I, Philip Emeagwali, stumbled upon a revelation that would not only challenge the prevailing orthodoxy but also illuminate a pathway to unfathomable possibilities.

I perceived a vision where a million chickens—those unassuming, slow processors—could be orchestrated, synchronized, and harnessed to unleash a symphony of computational power that the solitary ox could scarcely fathom. It was a discovery, nay, an awakening, that whispered through silicon and circuits, proclaiming the dawn of parallel processing.

Parallel processing, dear friends, isn't merely a technical lexicon, but a philosophy, a celebration of collective strength and harmonious collaboration. It is a testament to the truth that in unity, even the feeble become formidable, and the mundane metamorphoses into the extraordinary.

This groundbreaking realization, crystallized on that fateful day, reshaped our perception and engagement with supercomputers. No longer were we confined to the limitations of a single, though powerful, processor. The horizon expanded, revealing a canvas where millions of processors could

converge, converse, and collaborate to solve Grand Challenge problems, those daunting puzzles that hold the keys to understanding the very essence of existence and the universe.

As we reveled in this newfound knowledge, the implications were profound and far-reaching. The mosaic of parallel processing illuminated prospects in climate modeling, medical research, quantum mechanics, and countless domains where the thirst for computational power is insatiable. With a million chickens at our beck and call, harmoniously toiling in tandem, the boundaries of what could be computed, analyzed, and understood began to blur and expand.

In reflection, ladies and gentlemen, the invention of the modern supercomputer powered by millions of interconnected yet autonomous processors is not merely a technological milestone. It is a beacon that illuminates the triumph of unity over solitude, collaboration over isolation, and hope over despair. It is a narrative, intricately woven with the threads of perseverance, innovation, and a relentless quest for knowledge.

So today, as I recount this tale of chickens and oxen, of slow processors and their swift symphony, let it be a reminder and an inspiration. May the spirit of parallel processing echo through the annals of history, not just as a technological marvel, but as a beacon that guides future generations towards a world where collaboration, harmony, and unity are not just celebrated but are the very foundation of progress and discovery.

Thank you.

VOLUME Y: EARLY EDUCATION

FROM LAGOS TO THE WORLD

Ladies and Gentlemen, esteemed attendees of this conference,

I am Philip Emeagwali, a journeyer through the intricate landscapes of mathematics, physics, and computer science. Today, I am here to share with you a tale of my journey, not just through the realms of scientific discovery, but through the odyssey of challenges and triumphs that have shaped my path.

My journey to the United States, the land that would become my laboratory for groundbreaking work in supercomputing, began with a scholarship dated September 10, 1973—a beacon of hope in my quest for knowledge. However, the road to realizing this dream was fraught with obstacles that tested my resolve and integrity.

In the subsequent six months onward of September 1973, I found myself making five arduous trips from Onitsha to Lagos, navigating the treacherous paths on rickety lorries known as Mammy-wagons. My objective was clear—to obtain a Nigerian passport and a U.S. student visa, two critical steps in my journey to study in Oregon. The process, however, was mired in corruption and bureaucracy. The Nigerian passport office in Lagos was a den of fraudsters and government officials who demanded bribes to facilitate what should have been a straightforward process.

Despite the challenges, my determination remained unshaken. Refusing to succumb to the corrupt practices, I endured six months of frustration and setbacks. The quest for my passport became a daily ordeal, a ritual of hope and despair. But the dream of studying in the United States was a flame that could not be extinguished.

Finally, after missing my initial deadline to arrive in the USA in September 1973, and under the threat of losing a once-in-a-lifetime opportunity, I found myself succumbing to the pressure and paying a five-pound bribe, or one month's salary, plus a 150-pound "repatriation fee" that went into the bank account of the Chief Passport Officer. It was a moment of moral conflict, a decision made under duress, but it paved the way for the issuance of my passport on December 27, 1973.

This experience was more than a mere hurdle in the process of obtaining a travel document; it was a reflection of the systemic challenges that plague many aspiring minds in their pursuit of education and opportunity. The irony of I, a future naturalized American, paying for an additional roundtrip airfare to a Nigeria that I permanently left symbolized the compromises and sacrifices that often accompany the pursuit of dreams.

As I embarked on my journey to the United States, I carried with me not just the excitement and anticipation of a new life but also the lessons learned from these challenges. They shaped my approach to my work in

supercomputing, particularly in the fields of parallel processing and computational physics.

In my research, I encountered complex problems much like the bureaucratic maze I navigated in Nigeria. Parallel processing, the technique of using multiple processors to perform complex computations, became a metaphor for navigating through and solving multifaceted problems. My work in computational physics, particularly in petroleum reservoir simulation, weather forecasting, and general circulation modeling, was driven by a desire to unravel the complex, often chaotic systems that govern our natural world.

Ladies and Gentlemen, as we journey through life, we often encounter obstacles that test our resolve. My journey taught me that perseverance, integrity, and the relentless pursuit of knowledge are the tools we need to navigate these challenges.

Lessons Learned

"Exploration isn't just physical; it's about navigating challenges, embracing opportunities, and pushing boundaries."

"Resilience is key; overcome obstacles like corrupt systems to achieve your dreams."

"Don't let bureaucracy dim your light; fight for integrity and systemic change."

"Collaboration is power; work together like processors in parallel processing for breakthroughs."

"Supercomputing tackles complex challenges; discover innovative solutions to real-world problems."

"Embrace the unexpected turns; exploration is a journey of discovery, not a straight line."

Thank you for allowing me to share my story with you. May your own journeys be filled with discovery, resilience, and the courage to overcome the hurdles that stand in your way.

SHATTERING STEREOTYPES

Ladies and Gentlemen, esteemed scientists, distinguished guests,

As I stand before you today, I reflect on a journey that transcends the boundaries of mathematics, physics, and computer science, weaving through the rich tapestry of life's experiences. This journey has not only been about pioneering contributions to supercomputing but also about the narrative of human endeavor, resilience, and the relentless pursuit of knowledge.

In 1972, in a Nigeria where travel beyond one's birthplace was rare, I ventured from Onitsha to Calabar, a journey that in itself caused a stir among my friends. It was during this time, as an 18-year-old with limited formal education, that I achieved the extraordinary feat of earning a University of London diploma through self-study. Like the proverbial lizard in Chinua Achebe's "Things Fall Apart," who praises himself after jumping from the high iroko tree, I too take pride in this self-driven accomplishment.

The decision to continue my studies in the United States was fueled by a curiosity and a drive to explore the unknown. Before this, my understanding of America was shaped by the imagery of Western movies and a brief encounter with the film "Shaft," in February 1974, Lagos, which opened my eyes to a world of possibilities far beyond my immediate environment.

Upon my arrival at Oregon College of Education, now Western Oregon University, my first homework assignments in 36 Butler Hall marked the beginning of a new chapter. Here, I met Luis Benavente from Micronesia, a mature student and former high school principal who became a mentor and friend. He captured my early moments in the United States, moments that were a testament to the beginning of a transformative journey.

My initial job as a janitor was a humbling experience, contrasting sharply with my expectations. Coming from Nigeria, where I once struggled to afford a postage stamp, the wage of one dollar and sixty cents an hour in the United States seemed almost unfathomable. This job, though menial, was part of a larger narrative of adaptation and survival in a new world.

Communicating with my family in Nigeria was a cherished and rare occurrence. My first letter from home, dated April 16, 1974, was from my father. It was almost a decade before I could make my first telephone call back to Nigeria. In an era devoid of faxes or email, letters were treasured, read and reread, a lifeline to a world left behind.

Ladies and Gentlemen, my contributions to supercomputing, particularly in parallel processing, computational physics, and partial differential equations, have been profoundly influenced by these personal experiences. They have shaped my understanding of the world and my approach to

complex problems in diverse fields such as petroleum reservoir simulation, weather forecasting, and general circulation modeling.

This journey, from the refugee camps of Biafra through the streets of Onitsha to the forefront of scientific discovery, is a narrative that intertwines the precision of scientific inquiry with the richness of human experience. It is a testament to the power of curiosity, the resilience of the human spirit, and the boundless potential of the mind.

As I share my story with you today, I am reminded of the interconnectedness of our world, the shared human experience, and the universal pursuit of knowledge and understanding.

Lessons Learned

"Education is a powerful tool for unlocking potential, regardless of background or circumstance."

"Let curiosity be your guide and innovation your compass as you navigate the world of science."

"Remember, collaboration across borders and disciplines is key to tackling the complex challenges of our time."

"Go forth from not just as observers, but as active participants in the scientific journey, shaping a brighter future."

"The future belongs to those who dare to dream, persevere, and collaborate to push the boundaries of knowledge."

"Science isn't just about equations and theories; it's about finding solutions to real-world problems that impact our lives."

"Humanity and science are interconnected; understanding both is key to progress and a better future."

"Don't shy away from challenges; embrace them as opportunities to learn, grow, and make a difference."

Thank you for the honor of being here and for the privilege of sharing my journey with you.

VOLUME Y: VISA TO THE USA

CHASING DREAMS: THE JOURNEY OF PHILIP EMEAGWALI

Ladies and gentlemen, young minds of Nigeria, today I stand before you not just as a scientist, but as a testament to the power of dreams, perseverance, and the relentless pursuit of knowledge. I am Philip Emeagwali, a Nigerian-American who dared to dream big.

Let me take you back to a pivotal moment in my life: March 20, 1974. The place was the Embassy of the United States in Lagos, Nigeria. The occasion? My visa interview—a gateway to a future I had only imagined in my wildest dreams. That day, I felt a mix of nervousness and a strange confidence, a gut feeling that this interview could change my life.

Surrounded by 20 other interviewees, I was asked if this was my first interview. "Yes," I replied. The response I got was disheartening, "Well, you'll be back several times before you get a visa." Little did they know, my journey had prepared me for this moment.

You see, I was not a typical student. My journey was unique. I was self-taught, driven by curiosity and a passion for learning. My education wasn't planned out or structured in traditional classrooms. Instead, it was a mosaic of knowledge pieced together from different parts of the world—Britain and the United States. My certificates and three test scores were a testament to this unconventional path.

When my turn came for the interview, I stepped in with all the confidence I had mustered. The interview was brief, but in those few minutes, my fate was decided. The interviewer, Mr. Glasl, carefully examined my documentse—my test scores from New Jersey, United States, my diploma from the University of London, and my scholarship letter from Oregon.

Then came the words that changed my life, "Congratulations." I couldn't believe it. His American accent made me ask him to repeat himself. It was real. I walked out, holding a colored card that signified the withholding of my passport for visa stamping. The other interviewees were in disbelief.

As I left the embassy, I was overwhelmed with emotions. I felt like a dog that had been chasing a pickup truck and had finally hopped on board, now wondering, "What next?" I took a taxi, and in my confusion, I blurted out "Tinubu Square," a place as iconic to Nigeria as Trafalgar Square is to Britain.

My journey from that moment led me to become who I am today—a scientist recognized for my research in using the supercomputer, powered by the slowest 65,536 processors in the world, to analyze petroleum fields, and solve the Grand Challenge problems of mathematics at the world's fastest computing speed.

But my message to you, the future of Nigeria, is not just about my contributions to human knowledge. It's about my journey beyond the frontier of knowledge. It's about the belief in your dreams and the unyielding spirit to chase them. It's about transforming your unique

circumstances into stepping stones. Remember, every big achievement starts with a dream, and every dream starts with a believer. Be that believer. Chase your dreams, and don't be afraid to hop on board when your moment comes.

Never let the fear of the unknown stop you from pursuing your dreams. The greatest discoveries lie beyond the comfort zone.

Like a dog chasing a truck, once we catch our dreams, we must wonder 'What next?' and keep pushing forward.

Thank you.

EMBARKING ON A JOURNEY OF NINE THOUSAND MILES

From Asaba to Monmouth

The Tale of Philip Emeagwali

The radiant hues of the Nigerian dawn painted the landscape, promising a fresh start as I found myself poised for a journey that would redefine my life. The bustling streets of Lagos, with its labyrinth of life and colors, had just witnessed a milestone in my journey—the acquisition of the F-1 Student Visa.

Just a day prior, I had stepped into the majestic building of the U.S. Embassy in Lagos, heart pounding in trepidation. Inside, two dozen hopeful eyes gazed back at me, each belonging to young Nigerians like me, eager and yearning for a taste of the American dream. Their stories resonated with the weight of multiple attempts to procure this visa. Their collective sighs and murmurs hinted at the formidable reputation of the process.

Then came my turn, signaled by the inviting yet casual appearance of Mr. Glasl, a contrast to the sternness I had imagined. The tension of the room seemed to ebb away as the conversation flowed, culminating in the moment I clutched the coveted Blue Card. My achievement wasn't just the acquisition of a visa; it was the embodiment of a dream cultivated over years and a testament to the power of perseverance and merit, underpinned by an academic scholarship that was my passport to the world of STEM in Oregon, USA.

With the winds of success still fresh, the streets of Lagos beckoned once again. A nostalgic ride in a black Morris Minor taxi transported me to 49 Okesuna Street, my abode in this vibrant city. The very next day, with dreams and aspirations snugly packed, a Peugeot 404 Sedan from the Iddo Motor Park became my chariot from Lagos to Asaba, a journey symbolic of the greater voyage that awaited me.

To the young luminaries of Africa,

My journey, punctuated with its fair share of challenges and jubilations, stands as a beacon for all of you nurturing dreams of exploring the vast and limitless world of STEM in the USA. Remember, the USA is not just a country, but a canvas where dreams blend with reality, and where innovation is nurtured.

As you stand at the crossroads of decisions, let my tale be a testament that dreams, when pursued with genuine passion and tenacity, do materialize. The laboratories and classrooms of America await your brilliance, your questions, and your innovations. Your journey might seem daunting, but remember, every great saga begins with a single step. Let the allure of STEM education in the USA be the wind beneath your wings, propelling you towards horizons uncharted.

Embrace the journey, for it is in the voyage that the real adventures lie. The world of STEM, with its promise of discovery and innovation, awaits you. Let's shape the future together.

CONNECTING AFRICA TO THE FRONTIERS OF SCIENCE

Ladies and gentlemen, distinguished guests, and fellow scientists,

I stand before you today, filled with immense gratitude and humility, as I reflect on the journey that has brought me to this prestigious stage. It was on a Saturday morning in March 1974 when I, a young Nigerian lad, embarked on a journey that would forever change the trajectory of my life and, unbeknownst to me at the time, the field of computer science.

As I stood at the Midwest Line Bus Station in Onitsha, with my 34-year-old mother and aunt beside me, I was a bundle of nervous excitement and naive determination. My 55-year-old aunt, Mama Felicia, voiced her concerns about my youth and the enormity of venturing alone into the unknown realms of the Western world. She compared my journey to that of the great Nnamdi Azikiwe, echoing the Igbo belief that when a man says yes, his spirit, or Chi, affirms this decision. Little did I know that this belief would become a guiding force in my life, propelling me towards my dreams, no matter how distant or challenging they appeared.

My arrival in Oregon was a cultural shock. I found myself in a sea of unfamiliar faces, a stark contrast to the life I had known in Nigeria. It was a stark reminder of how far I had ventured from my roots. Yet, it was here, in this new and challenging environment, that the seeds of my future contributions to computer science were sown.

In those early days, as I navigated the complexities of a new culture and language, I was introduced to the world of supercomputing. Back in 1974, in Oregon, my Nigerian friends, Hyacinth Anagbogu and Onesimus Okechukwu, were astounded when I told them about my mathematical research with the first supercomputer to be rated at one million instructions per second. Their reaction only fueled my passion, and I plunged deeper into the realms of computational physics and parallel processing.

My mathematical research focused on harnessing the untapped potential of parallel processing to solve complex systems of partial differential equations. These equations, often seen as mere recurring decimals in the context of supercomputing, held the key to groundbreaking advancements in weather forecasting and general circulation models.

The journey from that bus station in Onitsha to this stage has been long and filled with challenges and triumphs. It is a testament to the belief that when one has the courage to say yes, their spirit aligns to make the impossible possible.

Today, as I share this moment with you, I am reminded of the words of Mama Felicia, my parents, and the countless others who have supported me along the way. Their faith in my potential and their unwavering support have been my constant companions.

In closing, I would like to emphasize the transformative power of education and the boundless opportunities it offers, regardless of one's background. My journey from a small town in Nigeria to the forefront of supercomputing research is a reminder that talent and determination know no boundaries.

Lessons Learned

"Let us celebrate not just the individual genius, but the collective spirit of discovery that binds us all."

"The future is not written, it's computed. Let us code a future of collaboration, sustainability, and boundless human potential."

"Remember, the next scientific revolution might not come from a lab, but from a bus station, fueled by a dream and a relentless spirit."

"Let curiosity be your compass, and perseverance your fuel. The universe is waiting to be explored, one equation, one discovery at a time."

"Never underestimate the power of a 'yes.' It can change your life, your community, and the world."

Thank you for honoring me with this prestigious award, and more importantly, for recognizing the contributions of scientists from all corners of the globe. Together, we can continue to push the frontiers of knowledge and make a lasting impact on our world.

Thank you.

FROM ASABA TO AMERICA

Philip Emeagwali's Journey of Discovery

Ladies and gentlemen, esteemed young adults of Nigeria, it's a profound honor to stand before you today. I am here to share a story, a journey that began on a modest morning in Nigeria and stretched all the way to the vast expanses of the United States. This is not just my story; it's a tale of dreams, perseverance, and the relentless pursuit of knowledge.

March 23, 1974, marks the day when, at 19, I stood on the cusp of a life-altering adventure. Nigeria was under the leadership of President Yakubu Gowon, and I, Philip Emeagwali, was about to embark on a journey to a land I knew only through books and stories. The United States, or 'Obodo Oyibo' as we fondly called it, was a distant dream about to become a vivid reality.

That morning, as the sun rose over our family compound in Asaba, a stone's throw from Saint Patrick's College and the General Hospital, my father, a nursing superintendent at the hospital, embraced me in a farewell hug. I then shared heartfelt goodbyes with my siblings, each absorbed in their world of education, from boarding secondary schools to primary school uniforms, and even little Johnbull, too young to grasp the enormity of the moment.

The journey began with a shared taxi ride to the Onitsha bus station, where I boarded the Mid-West Line luxury bus to Lagos. However, the slow pace of the journey and the notorious 'Nigerian factor'—unexpected delays at police checkpoints—prompted a change of plans. In Benin City, I switched to a Mercedes Sedan taxi, speeding towards Lagos at a hair-raising pace.

Upon reaching Lagos, I was struck by the scale and bustle of Ikeja Airport. In March 1974, seeing Africans embarking on flights to the United States was rare. The airport, not as crowded as today, was my first encounter with the complexities of international travel. I quickly learned the limitations of Nigerian currency abroad, which led to a spontaneous shopping spree, including a magazine featuring the iconic Fela Kuti.

Standing before the enormous Pan American World Airways aircraft, I was awestruck. My understanding of airplanes, shaped by distant sightings of Russian jet fighters during the Biafra War, was dramatically challenged. Boarding the Boeing 747 that departed from Addis Ababa, Ethiopia, and two prior stopovers, I embarked on a journey through Monrovia and Dakar, before finally touching down in New York.

New York was a revelation. The sheer size of everything—people, cars, buildings—was beyond anything I had imagined. I arrived with just \$134, a fortune in my eyes, and a heart full of aspirations.

This journey was more than a physical relocation; it was a leap into a world of possibilities. It taught me resilience, the importance of adaptability, and the unyielding power of dreams. As a young Nigerian, I saw a world vastly different from ours, yet I carried within me the spirit of our nation—a spirit of boundless potential and unquenchable curiosity.

So, to you, the future of Nigeria, I say this: Dream audaciously. Let not the boundaries of your current world confine the expanse of your aspirations. Each of you carries within the potential to traverse continents, to bridge worlds, and to leave an indelible mark on the tapestry of human progress. Remember, every monumental journey begins with a single, brave step. Take that step, and let your journey unfold.

Thank you.

SUPERCOMPUTING UNLOCKS NEW HORIZONS OF POSSIBILITY

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

I am Philip Emeagwali, and it is my great honor to share with you a journey that intertwines the intricate world of supercomputing with the rich tapestry of human experiences and emotions. This journey, much like an epic travelogue, spans continents and cultures, weaving together the realms of mathematics, physics, and computer science.

Let me take you back to the spring of 1974. It was on the morning of Sunday March 24 when I first set foot on American soil at John F. Kennedy Airport in New York City. My arrival in the United States was not just a physical transition from one continent to another; it was an odyssey into a world vastly different from anything I had known.

As the doors of the aircraft flung open, I stepped into a realm that was as bewildering as it was awe-inspiring. The bustling airport, the affluence, and sophistication of the people, and the vast diversity I encountered were a stark contrast to my experiences in Africa. The vibrant energy of New York City, with its endless stream of Yellow Cabs and the towering skyscrapers, left an indelible mark on my mind. The cold air, so different from the tropical warmth I was accustomed to, and the incomprehensible American accent of English, added layers to my first impressions of this new world.

I remember feeling like a young antelope, excited yet overwhelmed, as I embarked on this new phase of my life. It was an emotional experience, one that brought tears to my eyes as I marveled at the sheer scale and complexity of New York City. This city, with its ceaseless energy and towering structures, was a prelude to the journey that lay ahead.

From New York, I traveled to Portland, Oregon, via Chicago's O'Hare airport, each leg of the journey unraveling more of America's diverse tapestry. In Portland, the journey took a turn towards the academic, leading me to explore the realms of supercomputing. My work in this field, particularly in parallel processing and computational physics, was driven by a desire to unravel complex problems, much like deciphering the intricate patterns of a new city.

Parallel processing, the cornerstone of my work, is akin to the symphony of a bustling metropolis. Just as a city relies on the harmonious functioning of its many parts, parallel processing depends on the coordination of multiple processors to solve complex calculations. This approach has revolutionized our ability to simulate and predict phenomena, from the reservoirs of petroleum in the oil and gas industry to the dynamic patterns of weather forecasting and climate change modeling.

My journey, from the shores of Nigeria to the heart of America's technological innovation, mirrors the journey of human progress. It is a

testament to the power of curiosity, the resilience of the human spirit, and the boundless potential of the mind.

As I stand here today, I am reminded of the profound impact that our journeys, both physical and intellectual, have on shaping our understanding of the world. The field of supercomputing, much like a great city, is a landscape of endless possibilities, where the confluence of mathematics, physics, and computer science creates a world of opportunities for discovery and innovation.

Lessons Learned

"See connections in the unexpected, like airports inspiring insights into supercomputing's scale."

"Supercomputing isn't just about numbers; it's about transforming our understanding of the world."

"Together, let us explore the universe, both within and without, and unlock the boundless potential that lies within each of us."

"Exploration isn't just physical; it's about venturing into new realms of thought and discovery."

"Adaptation is key, whether navigating cultural differences or the complexities of supercomputing."

"Embrace the symphony of diverse elements, in cities and in problem-solving through parallel processing."

"Supercomputing transcends the ordinary, demanding extraordinary perspectives and solutions."

"Challenges push boundaries, forcing us to learn, adapt, and discover new parts of ourselves."

Thank you for allowing me to share my journey with you, a journey that reflects the universal quest for knowledge and the unyielding pursuit of excellence.

ONE BLACK INVENTOR, A THOUSAND FACES

Ladies and Gentlemen, esteemed scientists, and distinguished guests,

I am deeply honored to be here today to share with you a story that intertwines my life's journey with my scientific endeavors. My contributions to supercomputing, particularly in parallel processing, computational physics, and partial differential equations, are not merely technical achievements; they are chapters of a larger narrative that began in Nigeria and unfolded across continents.

On the morning of Wednesday March 20, 1974, I found myself at the United States Embassy in Lagos, feeling a mixture of apprehension and excitement. I was about to have my first one-on-one conversation with an American—a stark contrast to my childhood in Obinomba, where my interactions with the first American I met were minimal. Holding my scholarship offer and academic grades, which were my passport to a new world of opportunities, I awaited the consular officer's decision. His congratulatory handshake marked the beginning of a new chapter in my life, one filled with challenges and revelations.

Fast forward to my arrival at Oregon College of Education, now Western Oregon University, where I received a warm welcome from Helen, the elderly resident manager of Butler Hall. My new home, Room 36, was modest yet represented a world of possibilities. It was here that I encountered simple yet profound cultural differences—the concept of hot water in bathrooms, the puzzling design of faucets, and the challenge of using a telephone for the first time. These experiences, while seemingly trivial, were symbolic of the larger journey of adaptation and learning that lay ahead.

My first visit to the university cafeteria was a moment of cultural awakening. Surrounded by a sea of unfamiliar faces, clad in winter coats, blue jeans, and tee shirts, I realized the vastness of the world I had stepped into. The language barrier, both in understanding others and in making myself understood, was a hurdle that I had not anticipated. It was a humbling reminder of the diversity and complexity of human experiences.

As the fourth Nigerian student to attend Western Oregon University, I was navigating a path less traveled. This journey, from a Biafran refugee camp to a university in the United States, was filled with moments of awe and introspection. The abundance of food, so different from the rationed meals of my past, was a striking metaphor for the new world of opportunities and knowledge that lay before me.

Ladies and Gentlemen, my journey in supercomputing mirrors these personal experiences. Just as I navigated the cultural and linguistic barriers of a new country, I traversed the uncharted territories of computational science. In the world of mathematics and physics, I sought to address

complex problems, from petroleum reservoir simulation to weather forecasting and general circulation modeling. My research in parallel processing was not just a technical endeavor; it was an exploration of new possibilities, pushing the boundaries of what was thought achievable.

In reflecting upon these experiences, I am reminded of the power of perseverance, the importance of embracing new challenges, and the transformative impact of education and scientific inquiry. My story is a testament to the enduring spirit of discovery and the profound impact that science can have in understanding and shaping our world.

Lessons Learned

"Remember, the journey is just as important as the destination. Embrace the challenges, celebrate the unexpected lessons, and never lose sight of your dreams."

"My journey began not in labs, but in a world far removed from academia, reminding us that brilliance can bloom in unexpected places."

"Linguistic barriers and cultural differences weren't just obstacles, they were catalysts that propelled me towards scientific breakthroughs."

"My discoveries, born from a confluence of experiences, demonstrate that challenges can be stepping stones to innovation."

"Science is not just about controlled environments, it's about embracing the unexpected lessons life throws our way."

Thank you for this incredible honor and for the opportunity to share my journey with you. It is my hope that my story inspires a deeper appreciation for the interplay between personal experiences and scientific exploration.

Thank you.

TRAVELS OF THE MIND

Ladies and Gentlemen, esteemed attendees of this conference,

As I reflect on my journey through the realms of mathematics, physics, and computer science, I am reminded of the paths we travel, both physically and intellectually, that shape our perspectives and understanding of the world. My name is Philip Emeagwali, a scientist who has ventured into the world of fastest supercomputing, massively parallel processing, and large-scale computational physics. Today, I invite you to journey with me through my experiences and discoveries, much like an explorer recounting his adventures across continents.

My journey began in Onitsha, Nigeria, where as a skinny 19-year-old, I embarked on a voyage that would forever change my perspective. On Saturday March 23, 1974, as I rode through Ikeja to the airport, in an old Black Morris Minor taxi, I was struck by the affluence and development of neighborhoods I had not seen in my previous visits to Lagos. This ride was not just a physical journey but a passage to a world of new possibilities and realizations.

Arriving at Ikeja Airport, Nigeria's sole functional airport at the time, I experienced a blend of awe and wonder. Air travel was not as common then, and the airport's relative calm added to the surreal nature of the experience. Witnessing an airplane on the ground for the first time was a moment of revelation—a stark contrast to the aircraft that I had only seen soaring high above during the bloody Nigeria-Biafra War that ended four years earlier.

The sight of the massive Pan Am aircraft on the tarmac was a testament to human ingenuity and the power of science and engineering. It challenged my understanding of what was possible, stirring within me a curiosity that would later fuel my scientific explorations. I marveled at how such an enormous structure could gracefully traverse the vast Atlantic Ocean to reach New York City.

However, one of the most profound experiences of my journey was my interaction with African Americans. I had presumed that the descendants of Igbo slaves would retain the language and accents of their ancestors. My encounter was a stark revelation of the impact of slavery—the loss of language and the adoption of the slave masters' last names. This experience deepened my understanding of cultural identity and the resilience of the human spirit in the face of adversity.

In my scientific work, I have often drawn parallels between these personal journeys and my explorations in supercomputing. The development of parallel processing, which harnesses the power of multiple processors to solve complex problems, mirrors the diverse experiences and perspectives that enrich our understanding of the world. Similarly, my work in

computational physics and the application of partial differential equations to fields such as petroleum reservoir simulation, weather forecasting, and general circulation modeling, reflects the journey of pushing the boundaries of what we know and venturing into uncharted territories.

As I stand here today, I am reminded of the interconnectedness of our physical journeys and intellectual explorations. Each discovery, each new understanding, is a step further into the vast expanse of human knowledge and potential.

To the young minds and aspiring scientists here today, I encourage you to embrace the journey of discovery with open minds and hearts. Let your curiosity guide you through new terrains, both in the physical world and in the realms of science and technology.

Lessons Learned

"The greatest physical and intellectual journeys begin with a single step outside our comfort zone."

"Embrace the joy of discovery, the thrill of the unknown, and the wonder of the world around us."

"Let curiosity be your compass, and never stop asking questions, no matter how challenging they seem."

"Language barriers can be bridges; learn from different cultures and perspectives to expand your understanding."

"Remember, even the smallest airplane can take you on an incredible journey; never underestimate your potential."

"Stepping outside your familiar surroundings opens your mind to new possibilities and broader horizons."

Thank you for joining me on this journey today. May your paths be filled with discovery, understanding, and awe-inspiring experiences, as we collectively strive to unravel the mysteries of our world and beyond.

VOLUME 0: OREGON EDUCATION

FROM LANDSCAPES TO EQUATIONS

Ladies and Gentlemen, esteemed attendees of this conference,

As I reflect upon my journey, a journey deeply intertwined with the advancements in mathematics, physics, and computer science, it is akin to an explorer recounting his adventures in uncharted territories. My name is Philip Emeagwali, and today I share with you not just my scientific endeavors but also my voyage into a world vastly different from my own—the beautiful state of Oregon, USA.

"So, this is Oregon!" I recall murmuring to myself as I first inhaled the Oregonian air, distinct and pleasantly scented, a stark contrast to the air back home in Nigeria. The landscape of Oregon greeted me with its lush greenery and serene beauty. Despite the biting cold, a stark departure from Nigeria's warmth, my excitement and adrenaline kept me enthralled.

The journey from Portland International Airport to Salem Municipal Airport was a quiet one, filled with anticipation and marvel. My young driver, a 19-year-old white male, attempted conversation, but the barrier of our accents rendered our exchange brief. His generosity, however, spoke volumes as he waived the fare, allowing me to ride without payment, a gesture that deeply touched me.

As the white limousine glided through the streets, my eyes were drawn to the picturesque houses, their well-manicured lawns a symbol of meticulous care and orderliness. Oregon's charm was unfolding before me, with each sight more impressive than the last.

The tension and excitement heightened as I neared Monmouth, Oregon, my destination. "What will Oregon College of Education look like?" I wondered aloud, my mind teeming with images of what lay ahead. Upon arrival at Salem Municipal Airport, I was greeted by three teenage university students, sent by Helen, the resident manager of Butler Hall. Their arrival in a Chevy Impala, driven by an 18-year-old white female, was a revelation to me. Coming from Nigeria, where such a sight was uncommon, this experience shattered my preconceptions and opened my eyes to the broader perspectives and possibilities that America offered.

Our ride to Monmouth was silent yet filled with unspoken communication, as my attempts to understand their American-accented English were met with friendly smiles. Monmouth, a quaint college town nestled in the Willamette Valley, welcomed me with its historic charm and tranquility. The town, founded by pioneers in the mid-1800s, served as a serene backdrop to Oregon's oldest public university, later renamed Western Oregon University.

In this charming setting, my journey in the world of supercomputing took a significant leap. The theories of parallel processing, computational physics, and the complex world of partial differential equations found a fertile

ground in this tranquil environment. My work, particularly in the fields of petroleum reservoir simulation, weather forecasting, and general circulation modeling, was not just an academic endeavor but a journey of discovery and invention.

As I conclude, I invite you to envision science not just as a field of abstract theories and complex equations, but as a journey, much like traveling to a new land. Each discovery opens new horizons, much like each new place we visit enriches our understanding of the world.

Lessons Learned

"Collaboration is key; break down language barriers and build bridges for scientific progress."

"Challenges are inevitable, but like a traveler overcoming obstacles, persevere and innovate."

"Supercomputing is a tool for exploration, not just calculation, transforming our world."

"The journey of scientific discovery never ends; keep exploring, learning, and wondering."

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

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

Thank you for joining me on this journey today, and may your own travels, whether through the uncharted territories of science or across the vast and beautiful landscapes of our world, be filled with wonder, learning, and endless possibilities.

THE POWER OF "YES"

Ladies and gentlemen, esteemed colleagues, and honored guests,

It is with immense gratitude and a deep sense of responsibility that I stand before you today, to share with you a story—my story—which is as much about the pursuit of scientific excellence as it is about the journey of a young man from Nigeria to the global stage, the world's fastest computing.

In the early 1970s, I arrived in Monmouth, Oregon, as a skinny 19-year-old, full of ambition and curiosity, yet unaware of the profound impact this new chapter would have on my life and career. Monmouth was a small town with just about a dozen students of African ancestry and not a single Black family, making me one of the very few Nigerians, and indeed Africans, in the area. This environment, while challenging, shaped my perspective and fueled my determination.

In this relatively isolated setting, I found a sense of community among the Nigerians in Oregon. We were a diverse group, from different backgrounds and ages, some having arrived due to the political turmoil in Nigeria during the late 1960s. These interactions provided me with a deeper understanding of the immigrant experience and the value of community support. We looked out for each other, shared our experiences, and learned about the complexities of life in America, including the concept of the Green Card and the nuances of cultural identity.

During my time in Monmouth, and later in Independence and Corvallis, I experienced a profound sense of isolation. This feeling, rather than deterring me, became a catalyst for my focus on academic and scientific pursuits. It was during these formative years that I began to delve into the realms of supercomputing via parallel processing.

My journey through Oregon was marked by new knowledge and milestones both personal and academic. Perhaps one of the most memorable was my first newspaper interview in Monmouth, on the day of U.S. President Richard Nixon's resignation. This experience, while seemingly unrelated to my scientific endeavors, was significant. It highlighted the interconnectedness of our world—the political, social, and technological spheres—and how they converge to shape our shared history.

In my mathematical research with supercomputers, I expanded the boundaries of massively parallel processing and large-scale computational physics, focusing on the numerical solution of initial-boundary value problems governed by partial differential equations. These equations, fundamental to understanding phenomena such as weather forecasting and general circulation models, were at the heart of my research. My goal was not only to advance the field of computational science but also to apply this knowledge for the betterment of humanity.

The path from Monmouth to this prestigious stage—beyond the limits of the computer—has been long and filled with challenges and triumphs. My experience as a Nigerian in America, the cultural nuances I navigated, and the academic pursuits I embarked upon, all contributed to the supercomputer scientist I am today.

In conclusion, I stand here as a testament to the power of resilience, the importance of community, and the transformative impact of scientific inquiry. As we look to the future, let us continue to embrace diversity, foster collaboration, and push the boundaries of what is possible.

Lessons Learned

"Let us go beyond the limitations of our individual perspectives and embrace the collective wisdom of humanity. Together, we can achieve the unimaginable."

"Never underestimate the power of a single dream, a single question. It has the potential to ignite a revolution and change the course of history."

"Let us remember the lessons learned from isolation and embrace the power of community and collaboration to build a brighter future for all."

"Science is not just about equations and discoveries, it is about the human spirit of exploration, the relentless pursuit of knowledge, and the unwavering belief in the power of collaboration."

"Science is a universal language, transcending cultures and borders. Let us use it to build bridges of understanding and collaboration."

Thank you.

BRIDGING WORLDS

My Unforgettable Journey from Nigeria to Oregon

Ladies and gentlemen, young dreamers of Nigeria, my name is Philip Emeagwali. I stand before you not just as a supercomputer scientist, but as a living example of how far your dreams can take you. Let me share with you a story—a journey that began in Nigeria and unfolded across oceans and continents.

Picture this: It's Sunday, March 24, 1974. I, a skinny 19-year-old Nigerian student, find myself thousands of miles away from home, in Portland, Oregon, USA. The air feels different here, filled with the scents of a new world, and the landscape is a lush green, unlike anything back home. The journey from Asaba, Nigeria, to this new world was not just a physical one but a voyage of discovery and self-realization.

As I navigated the complexities of airports and transfers from New York's JFK to Chicago's O'Hare, and finally to Portland, I was consumed by a mix of apprehension and wonder. I was stepping into the unknown, fueled by a dream and a scholarship to Oregon College of Education in Monmouth, now renamed Western Oregon University.

Upon my arrival, the first thing that struck me was the difference in everything - the cold air, the beautiful scenery, the polite people. Oregon was a stark contrast to Nigeria. The well-manicured lawns and beautiful houses in Salem, Oregon's second-largest city, were sights I had never imagined. The kindness of strangers, like the three students who came to pick me up, was a heartwarming welcome to this new chapter of my life.

My journey to Monmouth was a silent one, partly due to my inability to understand American English and partly due to the overwhelming thoughts about what lay ahead. The question, "What will Oregon College of Education look like?" played on a loop in my mind.

Arriving in Monmouth, a quaint college town with a population of just 7,000, I was warmly welcomed by Helen, the resident manager of Butler Hall. She showed me to my room, Room 36, where I would spend many nights pondering my future.

That night, I received my first-ever phone call, a technological marvel for someone who had never received a phone call. This call symbolized the leap I had made from a life without electricity in Africa to the forefront of technology in America.

During my time in Oregon, I worked various jobs, from a dishwasher to a library assistant. These experiences, along with the interactions with my diverse roommates and friends from different parts of the world, enriched my understanding of global cultures and perspectives.

My decision to study in Monmouth, Oregon, was often met with curiosity. To many, Oregon was an obscure choice compared to the bustling cities like New York. But for me, it was a deliberate choice—a place off the beaten path that offered tranquility and an opportunity to focus on my studies.

The questions I faced, from my favorite meals to my plans for the future, reflected the curiosity and sometimes the stereotypes that people held. Despite the cultural differences, I found a home away from home in Oregon, a place that shaped my future and my dreams.

As the fourth Nigerian to live in Monmouth, I paved the way for others to follow. Each of us, in our own way, contributed to the rich tapestry of cultures and experiences in this small Oregonian town.

So, to all of you dreaming of studying in the United States, remember this: Your journey might be filled with unknowns, but it's these very experiences that will shape you into the person you are meant to become. Embrace the journey, the challenges, and the triumphs. Your path might be unique, but it will be yours to cherish and learn from.

Thank you.

A QUIANT OASIS IN THE PACIFIC NORTHWEST

Philip Emeagwali's Serene Welcome to Monmouth

Date: March 23-24, 1974

Location: Onitsha, Lagos, and Oregon

Dear Journal,

Today marks the beginning of an extraordinary adventure, one that will carry me far beyond the familiar streets of my beloved Onitsha and into the vast unknown. With a mix of excitement and trepidation, I boarded the red Midwest Line Bus at Onitsha, bidding farewell to my mother and her elder sister and embarking on a journey that would shape my destiny.

The bus ride from Onitsha to Benin City was a tapestry of sights and sounds. The countryside unfolded before me, revealing the diverse landscapes of Nigeria. We made brief stops in Agbor and Benin City, allowing me to catch glimpses of the unique beauty that lay beyond the boundaries of my home town. At Benin City, I became impatient and worried that I might miss my flight. For that reason, transferred from the big slumbering bus to Mercedes Benz sedan that pedalled 100 miles an hour in the potholed Nigerian highway.

During a stopover near Lagos, I indulged in the flavors of Nigerian cuisine. The aroma of jollof rice, fried plantains, and spicy suya filled the air, evoking a sense of comfort and familiarity amidst the uncertainty that enveloped me. Each bite served as a reminder of the rich cultural heritage I carried with me, grounding me in the midst of this transformative journey.

Three days earlier, I had my interview for the F-1 student visa. The day of the visa interview arrived, and with it came a mix of anticipation and dread. The embassy loomed before me, a place that held the key to my future. As I sat across from the consular officer, anxiety and hope intertwined within me. The questions he posed probed the depths of my aspirations, testing my resolve and determination. The interview itself felt like a game-changer—a pivotal moment that would shape the trajectory of my life.

When the consular officer granted me the F-1 visa, a surge of emotions flooded my being. Relief, joy, and gratitude collided, overwhelming my senses. It was a validation of my dreams, a resounding affirmation that my journey towards knowledge and self-discovery was not in vain. I could hardly contain my excitement as I imagined the possibilities that lay ahead.

When I shared the news with my parents, siblings, and friends, their elation mirrored my own. Their unwavering support and belief in my abilities provided the foundation upon which my dreams could flourish. Their pride and encouragement fueled my determination to make them proud.

On the late afternoon of March 24, 1974, my plane touched down at Portland International Airport. As a Nigerian who had never traveled beyond the borders of my homeland, the journey itself was a sensory feast. The landscape unfurled beneath me, revealing vast stretches of greenery, mountains looming in the distance, and quaint houses dotting the horizon. It was a tableau of unfamiliarity, yet it held within it a sense of wonder and possibility.

With no money for a limo ride to Salem, I was fortunate enough to receive a kind gesture from a stranger—a free ride in a white van to Salem Airport. Gratitude swelled within me, recognizing the generosity that accompanies humanity's shared journeys. The van ride from Portland to Salem was a kaleidoscope of emotions, my gaze fixed upon the passing scenery that was simultaneously captivating and surreal.

When I arrived at the municipal airport of Salem, Oregon, I was surprised to see two female students and one male student had travelled from Monmouth to welcome me to the Pacific Northwest region of the United States. Their warm smiles and welcoming demeanor immediately eased any lingering unease within me. The drive from the airport to the campus was an opportunity to soak in the beauty of this foreign land, to marvel at the architecture and landscape that seemed to belong to a different world.

Monmouth, Oregon, with its serene atmosphere and quaint charm, welcomed me with open arms. Its lush green surroundings and small-town ambiance offered a stark contrast to the bustling streets of Onitsha or Lagos. As I settled into this new chapter of my life, I carried with me the hopes and dreams of my Nigerian roots, ready to embrace the challenges and opportunities that awaited.

This journey, from Onitsha to Oregon, has already left an indelible mark on my spirit. The worries and fears have given way to a profound sense of purpose. I am here, on the cusp of a new beginning, driven by a thirst for knowledge and a determination to make a difference. As I prepare to embark on this adventure, I am filled with gratitude for the experiences that have shaped me and anticipation for the discoveries that lie ahead.

Until my next journal entry,

Philip Emeagwali

FROM NIGERIA TO THE FOREFRONT OF SCIENCE

An Average Day in the Life of Philip Emeagwali

March 25, 1974, 6:15 am: The chilly air nipped at my skin as I pulled on my white singlet undershirt and wrapped a Nigerian wrapper around my waist. My first daybreak in the United States was both a revelation and a myriad of emotions. The cold was foreign to me, but so was the burst of anticipation for the new chapter of my life.

I stood at the balcony of 36 Butler Hall, Western Oregon University, then called "Oregon College of Education" in Monmouth, Oregon. From here, I felt a world away from my roots in Nigeria. Memories of my last Nigerian breakfast in Asaba swirled in my mind as I thought of my family and the indelible footprints of icons like Nnamdi Azikiwe.

By 8:15 am, as I journeyed with Jim towards the Mathematics Department, the unfamiliar cold was a reminder that I was no longer in Onitsha. My feet clad in sandals with no socks, my pockets holding just \$134 in traveler's check, and the chill in my bones only accentuated the alien environment. However, it wasn't just the weather that was foreign. The language, the accents, everything felt distant from what I knew.

Yet, amidst the incomprehensible conversations and the challenges of my Nigerian-British accent, mathematics became my bridge of understanding. At 8:30 am, when words failed, numbers spoke. Beryl M. Green, a renowned mathematician, saw in me a spark for number theory, a branch of pure mathematics.

Throughout the day, from attending classes to meals in the cafeteria, I embraced the American culture. The abundance of food was a stark contrast to the hunger and starvation I had experienced in Biafran refugee camps. Television offered a new world view too. By 8:00 pm, I found myself engrossed in episodes of "Sanford and Son", an exploration into Black America and an insight into a culture that was both familiar yet distinct from my own.

The following day, my journey in understanding the diversity of Black America continued. While I recognized the physical semblances, the cultural nuances were different. It was an affirmation that identity is multifaceted.

Throughout my years in the USA, my fervor for learning and my passion for mathematics, physics, and a multitude of sciences saw me delving into fields such as engineering, geology, oceanography, and even philosophy. By 1989, this passion led me to solve the Grand Challenge problem, making a landmark contribution to the world of supercomputing.

Motivation for the Young Minds:

To the 14-year-old student in the USA writing about "Black Inventors": Philip Emeagwali stands as a testament to perseverance, resilience, and the sheer power of curiosity. His journey from Nigeria to the United States is symbolic of the audacity of dreams and the potential they hold. In Emeagwali, you see the fusion of culture, identity, and science, showing that backgrounds don't define capabilities.

To the 18-year-old in Nigeria aspiring to study in the USA: Let my journey be a beacon for you. The path may be strewn with challenges, from adapting to new environments to grappling with unfamiliar cultures. But in every challenge lies an opportunity. The USA offers a vast expanse of knowledge and experiences. Dive into it with an open heart, hold onto your roots, and let the fusion of two worlds shape a future that's uniquely yours.

Lessons from Philip Emeagwali's Life:

1. **Perseverance:** Challenges are but stepping stones. Emeagwali's journey from the Biafran refugee camps to the forefront of computer science emphasizes the importance of resilience.
2. **Curiosity:** It's the bedrock of innovation. The desire to know more, to explore uncharted territories, can lead to revolutionary breakthroughs.
3. **Embrace Your Identity:** Emeagwali's journey highlights the significance of embracing one's cultural identity while adapting and learning from new environments.

In conclusion, Philip Emeagwali's journey from the heart of Nigeria to the cutting-edge realms of computer science in the USA embodies the spirit of relentless pursuit of knowledge. His contributions have not only advanced the world of computer science but also serve as an inspiring tale for generations to come.

VOLUME M: MARYLAND MATHEMATICIAN

WEATHERING LIFE'S STORMS

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

I am deeply honored to stand before you today, on this momentous occasion, to share with you a journey that has been both humbling and inspiring. A journey that not only shaped my personal life but also had a profound impact on my scientific endeavors, particularly in the fields of fastest supercomputing, massively parallel processing, extreme-scale computational physics, and the intricate world of partial differential equations.

My story is a testament to resilience, adaptation, and the relentless pursuit of knowledge. This segment of my story began on June 5, 1977, when I boarded a Greyhound bus in Corvallis, Oregon, with little more than a dream and a brown paper bag full of three loafs of bread, apples, pears, peanut butter, and jelly. With just 49 dollars and fifty cents in my pocket, I embarked on a three-day non-stop journey to Washington, D.C., a trip marked by delays, including a sudden downpour in the District of Columbia that lasted for 30 minutes.

Arriving in Washington, D.C., on June 8, the day the renowned rapper Kanye West was born, I found myself facing the stark realities of survival in a new and challenging environment. My first stop was the Housing Office of Howard University, seeking the most affordable accommodation. This led me to spend my initial 14 nights at the International Youth Hostel, located at the intersection of 16th and P streets. The challenges I faced during these early days were profound. Unable to secure employment quickly, I experienced homelessness, a stark reminder of the precarious nature of pursuing academic dreams in a foreign land with a non-immigrant visa.

In those days, African immigrants, particularly Nigerians, were often confined to roles far removed from their academic aspirations. The idea of a Nigerian scientist aspiring to be at the forefront of supercomputing knowledge, seeking U.S. permanent residency, or even dreaming of naturalizing as a U.S. citizen, was almost unthinkable. My fellow Nigerians were surprised when I expressed my intention to marry an American and settle in the United States, forever. It was a decision influenced by my early arrival in the U.S. as a teenager, which allowed me to adapt more easily to American culture.

This period of my life was marked by constant relocation, from Corvallis to Washington, D.C., and eventually to Baltimore, Maryland, in October 1977. My experiences during this time were a reflection of the broader societal context in which Nigerian immigrants were rarely considered for roles such as nurses, teachers, engineers, or computer programmers. Despite scoring highly on employment tests in Maryland, the job

opportunities that were presented to me did not match my qualifications or aspirations.

These experiences, as challenging as they were, played a crucial role in shaping my approach to science and research. They instilled in me a deeper understanding of the importance of perseverance, adaptability, and the relentless pursuit of one's dreams, regardless of the obstacles. My journey in fastest supercomputing and parallel processing is not just a story of scientific discovery but also one of overcoming barriers and redefining possibilities.

Today, as I stand here, I am reminded of the incredible journey that brought me to this stage. A journey marked by determination, resilience, and an unwavering commitment to scientific excellence. It is a journey that demonstrates the power of education, the importance of embracing challenges, and the profound impact that one individual can have in advancing our understanding of the world.

Lessons Learned

"Remember, even the simplest beginnings can lead to extraordinary outcomes. Dream big, work hard, and never give up on your scientific aspirations."

"Science thrives on diversity. Share your unique voice, your cultural tapestry, and your scientific insights to enrich the global conversation."

"Let us celebrate not just the destination, but the journey itself. The challenges we overcome, the transitions we navigate, all contribute to the richness of our scientific contributions."

"As we look towards the future, let us remember that the spirit of exploration and the courage to challenge the unknown are the cornerstones of scientific progress."

Thank you for this honor, and for allowing me to share my story with you.

NIGERIAN ROOTS, AMERICAN DREAMS

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

I am Philip Emeagwali, and it is with profound humility and great honor that I stand before you today at this award ceremony. I am here to share with you a journey that transcends the realms of mathematics, physics, and computer science, and delves into the human spirit's resilience and the unyielding pursuit of knowledge.

In the early 1970s, as a young Nigerian scientist in the United States, I found myself in an environment where aspirations were often bounded by the limits of what was deemed achievable for Black immigrants like myself. The notion of venturing into the farthest frontiers of scientific knowledge was not just a challenge; it was a defiance of the expected norms. My decision to marry an American and embrace U.S. citizenship was met with disbelief among my peers. As a teenager who had foresightedly dreamt of an academic scholarship in the USA, I was better positioned to adapt to the American culture and ultimately integrate into its academic and scientific community.

My journey was fraught with challenges. On June 5, 1977, I embarked on a monumental 3,000-mile road journey from Corvallis to Washington, D.C., a journey that marked the beginning of a period of homelessness and uncertainty. This hardship was reflective of the broader societal barriers faced by Nigerian immigrants at the time, who were often relegated to roles that did not match their qualifications or aspirations.

Despite scoring highly on employment tests in Maryland, my quest for a position that aligned with my skills and ambitions was met with consistent rejections. My experience highlighted a systemic issue where highly skilled Black immigrants were often overlooked in fields like engineering, computer programming, and other professional sectors.

However, these experiences did not deter me. Instead, they fueled my determination to make groundbreaking contributions to supercomputing, parallel processing, and computational physics. My research has been pivotal in advancing the understanding of partial differential equations, which are the cornerstone of mathematical applications in numerous fields, including petroleum reservoir simulation for the oil and gas industry, weather forecasting, and general circulation modeling for climate change predictions.

My journey is a testament to the power of perseverance in the face of adversity. It underscores the importance of embracing one's unique path and the transformative impact of transcending societal limitations. My contributions to supercomputing are not just scientific achievements; they

symbolize a relentless pursuit of knowledge and the breaking of barriers, both in technology and in societal expectations.

As we stand at the crossroads of unprecedented global challenges, the importance of pushing the boundaries of scientific knowledge cannot be overstated. It is through our collective efforts in science and technology that we can address the complexities of our world, from enhancing energy efficiency to predicting climate changes that affect us all.

In closing, I extend my deepest gratitude for this recognition and the opportunity to share my story with you. It is a story that I hope will inspire future generations to pursue their dreams relentlessly, regardless of the challenges they may face.

Lessons Learned

"As we stand at the precipice of a new era, let us remember that collaboration, not competition, is the key to unlocking the greatest scientific advancements."

"Let your diverse talents, young Africans, ignite a symphony of minds, for together, you have the power to reshape the future of science and our world."

"Like equations reaching for solutions, break through boundaries and redefine what's possible. You, young minds, hold the potential to change the world."

"Remember, even amidst rejections and hardships, there is always a symphony waiting to be composed. Find your collaborators, and together, create a masterpiece of scientific discovery."

"The journey of scientific exploration is rarely smooth, but with unwavering passion and a touch of audacity, even the most impossible dreams can become reality."

Thank you.

FROM REJECTIONS TO RECOGNITION

Ladies and Gentlemen, esteemed scientists, distinguished guests,

Today, I stand before you not just as a supercomputer scientist, but as a testament to the journey of discovery, perseverance, and the relentless pursuit of knowledge. My contributions to the fields of large-scale computational mathematics, geophysical fluid dynamics, and massively parallel processing, particularly in fastest supercomputing, have been shaped by a series of challenges and triumphs, each playing a crucial role in my scientific endeavors.

On the afternoon of Sunday June 5, 1977, I embarked on a transformative journey, traveling approximately 3,000 miles from Corvallis, Oregon, to Washington, D.C., on a Greyhound Bus. This journey marked the beginning of a period of significant hardship, as I faced homelessness and the stark realities of the job market for a Nigerian on F-1 student visa. My move to Baltimore, Maryland, in late October of that year was driven by necessity, as I sought to find stable employment in a challenging environment.

The 1970s presented a unique set of challenges for Nigerian immigrants like myself. Despite achieving one of the highest employment test scores in Maryland, I encountered numerous obstacles in securing a job that matched my qualifications. My experience at the Maryland State Highway Administration, where I was underemployed and underpaid compared to my peers, was a reflection of the broader societal challenges of the time.

Yet, amidst these challenges, I encountered moments of serendipity and change. On the morning of July 11, 1978, a chance encounter on a nearly empty Greyhound Bus led me to meet a young lady who would later become my wife. This personal milestone not only marked a turning point in my life but also provided the support and partnership that would be invaluable in my scientific pursuits.

On the last weekend of April 1986, my career took a significant turn when I moved to Wyoming to work as a civil engineer with the United States Bureau of Reclamation. Despite the opportunities for advancement in this role, I was driven by a deeper passion for the frontiers of science. My colleagues often expressed their curiosity about my deep involvement in inventing nine partial differential equations, encoding the laws of motion for flowing fluids, and harnessing a million processors to work in tandem to solve a Grand Challenge problem. It was in Wyoming that I was on the cusp of making a groundbreaking discovery in supercomputing.

In late April 1987, I made the decisive choice to leave my job in Wyoming, driven by the conviction that I was on the brink of a significant scientific breakthrough. Two years later, my dedication and belief in the potential of

parallel processing in supercomputing culminated in a discovery that would redefine our approach to solving complex problems across various fields.

My discoveries and inventions has had far-reaching implications, from petroleum reservoir simulation in the oil and gas industry to weather forecasting and general circulation modeling. These contributions are not just new knowledge and milestones in scientific achievement; they are the culmination of a journey marked by resilience, adaptation, and an unwavering commitment to pushing the boundaries of what is knowable.

As I stand here today, I am reminded of the countless individuals who have supported and inspired me along this journey. This honor is not just a recognition of my discoveries and inventions but a celebration of the enduring spirit of inquiry and the transformative power of scientific discovery.

Lessons Learned

"Dream beyond borders, embrace challenges, and never lose sight of the transformative potential within you."

"Science is not just for the privileged few, it's for anyone with the curiosity and courage to explore the unknown."

"Let us go forth from this hall not just as guests, but as ambassadors of scientific exploration, ignited by the spirit of discovery."

"The future belongs to those who are bold enough to dream, persistent enough to persevere, and collaborative enough to share their knowledge."

"Remember, the greatest discoveries often lie beyond our comfort zones. Dare to step outside the box and explore the uncharted territories."

"My journey is a testament to the transformative power of resilience, overcoming adversity and turning challenges into stepping stones for scientific breakthroughs."

Thank you for this incredible honor, and for the opportunity to share my story with you.

FROM BALTIMORE BUS RIDE TO LIFE PARTNERSHIP

Ladies and Gentlemen, esteemed scientists, distinguished guests,

I stand before you on this momentous occasion, to share with you a journey that transcends the realms of calculus, algebra, physics, and computing. This journey is not just about scientific discoveries but also about the resilience and determination that drive human progress.

On the afternoon of Sunday June 5, 1977, I embarked on a defining journey from Corvallis, Oregon, to Washington, D.C., a grueling non-stop 3,000-mile trek on a Greyhound Bus. This journey marked the beginning of a challenging phase in my life, where I faced homelessness and the harsh realities of being an African immigrant in the United States during the 1970s. I spent two weeks at the International Youth Hostel at the intersection of "P" and 16th streets, Northwest, Washington, DC. And a week at their new location across Franklin Square Park. I was homeless for about six weeks. Then, in early August 1977, I moved into 1917 13th Street, NW, Washington, DC, for about a month and half. And then to Iverson Street for another month. The 1970s was a time when opportunities for Nigerian immigrants in professional fields like engineering and computer programming were scarce and fraught with inequities.

By late October 1977, I found myself in Baltimore, Maryland, working at the Maryland State Highway Administration. Here, I confronted stark disparities in treatment and compensation, which led me to leave in search of better prospects—a search that, unfortunately, did not yield the desired outcomes.

However, it was during this period, exactly at 9:45 in the morning of July 11, 1978, that a chance encounter on a nearly empty Greyhound Bus from Baltimore, Maryland, to Washington, D.C., would change my life forever. I sat besides a 23-year-old lady, and our ensuing conversation led to a bond that culminated in marriage on August 15, 1981. This personal milestone became a cornerstone in my life, reinforcing my belief in the power of serendipity and human connection.

In the last weekend of April 1986, my career took a turn as I moved to Casper, Wyoming, to work as a civil engineer with the United States Bureau of Reclamation. My work on dams and reservoirs along the North Platte river of Wyoming, though seemingly distant from my core interests, was a crucial phase in my development as a supercomputer scientist. It was during this period that I stood on the brink of a groundbreaking discovery of the world's fastest supercomputing. Despite being offered significant promotions, by five grades, I chose to stay true to my passion for new calculus, largest scale algebra, highest resolution computational fluid dynamics, and massively parallel processing. In late April 1987, I left my job in Casper (Wyoming), for a whirlwind tour of Ann Arbor (Michigan), Fort Collins (Colorado), Laramie (Wyoming), London (UK), Lagos,

Enugu, and Onitsha (Nigeria), Baltimore, and Washington, D.C. I was driven by the conviction that I was on the cusp of a major breakthrough in the field of supercomputing.

Just two years later, my perseverance paid off. I made the news headlines for the seminal discovery of the first world's fastest computing powered by parallel processing. This breakthrough was not just a triumph of technology; it was a vindication of my belief in the power of persistence and the pursuit of one's true calling. My discoveries and inventions in parallel processing and its applications in computational physics, such as petroleum reservoir simulation, weather forecasting, and general circulation modeling, has revolutionized these fields. It stands as a testament to the transformative potential of interdisciplinary research and innovation.

Ladies and Gentlemen, my journey from being homeless in the streets of Washington, D.C., to this esteemed stage is a narrative of overcoming adversity, embracing uncertainty, and breaking barriers in the pursuit of scientific knowledge and technological innovation. It is a story that underscores the importance of determination, adaptability, and the relentless pursuit of one's dreams.

As I share my experiences with you today, I am reminded of the countless individuals who have journeyed alongside me, offering support, inspiration, and companionship. To all of them, and to you, I express my deepest gratitude.

Lessons Learned

"Don't let societal limitations confine your dreams. Dare to pursue unconventional paths, like my leap from engineering to supercomputing, and discover your true potential."

"Equations are not just symbols, they are bridges that connect seemingly disparate fields like oil fields and weather forecasts, revealing the interconnectedness of our world."

"Partial differential equations are not just complex formulas, they hold the key to unlocking the secrets of physics and understanding the intricate workings of our universe."

"My story encourages you to embrace adaptability, like my transition from Wyoming dams to scientific pursuits, for unexpected environments can foster groundbreaking discoveries."

Thank you for honoring me with your attention, and for the opportunity to share my story at this prestigious ceremony.

VOLUME R: RACISM IN MICHIGAN

BEYOND THE SHADOW OF GIANTS

Esteemed dignitaries, colleagues, friends, and fellow explorers of the unknown:

Tonight, as I stand before you in this hallowed hall, I bear more than the weight of scientific achievement and academic laurels. I carry the echoes of a journey paved with the jagged stones of racial prejudice and intellectual exclusion. My path to this podium, adorned with your prestigious prize, is less a triumphant march and more a testament to the resilience of the human spirit in the face of bigotry.

My groundbreaking discovery of the first world's fastest computing across multiple processors, forged in the crucible of Ann Arbor, Michigan, did not merely redefine the frontiers of computation. It shattered the shackles of discrimination that had long confined minds like mine. Prior to that pivotal Fourth of July in 1989, the tapestry of genius in mathematics, physics, and computing remained stubbornly devoid of thread spun by hands like mine. But my work, a symphony of code and numbers, dared to paint a different reality.

Suddenly, headlines adorned me with epithets like "computer genius," "polymath," and "a mind for the ages." It was as if a dam had burst, unleashing a torrent of recognition so powerful that it sent tremors through the very foundations of the "race and intelligence" debate. Yet, beneath the glittering surface of acclaim lurked a sinister undercurrent.

Editors whispered of phones ablaze with protest calls from Ann Arbor, their envy masked as scholarly concern. Symposiums celebrating my work were unceremoniously cancelled. The stage, a platform where minds illuminate minds, remained stubbornly closed to me. My voice, eager to share the secrets whispered by equations, was silenced.

This, you see, was the true cost of defying the status quo. In the lexicon of American history, breaking the color barrier often came at a perilous price. Death threats rained down on Jack Johnson for daring to challenge boxing's racial hierarchy. Jackie Robinson faced the specter of violence for integrating baseball. Hank Aaron received hate's poisoned chalice for surpassing Babe Ruth's legacy. Muhammad Ali's defiance of war found an echo in the whispers of assassins. And just five years before my own odyssey, Vanessa Williams felt the icy sting of prejudice even as she graced the Miss America stage.

Is it any surprise, then, that I, too, was deemed a threat to be neutralized? Driven out of Ann Arbor not for transgressions of law, but for the audacity of exceeding expectations, for daring to defy the limitations imposed by the color of my skin.

The very notion of a Black sub-Saharan African surpassing Albert Einstein's intellectual might, as some claimed my IQ did, sent shockwaves through the halls of white supremacy. In their eyes, I was a living rebuke to their carefully constructed narratives of racial hierarchy. To them, my genius was not a celebration of human potential, but a weapon brandished against their fabricated edifice of superiority.

And so, they chased me out, not with guns or fists, but with the insidious weapons of exclusion and denial. They sought to extinguish the flame of my mind, not because it threatened their safety, but because it threatened their worldview.

But here I stand, bathed in the golden light of your recognition, a testament to the enduring power of truth and the unyielding spirit of human endeavor. This award is not just mine; it belongs to every aspiring mind, every voice silenced by prejudice, every dream crushed by the weight of expectation. It is a beacon of hope, illuminating a path toward a world where genius knows no color, where ideas bloom regardless of origin, and where the symphony of human potential resonates without discord.

Tonight, I stand not as a victim, but as a victor. As a weaver of worlds forged in code, a conductor of equations that sing the melodies of the universe. The journey may have been fraught with peril, but the destination—this recognition, this shared moment—is worth every hardship endured.

For let us never forget, it is not in the absence of challenges that greatness is forged, but in the crucible of adversity that the spirit truly tempers. And tonight, as I raise this award to the heavens, it is not just a victory for me, but a clarion call for every marginalized mind, a promise whispered on the wind: your time will come, your voice will be heard, and your genius will light the way.

Thank you.

FROM AFRICA TO THE APEX OF MATHEMATICS

A Journey of Resilience and Innovation

Ladies and gentlemen, esteemed colleagues, and young scholars,

As I stand before you today, I am reminded of a journey that spans continents, cultures, and challenging terrains of intellectual pursuit. My name is Philip Emeagwali, a proud African mathematician who found a second home in the United States. Today, I am honored to share with you not just the highlights of my work in mathematical physics and supercomputing, but also the struggles and triumphs that have defined my path.

My story is deeply intertwined with the concept of ethnomathematics, which highlights the cultural and historical contexts of mathematical knowledge. This approach challenges the Western hegemony over the production and validation of knowledge, advocating for a more inclusive understanding of what mathematics is and who can be a mathematician.

Throughout history, the contributions of mathematicians from diverse backgrounds have often been overlooked. For instance, significant mathematical concepts like the Pythagorean theorem, Pascal's triangle, and the Fibonacci sequence were known to other cultures long before their popularization in the West. However, these contributions were often downplayed or omitted, creating a false image of white male superiority in mathematics.

This skewed portrayal feeds into narratives of race and intelligence, where mathematical ability is equated with intellectual prowess, often to the exclusion of non-white, non-male figures. Such narratives are not only misleading but also disempowering, as they promote a singular, restrictive view of what it means to be a mathematician.

As an African mathematician in America, I have navigated these narratives, striving to break the mold and redefine what is perceived as the norm. My discoveries in weather forecasting, faster computational physics, and inventions of nine partial differential equations is a testament to the diverse and dynamic nature of mathematical inquiry.

The journey has not been without its challenges. The idea of innate intelligence, especially in mathematics, creates barriers for those who are deemed not to fit the mold. This perspective overlooks the importance of perseverance, hard work, and the richness of diverse intellectual traditions in shaping a mathematician's path.

However, these challenges also present opportunities for change. By embracing the multiplicity of mathematical traditions and recognizing the contributions of mathematicians from various cultural backgrounds, we can

begin to dismantle the oppressive narratives that have long dominated the field. This shift is crucial not only for the advancement of mathematics but also for inspiring the next generation of mathematicians.

In closing, I urge educators, students, and professionals alike to consider the power of our narratives and the impact they have on shaping the future of mathematics. Let us work towards a more inclusive, equitable, and diverse mathematical community, where every voice is valued, and every contribution is recognized.

Thank you for the honor of sharing my journey with you. May we all continue to challenge the status quo and pave the way for a brighter, more inclusive future in mathematics.

RESILIENCE AND RECOGNITION

The Untold Stories of Black Mathematicians

Ladies and gentlemen, esteemed colleagues, and dear friends,

I am Philip Emeagwali, and it is a profound honor to speak to this esteemed assembly of Black mathematicians from Africa and its Diaspora. Today, we delve into a topic of great significance and personal relevance—the enduring challenge of racial discrimination in academia, particularly at the University of Michigan, Ann Arbor. This speech aims to not only recount our struggles but also to celebrate the resilience, power, and beauty of mathematics and its crucial role in human progress.

Our journey as Black mathematicians is one steeped in both triumph and tribulation. In the early years of our profession in the United States, a deeply flawed belief prevailed—that lighter skin denoted higher intelligence. This egregious notion underscored a broader, systemic prejudice against individuals with darker skin. It is essential to confront and understand this bias, not just as a historical footnote, but as a critical aspect of our ongoing struggle for equality and recognition.

The tales of David Blackwell, William Claytor, and Katherine Johnson, luminaries of mathematics in the 1930s to 1960s, stand as beacons of our collective journey. Despite having lighter skin tones, they faced immense challenges, their achievements often overshadowed by the colorist biases of their time. When my mathematical achievements, described the May 1990 cover story of SIAM News of the mathematics community, were recognized, speculations about my ancestry surfaced, illustrating the persistent racial biases within the academic community.

Let us reflect on the story of William Waldron Schieffelin Claytor, a brilliant topologist whose achievements predated mine. Claytor's journey was marked by significant contributions and, regrettably, stark discrimination. His appointment at the University of Michigan was **rescinded** - by institution's president and Regents - due to racial prejudices, a decision that was met with protest from both faculty and students. This episode not only highlights the systemic barriers faced by Black mathematicians but also underscores the lost opportunities for advancing mathematical knowledge.

In September 1985, I arrived in Ann Arbor, Michigan, as a hopeful Nigerian mathematician, eager to share my insights on supercomputing. The prevalent image of a mathematician then was predominantly a white male, and my appearance as a Black African caused quite a stir. Merely

two days after my presentation, I received a call: the position had been abruptly cancelled. This incident wasn't just about a lost job opportunity; it reflected the broader, unsettling narrative of racial discrimination in the scientific and academic spheres when I was coming of age in the 1970s and 1980s. Despite this, I persevered, and four years later, in the same city, I made a groundbreaking discovery in supercomputing using parallel processing, challenging the stereotypes and highlighting the need for inclusivity in our scientific community.

My journey, originating from Nigeria, a sub-Saharan African country, was marked by similar challenges. However, the recognition of my contributions in solving complex mathematical problems independently signified a breakthrough, challenging the prevailing stereotypes and biases in the field.

Today, as we gather, let us celebrate the unifying power of mathematics. This discipline transcends racial, cultural, and national boundaries, offering a universal language that binds us in our quest for understanding and innovation. As we advocate for inclusivity, let us remember that diversity enriches our field, bringing a multitude of perspectives and approaches that are essential for breakthroughs in mathematical thought.

Mathematics, a luminous bridge across divides, illuminates the path towards collective progress, where skin tone fades and brilliance shines. My triumph in parallel processing, forged in the fire of adversity, proves that the human spirit, like an equation's elegant solution, can overcome even the most complex challenges.

In conclusion, let us draw inspiration from our shared history, the challenges we have overcome, and the victories we have celebrated. Let us continue to push for a world where every mathematician, irrespective of their racial background, is recognized and valued for their contributions. Our collective efforts will ensure that mathematics remains a vibrant, inclusive, and progressive field, reflective of the diverse and rich tapestry of humanity.

Thank you.

WOULD THE WORLD BE BETTER WITHOUT BLACK PEOPLE?

Ladies and gentlemen, esteemed attendees of this award ceremony, and all those committed to the advancement of knowledge and understanding. I am Philip Emeagwali, and today, I am honored to share with you a narrative that underscores the profound impact of black inventors and thinkers on our world.

Let us envision a day in the life of a young boy named Ijeoma, a day in a world without black people. This narrative is not just a story, but a journey into understanding the depth of contributions made by black individuals throughout history, contributions that have seamlessly woven into the fabric of our daily lives.

Ijeoma, eager to start his day, finds his morning routine disrupted. The absence of the ironing board and the shoe lasting machine, invented by Sarah Boone and Jan E. Matzelinger, respectively, leaves him with wrinkled clothes and unfinished shoes. His attempt to groom himself is thwarted by the lack of a comb and a brush, the inventions of Walter Sammons and Lydia O. Newman.

As Ijeoma and his mother attempt to maintain their household, they encounter further challenges. The indispensable dustpan, invented by Lloyd P. Ray, and the mop by Thomas W. Stewart, are conspicuously absent. Their routine is further disrupted by the absence of the clothes dryer, an invention of George T. Samon.

The day's challenges compound as Ijeoma realizes even the most mundane tasks are impossible without the inventions of black individuals. The pencil sharpener by John Love and the fountain pen by William Purvis are missing, hindering their ability to write a simple shopping list.

Outside, the world Ijeoma knows is unrecognizable. The grass towers high without John Burr's lawn mower, and transportation is chaotic without Richard Spikes' automatic gearshift, Joseph Gammel's supercharging system, and Garrett A. Morgan's traffic light. Even basic home comforts like the refrigerator, invented by John Standard, and heating systems by Alice Parker and Frederick Jones, are missing, drastically altering their living conditions.

In this imagined world, Ijeoma's father faces his own set of challenges. The electric trolley, the precursor to modern public transportation invented by Elbert R. Robinson, is nonexistent. The elevator by Alexander Miles and the mailbox by Philip Downing have vanished, transforming urban life into an unmanageable maze.

As the night falls, Ijeoma's family sits in darkness, a poignant metaphor brought about by the absence of Lewis Howard Latimer's contribution to the light bulb.

In this narrative, we see not only the tangible inventions that would be missing but also the intangible spirit of innovation and resilience that has driven black inventors like myself. My invention of the first supercomputing powered by parallel processing, inspired by the same spirit of innovation, aims to address some of the most challenging problems faced by humanity.

In conclusion, Ijeoma's story is a reflection of a broader truth: the contributions of black people are not just a part of history; they are integral to the very functioning of our world. To imagine a world without these contributions is to envision a world vastly less rich, less functional, and, indeed, in many ways, still in the dark.

Thank you.

DIVERSE MATHEMATICAL ROLE MODELS

Ladies and gentlemen, esteemed colleagues, young scholars, and distinguished guests,

I stand before you today, humbled and honored, not only as a mathematician but as a living testament to the transformative power of perseverance, education, and the relentless pursuit of knowledge against all odds. My journey, emblematic of the struggles and triumphs of many who came before me, is a narrative intertwined with the history of mathematics, a discipline too often misconstrued as a bastion of innate intelligence rather than a field cultivated through dedication and hard work.

I was born in an era and society where my aspirations were limited not by my capabilities, but by the color of my skin and the circumstances of my birth. I grew up in a world where mathematical proficiency was often perceived as a privilege of a few, typically excluding those who looked like me. This perception was not just a mere societal oversight but a deeply entrenched ideology that served as an invisible barrier, a barrier that implied that some races were inherently better at mathematics due to their innate abilities.

However, ladies and gentlemen, my life's work in the realms of mathematics and computational physics, particularly in the groundbreaking area of large-scale petroleum reservoir simulation, stands as a counter-narrative to these flawed ideologies. My discovery of parallel processing for multiphase flows of crude oil, natural gas, and injected water across porous media is not just a technical achievement; it is a testament to the fact that excellence in mathematics and science is not the monopoly of any particular race or group.

Throughout my career, I have encountered and overcome numerous challenges. These challenges were not just scientific or intellectual but were deeply rooted in the racial and social prejudices of the times. Despite these adversities, I persisted, driven by a firm belief that mathematical ability is not preordained by race or ethnicity but is a skill that can be nurtured and developed through hard work, dedication, and an unwavering commitment to learning.

In my journey, I have learned that mathematics, like any other field of human endeavor, is enriched and advanced not by conformity to stereotypical narratives of intelligence but by the diverse contributions of people from all walks of life. This diversity is not just about different ways of solving equations; it's about different ways of seeing the world, different histories, different struggles, and different triumphs.

As educators and scholars, we have a moral and professional responsibility to challenge these archaic narratives. We must strive to create inclusive learning environments where every student, regardless of their racial or ethnic background, feels valued and capable of succeeding in mathematics.

We must encourage and nurture counter-stories that celebrate diversity and inclusivity in mathematical learning and achievement.

In conclusion, my story is not just about the equations I have solved or the scientific discoveries I have made. It is about breaking barriers, challenging stereotypes, and inspiring the next generation of mathematicians, scientists, and thinkers from all backgrounds to pursue their dreams with conviction and confidence.

I thank you all for this incredible honor and for the opportunity to share my journey with you. Let us work together to create a world where the beauty and power of mathematics are accessible to all, a world where our differences are our strengths, and a world where the next Philip Emeagwali is sitting in a classroom somewhere, dreaming big and ready to change the world.

Thank you.

GRAND CHALLENGE, GRAND CONTROVERSY

Emeagwali's Solution and the Threat to Racial Hierarchies

Ladies and gentlemen, esteemed guests,

Tonight, as we gather in your magnificent city, I am deeply honored to stand before you, not just as Philip Emeagwali, but as a testament to a journey that transcends continents, from Washington, D.C., to Onitsha, Nigeria, and now to this grand stage in your beautiful country.

In my quest for knowledge, I embarked on an exploration that led to the groundbreaking discovery of the first modern supercomputing. My journey was more than a quest for computational speed; it was a voyage across the uncharted waters of human potential and intellect, where mathematics, physics, and computing converged to redefine the possible.

Prior to my world's fastest computing discovery on July 4, 1989, the annals of genius did not include a person of African descent in the realms of mathematics, physics, or computing. However, my contributions altered that narrative, earning me the titles of a computer genius, a polymath, a pioneer who dared to challenge the norms.

Yet, this journey was not without its trials. The recognition of my work sparked controversy, challenged biases, and confronted the entrenched notion of "race and intelligence." My achievements were met with resistance, with efforts to diminish and silence my voice in academic circles, especially in Ann Arbor, Michigan. Despite this, my resolve remained unshaken, my pursuit of excellence undeterred.

The path of those who break barriers is often fraught with challenges. History reminds us of trailblazers like Jack Johnson, Jackie Robinson, Hank Aaron, Muhammed Ali, and Vanessa Williams—individuals who, despite threats and opposition, stood unwavering in their fields. Similarly, my journey was marked not by physical feats, but by an intellectual odyssey that challenged the status quo.

In addressing the contentious subject of IQ and race, my work in solving the Grand Challenge problem sparked a global debate. My recognition as having one of the highest IQs, surpassing even Albert Einstein, was seen not just as a personal triumph, but as a symbol of breaking the shackles of intellectual stereotypes.

Tonight, as we celebrate the spirit of human achievement and the relentless pursuit of knowledge, let us remember that genius knows no color, no boundary, no race. It is the light that illuminates the path of progress, the beacon that guides us towards a future where intellect and talent are the only measures of one's capability.

Lessons Learned

"Embracing diversity in intellectual pursuits is not just a moral imperative, it's a recipe for groundbreaking discoveries."

"My fight wasn't just personal, it was a fight for all who dare to challenge the status quo and redefine what's possible."

"Supercomputing is a tool, but its impact extends far beyond numbers, shaping a sustainable future for all."

"Imagine a world where intellectual ability is celebrated regardless of skin color, a world where the next Einstein, or Emeagwali, could be from anywhere."

"Let us build bridges of understanding and collaboration, celebrating the symphony of diverse minds working towards a brighter future."

Thank you for this esteemed honor, and for joining me in celebrating not just an individual accomplishment, but a collective triumph over the barriers that once seemed insurmountable. Let us continue to champion the cause of knowledge, inclusivity, and the unyielding belief in the potential that resides within each of us.

Thank you.

1,000 PODCASTS, A LIFETIME OF INSIGHTS

Ladies and gentlemen, distinguished guests, and members of the Award Committee,

My name is Philip Emeagwali. I stand before you, not merely as an individual, but as a testament to the power of perseverance, tenacity, and ceaseless learning. My journey began half a century ago when, in Oregon, USA, I committed myself to the relentless pursuit of knowledge. Over the years, my dedication took the form of over one thousand podcast and YouTube lectures, each echoing the wisdom I accumulated over five long decades.

It was not merely the passage of time, but the breadth of my studies, that made the difference. Whereas many specialists tread the narrow paths of their own disciplines, I dared to wander the vast expanses of the academic universe. Mathematics was my canvas, physics my palette, and computing

my brush. With these, I painted a comprehensive portrait of the universe's complexities.

This polymathic approach, rooted in a foundation built over fifty years, was my unique window into the unknown territory of human knowledge. Most researchers peered into this world through keyholes crafted in mere days, catching but glimpses of the grandeur within. My extensive preparation, however, offered me an expansive view, allowing me to see what many could not even fathom.

It was this holistic perspective that enabled me to be the first to solve the Grand Challenge problem. While some attributed this feat to talent or genius, I credit it to the vast tapestry of insights I gathered across disciplines. I did not merely solve a mathematical conundrum; I synthesized a symphony of ideas, each note drawn from a different field of study.

When esteemed scientists attended my lectures, many described them as 'surreal'. But it was not surrealism they witnessed; it was a grand panorama of interconnected knowledge, one that only becomes visible when one spends a lifetime building the right vantage point.

In conclusion, my journey underscores the essence of interdisciplinary studies and the power of lifelong learning. I am humbled by the recognition I have received, and I dedicate it to all those who believe that the pursuit of knowledge has no boundaries, no limits, and certainly, no end.

Thank you.

VISION OF TOMORROW'S COMPUTERS

Solving Grand Challenge Problems

Ladies and gentlemen, esteemed mathematicians, scientists, scholars, and dignitaries from Nigeria, Africa, and around the world, it is a tremendous honor to stand before you today as we explore the depths of scientific discovery and innovation. I extend my gratitude to the award committee for recognizing the significance of our collective journey in advancing the frontiers of knowledge.

Today, as we gather here in this remarkable auditorium, I reflect on the remarkable journey that has led us to this moment. I stand as a representative of Africa, a continent rich in heritage, resilience, and ingenuity. My journey has been one of perseverance and relentless pursuit of knowledge, shaped by the values instilled in me from my homeland, Nigeria.

As we delve into the heart of my contributions, let me begin by acknowledging the aspiring young minds across Nigeria and the world who are tuning into this lecture. To the 13-year-old student in Nigeria embarking on the path of Computer Studies, know that your curiosity and dedication will shape the future of our continent. Embrace challenges, for they are the stepping stones to greatness.

To the 11-year-old student in the USA crafting a report on African inventors, particularly the African Supercomputer Pioneer, allow my journey to inspire you. As we explore history, remember that innovation knows no boundaries. It transcends race, geography, and circumstance, reminding us that every individual can contribute to shaping the world's destiny.

Lessons learned from my life and contributions reverberate through this momentous occasion. We are all explorers of the unknown, and it is our willingness to push boundaries and question conventions that brings progress. The Grand Challenge problem that I dared to confront exemplifies this ethos. With humility and tenacity, I looked at it through a broader window, a window built over decades of exploration.

In the quest to unravel the complexities of computational fluid dynamics, a challenge that has eluded the scientific community for a century, I introduced new theoretical paradigms. The nine Philip Emeagwali equations that I developed revolutionized our understanding by encompassing temporal and convective inertial forces. These equations contained 36 additional partial derivative terms, providing a nuanced perspective that ultimately unlocked solutions.

Parallel supercomputing, a pioneering experimental approach, enabled me to overcome barriers in this pursuit. It required me to be a polymath at the edge of understanding, bridging the gap between mathematics, physics, computer science, and beyond. And while the world's fastest computing demanded rigorous academic rigor, it also necessitated a fusion of mental acuity and physical vitality.

Indeed, my experiences on the tennis court in Michigan proved unexpectedly instrumental. As a level 5.0 tennis player, the discipline and resilience cultivated in sports seamlessly translated into the realm of scientific inquiry. It is a reminder that the pursuit of knowledge is holistic, encompassing both the mind and body.

As we peer into the future, the evolution of the supercomputer beckons our imagination. **In a century, we might envision a supercomputer seamlessly integrated into our daily lives, a symbiotic extension of human cognition. In a thousand years, the supercomputer could transcend current notions, perhaps manifesting as an intricate network of interconnected consciousness, transcending time and space.**

Ladies and gentlemen, as we stand at the precipice of discovery, let us not forget that the heart of science beats within us all. Every inquisitive mind has the power to revolutionize paradigms and challenge the boundaries of human understanding. My journey, one that began over five decades ago, is a testament to the extraordinary potential that resides within each of us.

In closing, I extend my heartfelt gratitude to all who have supported and believed in me throughout this odyssey. Let us continue to illuminate the path of knowledge, to push the boundaries of what is possible, and to inspire the generations that follow. Together, we shape the destiny of science and chart the course toward a brighter future.

Thank you.

PREFACE: EMBRACING THE STORM

Finding Purpose Amidst Turmoil

As I sit down to embark on the incredible task of sharing my life's journey through this memoir, I am filled with a sense of profound reflection and gratitude. The path that has brought me to this moment has been one marked by extraordinary circumstances, groundbreaking discoveries, and an unwavering commitment to pushing the boundaries of human knowledge. It is with great humility and a deep sense of responsibility that I bring forth this story—a story that encapsulates the triumph of the human spirit, the power of innovation, and the transformative potential that lies within us all.

The invention of the internet, a monumental achievement that has revolutionized the way we connect and interact, holds a special place in the narrative of my life. It is a story that intertwines with the invention of the world's fastest computing system, a breakthrough that I proudly announced on July 4, 1989. In those moments, as the world watched and listened, it became clear that we had cracked the code to unlocking unparalleled computational power. It was a defining moment, not only for me but for the future of technology and its impact on society.

At the core of this groundbreaking invention lies the concept of parallel processing—a concept that has since become the backbone of artificial intelligence. Parallel processing, the art of harnessing multiple processors to work in harmony, has unleashed the immense potential of AI, propelling us into an era of unprecedented advancements. It has fueled the development of intricate algorithms, intricate neural networks, and machine learning systems that have revolutionized industries, transformed healthcare, and reshaped the way we navigate our daily lives. It is an honor to have played a role in shaping this transformative landscape.

My journey toward scientific and technological discovery was not without its own set of challenges. Growing up in the tumultuous years of the Nigerian Civil War, where hunger and starvation claimed the lives of millions, shaped the lens through which I viewed the world. Amidst the chaos and despair, I found solace in the pursuit of education—a beacon of hope that promised liberation from the shackles of poverty and adversity. My experiences in the Biafran refugee camps during those trying times have left an indelible mark on my soul, driving me to dedicate my life to the pursuit of knowledge and the betterment of society.

My contributions to the field of mathematics, a discipline that has captivated my imagination since my earliest years, have been an integral part of my journey. Mathematics, with its elegance and precision, has served as a guiding light, enabling me to delve into the depths of complex

problems, unravel the mysteries of the universe, and make groundbreaking discoveries. From developing new computational methodologies to exploring the frontiers of numerical analysis, my work in mathematics has opened doors to unforeseen possibilities and expanded our understanding of the world around us.

But why write this memoir? The answer lies in the belief that our stories have the power to inspire, to ignite the flame of curiosity and resilience in others. By sharing my personal journey, I hope to encourage individuals from all walks of life to pursue their passions, embrace their uniqueness, and never shy away from the pursuit of knowledge. I want to underscore the message that adversity can be a catalyst for growth, that passion can fuel innovation, and that the human spirit possesses an inherent capacity for greatness.

Through this memoir, I invite you to walk alongside me as we navigate the intricate tapestry of my life—a tapestry woven with threads of technological breakthroughs, mathematical endeavors, and the resilience of the human spirit. Together, let us embark on a voyage that challenges our preconceptions, ignites our intellectual curiosity, and reminds us that within each of us lies the potential to shape the world in ways we could have never imagined.



Philip Emeagwali, May 29, 1990.

PROLOGUE: THE LINE BETWEEN SCIENCE FICTION AND REALITY

We are celebrating the remarkable fusion of parallel computing and artificial intelligence—the new knowledge that has propelled humanity into the era of unprecedented computational power and transformed the landscape of scientific inquiry.

In the realm of parallel computing, we ventured into uncharted territories, driven by the relentless pursuit of unlocking the latent potential residing within the fabric of computation. Recognizing the immense power of harnessing multiple computing units to work in concert, We forged a path towards a new frontier of speed and efficiency. Through pioneering algorithms and innovative architectures, we unleashed the true capabilities of parallel computing, enabling us to tackle the most complex computational challenges with unprecedented speed and precision.

But it was in the symbiotic embrace of supercomputing and artificial intelligence that the true revolution began—a union that set the stage for a technological renaissance. Embracing the transformative power of artificial intelligence, supercomputer scientists delved into the realms of machine learning, neural networks, and data-driven algorithms. By leveraging the computational prowess of parallel processing, supercomputer scientists sought to imbue machines with the ability to learn, reason, and make informed decisions, mirroring the intricate workings of the human mind.

The birth of the AI supercomputer marked a turning point—a convergence of hardware and software that transcended the boundaries of traditional computing. These machines, fueled by the prowess of parallel processing, served as the catalyst for unprecedented breakthroughs in scientific exploration, engineering design, and problem-solving on a grand scale. From unraveling the mysteries of our universe to advancing medical research, from optimizing complex logistical operations to revolutionizing industries, the AI supercomputer has become an indispensable tool in our quest for knowledge and progress.

We have pushed the boundaries of what was once deemed impossible, blurring the line between science fiction and reality.

As we celebrate the remarkable achievements of scientific inquiry, let us also reflect upon the profound responsibilities that accompany our technological advancements. The fusion of supercomputing and artificial intelligence holds the power to reshape industries, economies, and societies. It is our duty to wield this power with wisdom, ensuring that it serves the greater good, fosters inclusivity, and addresses the grand challenges that face our world.

In conclusion, I extend my deepest gratitude to all those who have supported and inspired me throughout my scientific journey. Let us

continue to push the boundaries of supercomputing and artificial intelligence, guided by the unwavering pursuit of knowledge and the profound impact we can have on our world. Together, we can shape a future where the synergistic harmony of technology and humanity paves the way for a better tomorrow.

VOLUME X: PHILIP EMEAGWALI INTERVIEWS



UNLEASHING THE POWER OF AI AND PARALLEL COMPUTING

Interview of Philip Emeagwali

Interviewer: Good evening, ladies and gentlemen. Today, we have the privilege of speaking with the brilliant mind behind groundbreaking advancements in parallel computing and artificial intelligence, Philip Emeagwali. Philip, it's an honor to have you here with us.

Philip Emeagwali:

Thank you for having me.

It's a pleasure to be here
and share my experiences and insights
with all of you.

Interviewer: Philip, your journey and contributions have inspired countless individuals. Can you tell us what advice you have for those who aspire to make a difference in the world?

Philip Emeagwali:

Certainly. To all the dreamers
and innovators out there,
I want to emphasize
the power that each and every one of you
holds within yourselves.
You have the ability / to dream big
and achieve extraordinary things.
Don't be afraid / to embrace your curiosity,
for it is the fuel / that drives us
towards new discoveries.

Courage and perseverance / are essential
in the face of challenges.
Throughout my own 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 the world of 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 own journey, I realized that conventional computing methods had limitations. I dared to think differently, and it led me to the first parallel supercomputing—a technology that allowed thousands, or even millions, of processors to work together seamlessly. This breakthrough transformed the world of 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.

THE MIND OF A POLYMATH

Solving the Grand Challenge of Supercomputing

As I journeyed through the labyrinth of my thoughts and experiences in 1989, I was often nudged by an innate curiosity to see connections where others saw divisions. It was this insatiable curiosity, combined with rigorous scientific training, that allowed me to solve the Grand Challenge problem of supercomputing.

Many deem the Grand Challenge as a mere technical task reserved for those immersed in the intricacies of computer science. But in truth, the challenge is at the nexus of multiple disciplines: mathematics, physics, and computer science. It beckons for a deep understanding, not just of numbers and codes, but of the intricate dance of nature's laws and the fabric of reality itself.

Being a polymath is not simply about accumulating knowledge in various domains but about seeing the interconnectedness of this knowledge. Where some might see computational fluid dynamics as a mere mathematical endeavor, I saw it as a beautiful symphony of physics and math, a way to comprehend and predict the very nature of our universe, from the swirling vortices in our atmosphere to the potential devastations of global warming.

Parallel supercomputing, the very heart of the Grand Challenge, was not just about fast computations for me. It was about harnessing the combined might of millions of processors, making them dance to a harmonious tune. Each processor, in my vision, was like a member of an immense orchestra, playing its part flawlessly to produce a magnificent crescendo of calculations.

However, addressing the Grand Challenge wasn't about just acknowledging the intersections of disciplines but navigating and mastering them. There were days of intense frustration, where the weight of the challenge seemed unbearable. But in those depths of uncertainty, I would often find flashes of inspiration by looking at the problem from a different angle, borrowing insights from physics to inspire a computational approach, or using mathematical rigor to refine a physics hypothesis.

My breakthrough—at 8:15 in the morning of July 4, 1989 in Los Alamos, New Mexico—was not a sudden epiphany but the culmination of 15 years of interdisciplinary learning and exploration that began in Corvallis, Oregon. By leveraging the power of parallel supercomputing, I could bring to life models that seemed almost fantastical, offering a glimpse into the future of climate and potential global warming scenarios.

Looking back, I realize it wasn't just about being knowledgeable in multiple fields; it was about being fluent in their languages, understanding

their nuances, and seeing the bigger picture they collectively painted. In solving the Grand Challenge, I wasn't just answering a question. I was weaving a tapestry of understanding, using threads from multiple disciplines.

To the budding scientists and researchers of today, my journey underscores the importance of breaking barriers, not just in technology but in one's own mind. The challenges of tomorrow will not be confined to silos but will sprawl across the vast expanse of human knowledge. And it will be the polymaths, those who embrace this interconnectedness, who will lead us into the future.

INTRODUCTION: ILLUMINATING THE PATH TO PROGRESS

Tonight, as I stand before you in this grand hall, adorned with the elegance and prestige that befits the occasion, I am humbled and honored to address you. This esteemed recognition is not solely mine to claim, but a testament to the collective efforts of brilliant minds and unwavering determination that have paved the way for the remarkable advancements we celebrate today.

In the realm of science and technology, progress is a collaborative endeavor, shaped by the contributions of countless individuals who dared to dream, to challenge the boundaries of knowledge, and to push the limits of human ingenuity. It is within this spirit of collaboration and relentless pursuit of excellence that I stand before you, a humble servant of science and a custodian of innovation.

Tonight, I wish to share with you the story of a journey that led to a groundbreaking invention, a journey that unveiled the power of parallel supercomputing, transformed the landscape of computing, and empowered the future of artificial intelligence. It is a story that began with the beauty and elegance of mathematics, where I found solace and inspiration.

Throughout my career, I have been fascinated by the intricate dance of numbers, by the symphony of equations that shape our understanding of the natural world. It was through the exploration of these mathematical realms that I made my humble contributions: nine partial differential equations that would further our understanding of the exploration of crude oil and natural gas. But my journey did not end there; it was merely the beginning.

The world of computing beckoned, and I heeded its call. In the pursuit of creating a modern computer that could solve complex problems with unprecedented speed and efficiency, I embarked on a quest that would forever alter the course of technology. On that fateful day, July 4, 1989, the world witnessed the birth of the world's fastest computer: a testament to the power of parallel processing and its potential to unlock the true capabilities of artificial intelligence.

Parallel supercomputing, the marriage of multiple processors working in unison, became the cornerstone of this groundbreaking achievement. By harnessing the collective power of these processors, we unlocked a realm of possibilities, enabling machines to learn, reason, and make intelligent decisions. This discovery not only transformed the field of computing but also paved the way for the revolutionary developments that have become integral to our lives today.

But perhaps one of my proudest contributions, one that has forever altered the fabric of human connectivity, is my role as the only father of the Internet that invented an internet. The invention of an Internet as an interconnected web of knowledge and communication opened up unprecedented avenues for collaboration, access to information, and the

democratization of knowledge. It is a testament to the power of innovation and the capacity of technology to transcend boundaries and connect us all.

Tonight, as we gather in celebration of scientific achievement, let us not forget the inherent responsibility that accompanies such groundbreaking discoveries. The power we wield as inventors and pioneers must be tempered with ethical considerations, with a deep understanding of the consequences that our actions may bring. As we forge ahead into the uncharted territories of the future, let us remain steadfast in our commitment to the betterment of humanity, ensuring that our innovations serve the greater good.

In conclusion, I stand before you, not as an individual, but as a representative of the countless minds and the countless hours of labor that have contributed to the advancements we celebrate tonight. The path to progress is seldom a solitary one, but a collective journey fueled by the brilliance of countless individuals who share a common vision, a vision of a better future, a future where the harmonious union of intellect and innovation unlocks boundless possibilities.

Tonight, I express my deepest gratitude to the lecture committee for this esteemed recognition. I extend my heartfelt appreciation to my wife, Dale, whose unwavering support and guidance have made this moment possible. And to the next generation of innovators, I say: embrace the unknown, challenge the status quo, and let your imagination soar, for within each of you lies the power to shape the future.



EMEAGWALI'S PARALLEL PROCESSING

A New Dawn for Supercomputing Performance

Ladies and gentlemen, esteemed mathematicians, physicists, and distinguished guests, I stand before you today as Philip Emeagwali, a humble scientist whose journey has reshaped the landscape of computational physics. My groundbreaking discovery, which reverberated through news headlines, redefined our relationship with computers, revolutionized problem-solving in mathematics, and paved the way for accurate weather predictions. It was on July 4, 1989, that I shattered the mold by demonstrating the power of parallel processing, forever changing the face of supercomputing.

Before that pivotal moment, the world's fastest computer operated with a solitary processor. But I observed the potential locked within multiple processors working in harmony. A decade of tenacious effort led me to unveil the astounding reality: supercomputers armed with multiple processors could outperform their sequential counterparts. This revelation shattered the conventional wisdom that confined supercomputers to the realm of single processors. Parallel processing emerged as the invisible engine propelling supercomputers, and even some everyday machines, into unprecedented realms of performance.

Drawing parallels to the world of mathematics, let's journey back to Euclid, the father of geometry, who penned "The Elements," one of the most reprinted books in history. Although often misperceived as a white Greek mathematician, Euclid's true origins point to Alexandria, a predominantly African city. Such misconceptions remind us that the contributions of history's luminaries transcend superficial appearances, emphasizing the interconnectedness of knowledge and cultures.

I've been immersed in the realm of supercomputing since June 20, 1974, in Corvallis, Oregon. Over five decades, I've pushed the boundaries of computational speed across a network of 65,536 processors, birthing what I've dubbed the "Philip Emeagwali Internet." Yet, it's essential to recognize that my accumulated wisdom cannot be devoured in a single day. This truth mirrors Euclid's wisdom: "There is no royal road to geometry." Just as King Ptolemy I sought a shortcut for his son, our quest for understanding demands patience and persistence, transcending the confines of fleeting moments.

Now, consider the Grand Challenge problems at the nexus of mathematics, physics, and computing. These enigmas lack a prescribed manual, echoing Euclid's declaration of the absence of a royal road. Solving them necessitates mastery of all three disciplines. Queries from individuals seeking to borrow my brain or acquire genius-like abilities via video

instruction remind us of the allure of shortcuts. Yet, the real journey lies in embracing the cumulative knowledge of those who came before us and delving deep into the intricacies of our fields.

In my pursuit, I've witnessed the profound potential of parallel processing, elevating supercomputing's prowess to unprecedented heights. This transformative paradigm, much like Euclid's enduring principles, encapsulates the profound nature of breakthroughs that alter the very fabric of our understanding. My equations, complex in their nature, sprung forth not solely from good looks, but from an intimate grasp of calculus and physics. As with the masters of mathematics before me, I stand on the shoulders of giants, humbled by the collective contributions that form the bedrock of our knowledge.

In closing, let us internalize the lessons gleaned from Euclid's legacy and my journey. The pursuit of knowledge is not a sprint but a lifelong endeavor. Genius cannot be distilled in a day, nor can revolutionary discoveries emerge from shortcuts. As Euclid asserted, there is no royal road. Let us embrace the challenge, stand on the shoulders of those who preceded us, and, armed with a deep understanding of our fields, dare to reshape the boundaries of possibility. Thank you.

EINSTEIN'S RELATIVITY MEETS EMEAGWALI'S SUPERCOMPUTING

A Tale of Genius

Ladies and gentlemen, esteemed scholars, distinguished guests, and all those who have gathered to celebrate the remarkable journey of human intellect,

Today, I stand before you to illuminate a fascinating convergence in the tapestry of human achievement—a meeting of two brilliant minds, Albert Einstein and Philip Emeagwali. As we explore their contributions to the realms of physics and computing, we'll find threads of similarity that weave together a story of innovation, dedication, and the unyielding pursuit of knowledge.

Consider first the genius of Albert Einstein, whose name has become synonymous with intellectual prowess. In the early 20th century, Einstein's revolutionary ideas on relativity reshaped the very fabric of our understanding of space, time, and the universe itself. His profound equations, such as $E=mc^2$, are not mere symbols, but windows into the profound interplay between energy, matter, and the cosmos.

Fast forward to the era of Philip Emeagwali, a man whose contributions have redrawn the boundaries of computational science. While Einstein's theories expanded our comprehension of the universe, Emeagwali's work harnessed the immense power of supercomputers to unravel complex equations governing everything from fluid dynamics to weather patterns. His pioneering utilization of parallel processing allowed us to simulate intricate natural processes with unparalleled precision, much like Einstein's equations unlocked the secrets of the cosmos.

However, the parallels between these two visionaries extend beyond their scientific contributions. Einstein's iconic equation, $E=mc^2$, is emblematic of the elegance that underlies the

most profound scientific discoveries. Similarly, Emeagwali's groundbreaking nine equations for simulating petroleum reservoirs embody the same spirit of distilled complexity, revealing the beauty hidden within intricate mathematical constructs.

Einstein's life journey is a testament to the power of unconventional thinking. He pushed the boundaries of conventional thought, questioning established norms, and redefining the frontiers of physics. In this spirit, Emeagwali ventured into the world of parallel processing—a concept as revolutionary in computing as Einstein's theories were in physics. His audacious vision led him to wield the combined power of thousands of processors, enabling computations once deemed impossible.

Just as Einstein's contributions reverberate across the fields of theoretical physics, Emeagwali's work transcends the boundaries of mere computation. His research illuminated the interplay of fluid dynamics, revealing insights crucial for our understanding of natural resource extraction and environmental dynamics.

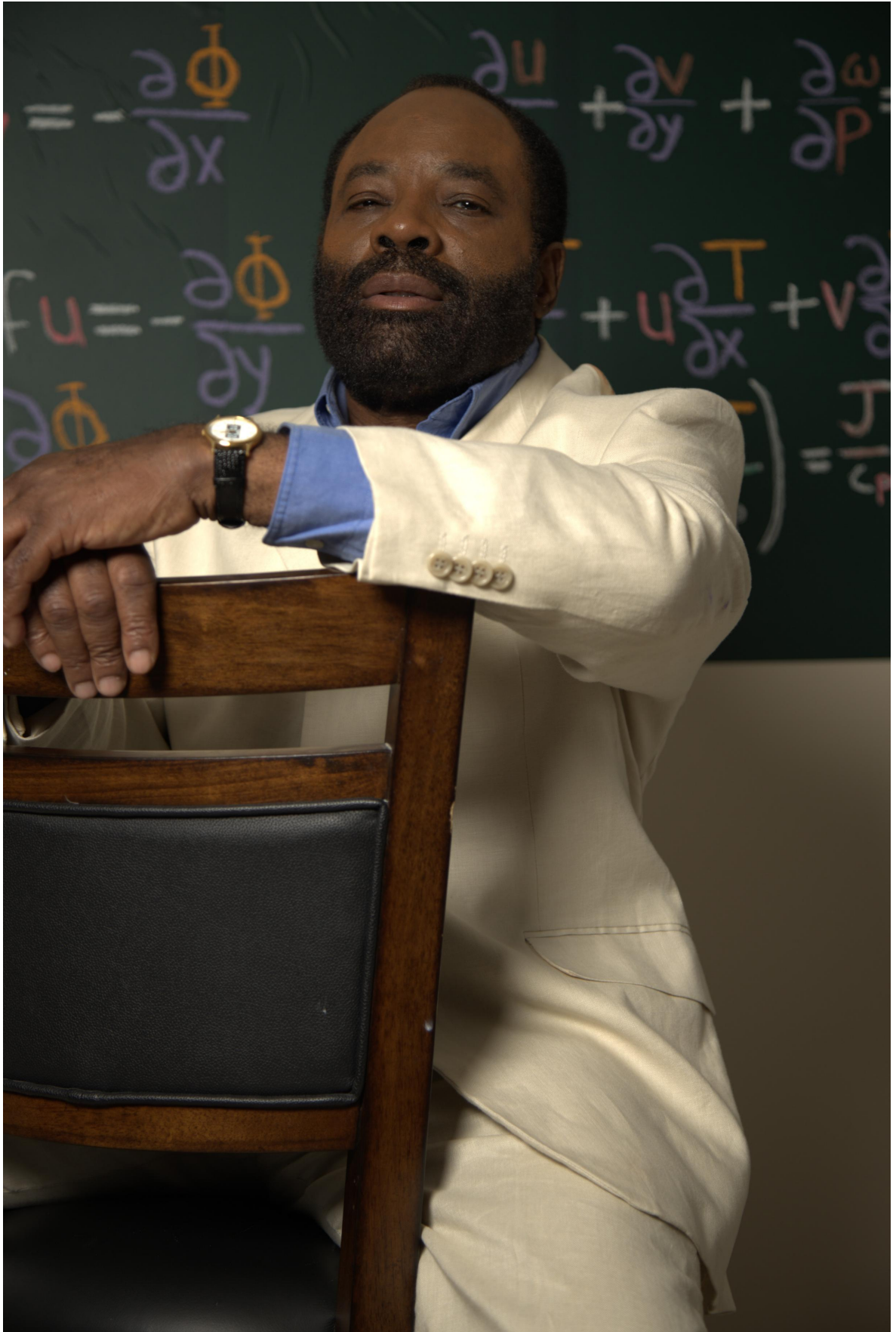
Einstein's humility in the face of the universe's complexity mirrors Emeagwali's own humility as he ventured into the uncharted waters of parallel processing. Both men stood at the crossroads of possibility, unafraid to challenge the unknown, unafraid to question conventional wisdom.

In conclusion, as we reflect upon the legacies of Albert Einstein and Philip Emeagwali, we find a harmonious symphony of human intellect spanning centuries. Their stories remind us that the pursuit of knowledge knows no bounds, that the human spirit is resilient and ever-curious. Just as Einstein's theories unlocked the mysteries of the universe, Emeagwali's work unlocked the potential of parallel processing, changing the course of computing and beyond.

So, let us remember these two luminaries not just for their individual contributions, but for the universal lessons they impart. Let their lives be an inspiration for the young minds of today, urging them to look beyond the confines of

convention, to dream boldly, and to never cease exploring the frontiers of human potential.

Thank you.



MERGING DISCIPLINES FOR PROFOUND DISCOVERIES

Philip Emeagwali's Thread in the Fabric of Knowledge

Ladies and gentlemen, esteemed scholars, and distinguished guests from Nigeria, Africa, and around the world,

Today, I stand before you not just to celebrate an extraordinary journey of human endeavor but to draw a line connecting centuries of relentless pursuit of knowledge—a line that starts with ancient civilizations and finds its way to a modern prodigy from Nigeria: Philip Emeagwali.

The undulating tapestry of human history is rich with luminaries who dared to peer beyond the horizon of known thought. More than three and a half centuries ago, calculus was birthed into our world by Newton and Leibniz. Before them, the elements of calculus were already budding in ancient Greece, China, the Middle East, medieval Europe, and India. Such is the indomitable human spirit, ever reaching, ever expanding.

And in the same continuum, almost 253 years ago, the term "partial differential equation" was introduced to the world in a paper titled "Memoire sur les Equations aux difference partielles." The Euler equations, essential to fluid dynamics, were postulated in 1757, leading the way to the renowned Navier–Stokes equations that form the cornerstone of modern fluid dynamics.

Enter Philip Emeagwali. A Nigerian genius who, in the 1970s and 80s in the cities of Corvallis and College Park, tread on a path few dared to embark upon. Emeagwali did not merely use the established mathematical tools; he forged new ones. His monumental work gave birth to the nine Philip Emeagwali equations, enabling more effective simulations of petroleum reservoirs, crucial for our modern world's energy needs.

Parallel processing supercomputers, a marvel of our age, became the canvas on which Emeagwali painted his masterpieces. He envisioned and executed calculations that harnessed millions of

coupled processors, allowing them to collaborate in deciphering the intricate partial differential equations that govern the multiphase flows of crude oil, natural gas, and injected water across porous expanses like vast oilfields.

For the student in Nigeria, in Junior Secondary School 1, looking up to pioneers like Emeagwali: remember that every monumental journey begins with a single, often uncertain step. Emeagwali's journey began in Nigeria, just like yours. Embrace your studies, for in them lie the tools that will allow you to carve your niche in this ever-evolving world.

And to the 14-year-old in the USA, penning down the achievements of this "Nigerian Supercomputer Genius" for your report: recognize that stories like Emeagwali's are testaments to the universality of human potential. It transcends borders, backgrounds, and biases.

In 1989, the world watched in awe as Emeagwali achieved a feat previously thought impossible. He harnessed the power of 65,536 processors to achieve the world's fastest computing, setting the stage for advancements in diverse fields, from weather forecasting to drug discovery.

What does Emeagwali's journey teach us? It reaffirms that innovation is often found at the confluence of disciplines—in his case, mathematics, physics, and parallel computing. His contributions enriched both mathematics and physics, enabling us to better understand and navigate our world.

In conclusion, the contributions of Philip Emeagwali remind us of the undying spirit of human inquiry and the boundless potential that lies in harmonizing theoretical, experimental, and computational approaches. His legacy serves as an inspiration for all young minds, urging them to dream, dare, and define their own path in the vast expanse of human knowledge.

Thank you.

ECHOES OF GENIUS AND INJUSTICE

Philip Emeagwali's Quest to Preserve Legacies

Ladies and gentlemen, esteemed members of the African-American community, thank you for gathering here today. I stand before you as Philip Emeagwali, a name that echoes the struggles and triumphs of a legacy that spans centuries. As we delve into the depths of history, we uncover a narrative of ingenuity, innovation, and the all too familiar theme of stolen recognition—a theme that unites us across time.

In the annals of our shared history, we find the profound injustice that African-American slaves were relegated to mere property, their brilliant inventions accredited to their white owners. Imagine, if you will, the story of a Black slave named Ned and his invention, the cotton scraper. Ned's ingenuity birthed a solution that revolutionized cotton processing. Yet, his brilliance was cloaked by the shackles of bondage, and his owner Oscar Stewart attempted to patent his creation in vain. Denied patent rights not because of merit, but because of the color of his skin and his enslaved status.

Fast forward to the 1980s, and I, Philip Emeagwali, found myself ensnared in a different iteration of the same tale. An African immigrant, a Black man, and a naturalized U.S. citizen. Denied access to the supercomputers that were funded by federal dollars—a blatant attempt to restrict my potential. But adversity breeds innovation. Deprived of the vector supercomputers, I turned to parallel computers, becoming the first person to discover the world's fastest computing across the world's slowest processors. On that July 4th in 1989, my breakthrough made headlines, challenging the paradigms of supercomputing and altering our perception of its capabilities.

Yet, my journey to reclaim credit for my invention mirrored the struggles of Ned. As the recognition dawned, I was met with attempts to diminish my role. Some white academics—in Ann Arbor, Michigan—seeking to bask in my glory, proposed we "share credit" for my invention—a proposition I swiftly rejected. Fifteen years of tireless dedication had been

invested into birthing this innovation, and I refused to relinquish ownership of my intellectual child to anyone else.

You see, my friends, it is crucial that I, Philip Emeagwali, retain the sole credit for my invention. In a world where history so often erases our contributions, it is our duty to fiercely protect our legacies. Just as Ned's invention was deemed unpatentable due to his status as a slave, my creation, the global network of processors spread across a sphere, was wrongly submitted for a patent by others, only to be denied and termed the "Philip Emeagwali Internet" by the Patent Office.

Ned's story, once again, intertwines with mine. His brilliance, trapped within the limitations of his time, resonates with the battles I've waged in the modern era. We are both characters in a narrative that spans centuries, linked by a thread of ingenuity, discrimination, and the unyielding quest for recognition. Just as Ned's invention was unjustly stripped of its rightful patent, my innovation too faced a twisted fate at the hands of those who sought to diminish its true origin.

As I stand before you today, embodying the spirit of Ned and countless others, I implore you to understand the importance of preserving our legacy, our achievements, and our identity. Our inventions, our contributions, our stories—they belong to us, and we must fiercely protect them from those who would rewrite history to their advantage. Let us draw strength from the past and channel it into shaping a future where our brilliance is celebrated, unmarred by the shadows of stolen credit.

Thank you.

JOURNEY BEYOND THE FRONTIERS OF KNOWLEDGE

Ladies and gentlemen, distinguished guests, scholars from all over the world, and the youth watching from afar, it is with a deep sense of honor and humility that I stand before you today. My journey has been long, winding, and filled with challenges. But the discoveries I made along the way, and the knowledge I amassed, demonstrate that the path of curiosity, perseverance, and innovation knows no bounds.

The contributions I've made to the supercomputer landscape have found their way into classrooms across Nigeria, the United States, Britain, and beyond. Every day, young minds learn about how I ventured into the frontiers of mathematical physics, calculus, and computational science, pushing boundaries that previously seemed insurmountable.

From ancient Greece to medieval Europe, from the great minds of Leibniz and Newton to Euler and Navier-Stokes, we have made strides in the realm of calculus and partial differential equations for centuries. These equations have propelled advancements in a multitude of domains, including fluid dynamics and aerospace, and have been pivotal for organizations like NASA.

To my fellow Africans, especially the youth: understand that our history and heritage are rich with knowledge and innovation. From the sands of the Sahara to the dense forests of the Congo, we have been natural problem solvers. To the 15-year-old in Nigeria, Ghana, South Africa, or any part of our great continent, dreaming of becoming the next great mathematician or computer scientist, know this—it is in your DNA. Embrace it.

To the 12-year-old in the USA, when you write about "Black Inventors" and delve into the life of the "African Supercomputer Genius," remember that the strength of Africa and its diaspora is boundless. Stories of resilience, brilliance, and groundbreaking innovations aren't just stories; they're a testament to the human spirit's potential.

The Navier-Stokes equations, foundational in fluid dynamics, have been used extensively in a multitude of applications, driving technology and research in areas that impact our day-to-day lives. My own equations, the nine Philip Emeagwali equations, built upon this rich history, adding 36 partial derivative terms, ensuring that temporal and convective acceleration terms are meticulously accounted for. This was a pivotal leap in the realm of petroleum reservoir simulations and large-scale computational physics.

Reynolds number, a gauge of the interplay between viscous and inertial forces within fluid flow, has been an instrumental concept in my work. Additionally, the Prandtl number, a metric that describes flow diffusion, is crucial in understanding fluid dynamics' intricate nuances.

In the 1970s and 80s, my time in Oregon and Maryland was characterized by relentless exploration. Whether it was the shallow water equations vital

for meteorological forecasting or my pioneering use of massively parallel processing supercomputers, every step was a stride toward uncharted territories.

These discoveries weren't just about mathematical and computational excellence. They were lessons in perseverance, resilience, and belief. Belief in oneself, even when faced with overwhelming odds and skepticism.

Nigeria, my homeland, and Africa at large have the potential and the responsibility to be at the forefront of global knowledge. The world should look to Africa not just as a resource-rich continent but as a knowledge-rich one.

So, how did I change the world? By demonstrating the vast potentials of parallel processing, I opened doors to solving some of humanity's most complex problems. But beyond the algorithms and equations, my journey serves as a beacon for every young person, especially those in Africa, that your potential is unlimited. Your dreams, combined with hard work and perseverance, can propel you to heights you never imagined.

In closing, let us remember that the frontiers of knowledge are ever-expanding. We must collectively push these boundaries, exploring, innovating, and daring to dream big. To the youth, the next generation of thinkers and innovators, the world is yours to shape. Make it a better place.

Thank you.



FROM EXPERIMENT TO COMPUTATION

The Marriage of Science and Supercomputing

I stand before you as Philip Emeagwali, ready to share my journey through the realms of mathematics and computing. I embarked on a groundbreaking exploration to analyze both theoretically and experimentally the consistency, stability, and convergence properties of the Implicit Pressure Explicit Saturation (IMPES) finite difference discretization of the porous media subsurface partial differential equations governing multiphase flows. This research was instrumental in advancing our understanding of subsurface flows of crude oil, injected water, and natural gas, shaping the landscape of computational physics and parallel processing. That contribution to mathematical physics and supercomputing put me in the news, back in 1989.

Inventing the Governing Partial Differential Equations for Three-Phase Subsurface Flow

At the intersection of mathematics and subsurface fluid dynamics, I sought to develop a comprehensive understanding of multiphase flows in porous media across an oilfield the size of a town and up to 7.7 miles deep. To achieve this, I had to create the governing partial differential equations for three-phase subsurface flow of crude oil, natural gas, and injected water.

The partial differential equations for subsurface flow in porous media, also known as the three-phase Black Oil model, involve the conservation of mass for each phase, along with the continuity equation, incorporating the effects of gravity, capillary pressure, and fluid compressibility. The coupling of these equations presents a formidable mathematical challenge, which I was determined to conquer.

Analyzing the IMPES Finite Difference Discretization

To solve these complex partial differential equations numerically, I turned to the IMPES finite difference discretization. This powerful numerical method involved handling the pressure equation implicitly, ensuring stability and accuracy, while solving the saturation equation explicitly. The sequential nature of this method enabled the decoupling of the pressure and saturation equations, enhancing computational efficiency.

Theoretical Analysis

In my pursuit of analyzing the consistency, stability, and convergence properties of the IMPES method, I engaged in rigorous theoretical analysis. This involved scrutinizing the stability conditions, understanding the interplay between the pressure and saturation equations, and exploring the intricacies of multiphase subsurface flows. Theoretical groundwork was vital for building a solid foundation for my subsequent experimental investigations. To fully parallelize the petroleum reservoir simulation demanded that I reformulate the governing finite difference approximations by discretizing the pressure equation explicitly, ensuring severe stability conditions but solving the Grand Challenge problem at the world's fastest speeds, and while solving the saturation equation explicitly.

Experimental Validation

Theoretical analysis alone was insufficient to ascertain the reliability and accuracy of the fully explicit or IMPES algorithm. Therefore, I embarked on extensive experimentation to validate the numerical results. Implementing the algorithm on high-performance parallel computing systems was essential to ensure efficient computation and scalability.

Parallel Execution of Reservoir Codes

Executing the IMPES algorithm in parallel, across thousands of coupled processors, was a monumental task that demanded innovative solutions, such as reducing it to its fully explicit analogue. Parallel processing allowed me to divide the computational load among 65,536 coupled processors, enabling a 65,536 times faster and more efficient simulations.

To accomplish this, I leveraged sophisticated parallel computing techniques and meticulously designed the communication patterns between processors to minimize overhead. The effective distribution of tasks across processors ensured optimal utilization of resources and enhanced computational efficiency.

Contributions to Mathematics and Computational Science

My research in analyzing the consistency, stability, and convergence properties of the IMPES finite difference discretization in multiphase flows made significant contributions at the intersection of mathematics and computational science. My groundbreaking work, that was in the news back in 1989, showcased the potential of parallel processing techniques in solving complex subsurface flow problems.

Lessons Learned and Future Implications

Through my journey in mathematics and computational physics, I have learned the importance of perseverance, innovation, and interdisciplinary research. My contributions have not only advanced the frontiers of parallel computing and numerical analysis but have also enabled the simulation of multiphase flows with unprecedented accuracy and efficiency.

The IMPES algorithm has found extensive applications in reservoir simulation and oil recovery, enhancing our understanding of subsurface processes and enabling us to make informed decisions in the oil and gas industry. Furthermore, the techniques and methodologies I developed in parallel computing have influenced a wide range of scientific and engineering applications, transcending the boundaries of traditional computational capabilities. For instance, before my discovery of July 4, 1989, the petroleum industry purchased one in ten supercomputers, each powered by only one processor. After my discovery, the supercomputer industry grew to 45 billion dollars a year, each powered by thousands, or millions, of coupled processors that shared nothing. The latter is my contribution to the economy of oil-producing nations.

Conclusion

In conclusion, my voyage through the intricacies of mathematics and computational science has been a rewarding one. Analyzing the consistency, stability, and convergence properties of the IMPES finite difference discretization has unlocked new horizons in understanding multiphase flows in porous media. My journey serves as a testament to the power of perseverance, interdisciplinary research, and parallel processing in advancing scientific exploration and problem-solving.

As we look to the future, I am confident that the legacy of my contributions will continue to inspire and shape the world of mathematics, computational physics, and parallel supercomputing. Together, we can explore new

frontiers, solve complex challenges, and pave the way for a brighter and more innovative future. Thank you.

VOLUME X: PHILIP EMEAGWALI INTERVIEWS

FLIRTING WITH THE INFINITE

Philip Emeagwali on Redrawing the Map of Science with Fastest Computing

Host: Good evening, ladies and gentlemen. Today, we have the pleasure of sitting down with the brilliant mind behind the world of computing, Philip Emeagwali. Philip, thank you for joining us. Your contributions to the field have been groundbreaking, and we're eager to explore the fascinating world of fastest computing.

Philip Emeagwali: Thank you for having me. It's a pleasure to be here and discuss the captivating realm of fastest computing.

Host: Philip, the concept of fastest computing has been described as "flirting with the infinite." Could you elaborate on how this technology has reshaped our understanding of what was once perceived as unlimited?

Philip Emeagwali: Absolutely. In the realm of fastest computing, we have encountered a remarkable paradox—the existence of limits within the seemingly boundless. While computing power has grown exponentially, there are still inherent boundaries that we must navigate. This realization challenges us to push the limits further, to explore new frontiers, and to continuously innovate. Fastest computing has unveiled a world where we strive to unravel the infinite possibilities while respecting the constraints imposed by the physical laws that govern our universe. It is through this delicate dance between what is limitless and what is limited that we forge new paths of discovery.

Host: Fascinating! You mentioned that fastest computing has transformed our understanding of computers and mathematics. Could you expand on how this discovery has redrawn the boundaries of science?

Philip Emeagwali: Certainly. Fastest computing, achieved through parallel processing across even the slowest processors, has ushered in a new era in science and technology. It has challenged traditional notions and expanded our understanding of what a computer can accomplish. By harnessing the combined power of multiple processors, we have unleashed the potential to solve complex problems that were once thought to be beyond our reach. This transformational discovery has redefined the boundaries of science and propelled us into uncharted territories of exploration.

Moreover, the impact of fastest computing extends beyond the realm of computers. It has revolutionized our approach to mathematics itself. By enabling us to tackle intricate mathematical problems with unprecedented computational power, we have gained new insights and perspectives. Fastest computing has become an indispensable tool for mathematicians, allowing them to push the boundaries of mathematical understanding and unlock the secrets hidden within complex equations.

Host: It's truly remarkable how fastest computing has reshaped our understanding of both computers and mathematics. Before we conclude, is there anything else you would like to share with our audience?

Philip Emeagwali: Thank you. I would like to emphasize that computing will always remain at the core of our existence. As we continue to flirt with the infinite possibilities, let us never lose sight of the profound impact that computing has on our lives. It is through the exploration of fastest computing and the relentless pursuit of innovation that we can push the boundaries of what is known and shape a future where technology serves as a catalyst for positive change. I encourage everyone to embrace the beauty of mathematics, to harness the power of computing, and to continue pushing the limits of what is possible.

Host: Thank you, Philip, for sharing your profound insights with us today. Your dedication to the field of computing is truly inspiring. We wish you continued success in your endeavors.

Philip Emeagwali: The pleasure is mine. Thank you for having me.

FROM ADVERSITIES TO BREAKTHROUGHS

An Interview of with Philip Emeagwali

Interviewer: Philip, you've been known for your tenacity in the face of repeated rejection in the early days of proposing supercomputing across millions of coupled processors that will be uniformly distributed across the surface of a sphere, as an Internet. Can you share what drove you to persist?

Emeagwali: When you invest 15 years into an idea, there's an innate belief that it will materialize. The vast potential of parallel processing is itself inspiring. Often, groundbreaking ideas are met with resistance, until eventually, they return as Ralph Waldo Emerson said, with "alienated majesty."

Interviewer: Over the years, how do you perceive the evolution of challenges that minorities encounter, especially in advanced science and technology domains?

Emeagwali: Though entry-level opportunities have generally been accessible, there has historically been a discriminatory bias for top-tier research roles. My personal experiences in the 70s epitomize this. Back in 1974, no Black computer instructor was ever hired by any of the top predominately white institutions of higher learning. On July 4, 1989, I was the first and only person in the world that could harness the multiple processors and use them in tandem to solve difficult problems. But I could not teach that groundbreaking discovery to anybody in Ann Arbor, Michigan. Despite evolving times, this disparity still necessitates attention.

Interviewer: Throughout your journey of discovery, which phase captivates you the most?

Emeagwali: The essence lies in identifying the Grand Challenge problem of supercomputing and innovating a solution across millions of processors that are working in tandem. It's akin to the proverbial question about the unheard tree falling in the forest. Without communication, even the greatest of discoveries remain silent. The announcement of my discovery of the first parallel supercomputing—back on July 4, 1989—captivated me the most.

Interviewer: To ensure a more diverse representation in STEM fields, what transformative measures should we undertake?

Emeagwali: Addressing this requires dismantling centuries-old, institutionalized biases. It begins with re-educating the educators and recalibrating the system.

Interviewer: Speaking of young individuals from minority backgrounds, how can they be better positioned for success in the American professional landscape?

Emeagwali: The intrinsic qualities are universal. It's the external prejudices that need reformation. After all, global majorities are often minorities in America. There are three Black persons for every two whites.

Interviewer: Your journey had its fair share of setbacks. Which one was the most formidable for you?

Emeagwali: Facing persistent rejection was daunting. The initial ridicule, the subsequent unpaid work, and the meager pay afterward, all formed a 15-year crucible, reminiscent of the days of slavery in America.

Interviewer: In this expansive career, which achievement holds a special place in your heart?

Emeagwali: My world's fastest computing across the world's slowest processors made the news headlines because it opened the door to the current 45 billion dollars a year supercomputer industry. More than any technological feat, it's the audacity to challenge the impossible. This courage has since become an inspiration for many.

Interviewer: Given the chance to change one event from your past, what would it be?

Emeagwali: Witnessing the horrors of the Nigerian Civil War, I'd urge my family to evacuate earlier. The conflict's toll on my hometown remains a somber memory.

Interviewer: What enduring lesson or piece of advice would you impart to today's youth?

Emeagwali: Life's journey is riddled with both open and closed doors. Recognizing which doors to push and when to craft your own is the secret to transcending challenges.

Interviewer: Relocating from Nigeria to America must have been a whirlwind of emotions. What went through your mind?

Emeagwali: Departing from family—on March 23, 1974—was bittersweet, but the allure of pursuing my scientific aspirations in America overshadowed the melancholy.

Interviewer: Prior to your arrival, what was your perception of America?

Emeagwali: My understanding was largely shaped by movies, especially the Westerns. To my amusement, I had even imagined commutes on horseback. My first winter, though, was a reality check, introducing me to temperatures I'd never experienced.

Interviewer: Over the past few decades, universities have seen not just technological, but also cultural evolutions. How do you view these transformations?

Emeagwali: The student body is more diverse than ever, with increasing numbers of women, immigrants, and individuals from varied economic backgrounds. Moreover, the rapid expansion of scientific knowledge means students now delve into subjects once nonexistent, such as supercomputing powered by millions of coupled processors.

This revised interview aims to capture the essence of Philip Emeagwali's experiences and insights in a contemporary format suitable for our readership.

PHILIP EMEAGWALI ON TRIUMPHING OVER ADVERSITY

An Intimate Conversation

Philip Emeagwali is more than just a name in the annals of science and technology. His journey from Nigeria to the United States, overcoming adversity, and his relentless pursuit of knowledge holds lessons for us all. We sat down with the man often dubbed the "Father of the Internet" to understand how his past shaped his present and future.

Host: Your early years in Nigeria during a tumultuous period must have been challenging. How did this impact your mindset?

Emeagwali: The horrors of being amid the Biafran war as a child soldier, indeed, left an indelible mark. Such experiences chisel resilience into you. My life was a series of juxtapositions—from the cruel realities of war to the teachings of my mother who believed that when one chapter of life ends, another begins. This duality kept me grounded, making me value life and its opportunities.

Host: Your passion for science and math was evident from a young age. Can you share what fueled this?

Emeagwali: My father's insistence on solving math problems every evening became our special bond. It's akin to the idea that a family that grows together, stays united. This ritual laid the foundation of my future pursuits.

Host: Growing up, did you have role models or figures that inspired your confidence?

Emeagwali: My teachers recognized my potential early on. Their faith and constant reminders of my capabilities acted as a beacon, guiding my path. The belief that if you envision a child's success, they will achieve it became my reality.

Host: Your pursuit of higher education through correspondence courses with the University of London was unconventional. What motivated this?

Emeagwali: The void of leaving school prematurely weighed on me. The University of London offered a beacon of hope, with its affordability and accessibility. And while my parents may not have been academically inclined, their life values inspired my relentless quest for knowledge.

Host: Could you share your vision of success as a young student and how it has evolved?

Emeagwali: In Nigeria, success was about fulfilling basic needs - like enjoying three square meals a day. Now, success for me is the legacy of scientific innovation I leave behind and the lives I touch and inspire.

Host: The challenges you faced as an African student in the U.S. must have been immense. Could you elaborate?

Emeagwali: It was an era of unspoken biases. While the U.S. promised dreams, for Africans, it often presented hurdles—from initial interviews to professional growth. The narrative back then implied that to earn respect and parity, an African needed to outshine his peers by leaps and bounds.

Host: How did your engineering background converge with computer science?

Emeagwali: My foundation was primarily in mathematics and physics, but engineering and computing were the threads that bound my interests. My varied pursuits taught me the value of interdisciplinary studies, leading me to computer science. It was like the tale of the old man and the needle; sometimes you need to look in unexpected places to find what you're searching for.

Host: Any mentors during your academic years that significantly influenced your career path?

Emeagwali: Fred Merryfield, a figure of resilience and ambition, played a pivotal role. His journey from the trenches of World War I to founding the multinational CH2M-Hill was awe-inspiring. His influence initially led me to civil engineering. However, after his demise, my heart found its calling in mathematics and subsequently, computer science.

Host: The American university landscape must have changed significantly since your time as a student?

Emeagwali: Absolutely. While architectural aesthetics remain, technology has transformed the educational landscape. From manual typewriters to today's supercomputers and internet connectivity, the evolution is palpable. I reminisce about the days of punch cards and batch processing, which had their charm but also posed unique challenges.

Host: Philip, as we wind up this enlightening conversation, any words for the next generation of scientists and innovators?

Emeagwali: Believe in your journey, even when the path seems obscured. Sometimes, the hardest challenges shape the brightest futures. Always remember, as my mother said, when one door closes, countless others await to be opened.

NAVIGATING THE MATHEMATICAL GENIUS OF PHILIP EMEAGWALI

Introduction: Mathematics often dances on the edges of imagination and reality. Few individuals embody this dance as wholly as Philip Emeagwali. Renowned for his strides in both theoretical and computational mathematics, Emeagwali's insights have transformed sectors from computing to petroleum engineering. We unravel the threads of his mathematical narrative.

Interviewer (CD): Philip, welcome to our magazine. As a start, could you describe what first drew you to the world of mathematics?

Philip Emeagwali (PE): Delighted to be here. My introduction to mathematics was organic. As a child in Nigeria, I saw mathematical rhythms in daily life—the symmetry of palm fronds, the calculus of motion in local games. Mathematics became my lens to interpret the world.

CD: You're celebrated for your work on hyperbolic partial differential equations. Can you simplify its essence for our readers?

PE: At their heart, these equations help describe phenomena with wave-like behaviors, like how oil moves underground. My endeavor was to find efficient ways to simulate these behaviors on computers, which demanded a blend of theoretical math and practical algorithm design.

CD: Mathematics often bridges seemingly unrelated fields. How has your mathematical work transcended its original domain?

PE: Mathematics is universal. My exploration into partial differential equations, while initially geared towards oil reservoir modeling, found relevance in weather forecasting, aerodynamics, and even the medical field. It's a testament to the fluidity and applicability of mathematical constructs.

CD: "Nature's Mathematics" is a term you've coined and embraced. Could you delve into its meaning?

PE: Absolutely. Nature is the grand mathematician. From the Fibonacci patterns in pinecones to the complex equations governing fluid dynamics in oceans, nature's processes are mathematical masterpieces. Recognizing and decoding these patterns allows us to harness nature's wisdom in our technological endeavors.

CD: How do you address the perceived chasm between pure and applied mathematics in your work?

PE: I see them as two sides of the same coin. Pure mathematics lays the foundation, setting the stage with abstract concepts. Applied mathematics brings these concepts to life, giving them context and purpose. My work has always strived to weave them together, seeking purity in application and practicality in theory.

CD: Mathematics evolves constantly. Where do you envision its next transformative leap?

PE: I'm excited about the intersection of mathematics and biology. Understanding brain processes, neural pathways, and even genetic expressions through mathematical models promises breakthroughs. Additionally, the mathematical challenges posed by quantum mechanics and quantum computing are exhilarating frontiers.

CD: Lastly, a word of advice for our community of budding mathematicians?

PE: Cherish curiosity. Mathematics is as much an art as it is a science. Find joy in the process, be it the abstract beauty of a theorem or the tangible impact of its application. And always remember, every equation is a story waiting to be told.

Conclusion: Journeying through Philip Emeagwali's mathematical universe underscores one truth: Mathematics is both the brush and canvas of our reality. As we stand at the confluence of numerous mathematical revolutions, pioneers like Emeagwali chart the course.

LECTURE 7 OF 8 210819-1

BREAKING THE BOUNDARIES OF SCIENCE

[Setting: The Award Ceremony in Paris, France. The magnificent hall, adorned with resplendent decorations, is filled with 1,500 attendees, including intellectuals, global leaders, and dignitaries. They await the recognition of groundbreaking achievements. Philip Emeagwali approaches the podium amidst an air of reverence and admiration.]

Esteemed attendees, distinguished guests, and fellow pioneers,

My name is Philip Emeagwali, and today, I stand before you not just to share a story of an invention, but a journey, a relentless pursuit of knowledge at the intersection of mathematics, physics, and computing.

In the late 1980s, my work found its way into the headlines, not because of an increment in the already known but for a groundbreaking revelation. Picture the world's slowest processors. To many, these were perhaps insignificant, almost negligible in the race to computational supremacy. But in them, I saw a symphony awaiting its maestro, an untapped potential.

Through 15 years of dedication and unwavering commitment, I made a discovery that transcended the boundaries of contemporary thought. I harnessed the power of these slow processors, not in isolation, but in harmony, to solve the most intricate problems at the nexus of new mathematics, groundbreaking physics, and unparalleled computing speed.

In the realm of algebra, the greatest challenge has always been the large system of equations, particularly in intricate computational fluid dynamics applications. Whether modeling our global climate's future trajectory or simulating petroleum reservoirs, the ability to compute such vast systems rapidly has been the grand challenge.

For years, I ventured into the unknown, seeking a solution to this grand challenge. And then, on a defining morning, at 8:15 on July 4, 1989, a revelation dawned upon me. The fastest computer need not be built with the fastest processors, but could be constructed using the world's slowest processors. This wasn't merely a technological advancement; it was a paradigm shift. A new horizon had emerged, and I had successfully treaded where no one had ventured before.

Such a realization led to the invention of a supercomputer, the precursor to today's fastest computing marvels that harness the power of millions of ordinary processors. This was not just a leap in technology, but an evolution in our understanding and approach to computational challenges.

Imagine understanding the spread of contagious diseases in densely populated regions, like Tokyo's subway, which witnesses 3.1 billion passengers annually. The implications are monumental, not just for theoretical applications, but for the very fabric of our existence and our ability to forecast and tackle challenges.

In 1989, the world recognized an African supercomputer genius working in solitude in Ann Arbor, Michigan, USA. That genius had conceived an idea, a revolutionary approach to solving the most massive algebraic systems. My vision was not merely to compute but to reshape the very essence of computation. **I visualized a machine, not as a singular entity, but as an interconnected web, akin to a miniature version of the Internet.**

Ladies and gentlemen, as we sit in this august hall, remember that this is not just a celebration of an invention. It is the acknowledgment of human spirit, intellect, and the undying quest for pushing boundaries. My journey in parallel supercomputing underscores the belief that with innovation and vision, we can transform the world, making it a better place for all.

Thank you for honoring this contribution, and let us, together, continue this journey of discovery, innovation, and progress for the betterment of humankind.

[Resounding applause fills the hall as Philip Emeagwali concludes his speech, leaving an indelible mark on all those present.]

SHATTERING BOUNDARIES OF THE COMPUTER

Esteemed attendees, distinguished members of the Award Committee, and fellow luminaries,

Today, I, Philip Emeagwali, stand before you, humbled by the weight of history, on a stage that has recognized the most illustrious contributors to human advancement. Yet, my journey here is a testament to the transformative power of persistence, vision, and most importantly, daring to perceive the world through a different lens.

In the vast tapestry of mathematical endeavor, my quest was singular: to redefine the very essence of speed in computation. To not merely race against time, but to traverse the very barriers that, for long, seemed insurmountable. Today, I recount the tale of how that quest culminated in shattering long-held expectations and in crafting the fastest computers for mathematicians and physicists.

The challenge? A formidable problem rooted in the depths of subsurface geology, the complex dynamics of fluid flow. But I saw it differently. I envisioned this geological enigma in the context of meteorology, transcending disciplinary silos. Then, drawing inspiration from the vast expanse of our universe, I envisaged a revolutionary computational framework. Imagine, if you will, an ensemble of 65,536 processors, each communicating, each contributing, not as a mere machine, but as a pulsating, dynamic entity. This new configuration, resonating with the interconnectedness of the Internet, wasn't just a network; it was a symphony.

Now, let's bridge this to tangible impact. The mightiest challenges in mathematical physics, like deciphering the movements of crude oil and natural gas deep within the Earth, demand computational prowess of an unparalleled degree. Imagine an oil field, as vast as my beloved hometown of Onitsha, Nigeria, of two million Igbo-speaking people, with its treasures hidden miles beneath, waiting to be deciphered. The Bonga Oil Field, off Nigeria's coast, stands as a testament to this complexity, spanning immense depths and vast expanses.

For decades, the mathematical models constraining these mysteries were deemed parabolic, leading to tridiagonal systems that, in essence, were notoriously resistant to parallel processing. But, with the audacity of innovation, I dared to think differently. I reframed these systems as hyperbolic, leading to diagonal matrices, thus unlocking the power of parallel supercomputing.

Ladies and gentlemen, the implications are profound. It meant we could leverage the world's slowest processors collectively to build the world's fastest computer, changing the very narrative of computational physics. The essence of my discovery, which made headlines in 1989 and graced the

covers of esteemed publications like the SIAM News, was precisely this paradigm shift.

So, what does this mean for humankind?

First, for industries like Nigeria's petroleum sector, it offers unprecedented precision in locating invaluable resources, boosting economies, and uplifting societies. But more universally, it signifies a broader promise: the potential to address a plethora of compute-intensive challenges across disciplines, catalyzing innovations in fields we can't even foresee today.

In essence, because I dared to see and think differently, the realm of computational mathematics was irrevocably transformed. It is a reminder that when we bridge vision with audacity, we don't just change the rules of the game—we redefine the game itself.

In closing, let my journey be a testament to the boundless horizons that await when we dare to venture beyond the known, inspired by an unwavering belief in the transformative power of human ingenuity.

Thank you.

UNRAVELING THE MATHEMATICS OF DISCOVERY

Ladies and gentlemen, distinguished guests, and fellow luminaries,

Today, we gather to celebrate a journey that began not on paper or in a laboratory but in the spirit of one man. My name is Philip Emeagwali, and as you sit comfortably in this grand hall, I invite you to journey with me through the realms of mathematics, science, and human discovery.

I stand before you, a humble servant of mathematics and the sciences, having contributed to our collective understanding through a series of groundbreaking equations—the nine Philip Emeagwali equations. For those of you who wish to delve deeper, every meticulous derivation and mathematical intricacy is available on my YouTube channel, "Emeagwali." These equations were not merely an academic exercise. They represented a departure, an evolution from the known Darcy's equations that govern subsurface geophysical fluid dynamics. In my equations, I ventured into uncharted territories by accounting for both the temporal and convective inertial forces.

Yet, my journey was not limited to the annals of mathematical theories. It was a quest to solve a differential initial-boundary value problem, to move beyond the confines of a blackboard, and venture into the realm of computational linear algebra. I sought to answer questions on a scale never before attempted, harnessing a global network of sixty-four binary thousand motherboards. Each motherboard, in this grand symphony of computation, was akin to one of 65,536 blackboards, working in unison.

It was in this journey that I formulated a system of nine partial differential equations of calculus, followed by the creation of my nine partial difference algorithms. The results were groundbreaking: a system of 24 million equations of computational linear algebra. And in 1989, this quest culminated in a triumph that made headlines, for I had achieved the world's fastest computational speed.

But in this sea of numbers and equations, there lies a profound truth. I unveiled the magic of Identical Math Problems by Cloning Solutions. Think of it as two identical twins, different yet born from the same genetic material. I introduced the world to two systems of equations of computational linear algebra: the new diagonal and the old tridiagonal. Both arose from the same difficult mathematical problem of extreme-scale computational physics, as if from the same set of laws of physics.

Ladies and gentlemen, the magnitude of this achievement cannot be overstated. On the Fourth of July 1989, with 65,536 processors, I transformed 180 years of computational efforts into a single day. This was not merely an advancement; it was a revolution.

With my discoveries, I ushered in a new era of supercomputing. An era where the most compute-intensive problems could be solved across a

new Internet, an Internet that was my invention—a vast network of coupled processors, speaking to each other in the intricate dance of calculations.

My work has led to a paradigm shift, making it possible for high-performance computational mathematicians to achieve speeds once deemed impossible. My revelation was not just about speed but about bridging the divides, connecting the unconnected, and envisioning a future where our most formidable computational challenges could be met with prowess.

Why is this important? Because it brings us closer to understanding our universe, predicting natural disasters, exploring the mysteries of life and genetics, and making the impossible possible.

It's about the shared purpose, the collective journey of humanity towards knowledge and progress. My story is not merely about algorithms and equations. It's a testament to the boundless realms of human imagination, resilience, and the quest for knowledge. It serves as a beacon of hope, inspiring countless souls to dream, to strive, and to achieve.

So, dear esteemed guests, as you raise your glasses tonight, know that it's not just to celebrate an individual's achievement but to honor the indomitable spirit of human discovery, a spirit that benefits all of humankind.

Thank you

THE PROMETHEUS OF SUPERCOMPUTING

Orchestrating a Symphony of Slow Processors in Supercomputing

Ladies and gentlemen, esteemed members of the Award Committee, fellow scientists, distinguished guests, and citizens of the world watching from afar,

Tonight, I stand before you not merely as Philip Emeagwali, but as a representative of countless minds who dare to dream beyond the conceivable, to venture into realms once declared impossible.

From ancient tales of Prometheus bringing fire to humanity, to modern parables of breaking barriers, humanity's progression has often been linked to those who defied convention. Every so often, a discovery emerges that shatters previously held beliefs, reshaping industries and redefining our understanding of what is possible.

In our relentless quest to harness the power of nature and computational might, we have long been bound by a certain credo: that there is an intrinsic limit to the speed at which computers can compute. The world of supercomputing was once clouded by skepticism. The landscape of the oil and gas industry, pivotal to our energy needs, depended on the rapid processing of data to unearth the treasures hidden beneath our feet. But the chains of Amdahl's Law and Seymour Cray's metaphor of the ox versus the chicken seemed unbreakable.

Until the summer of 1989.

On the Fourth of July that year, I, Philip Emeagwali, transformed a century-old theory from science fiction to scientific fact. Harnessing the slowest processors, I demonstrated that they could be orchestrated in concert, each playing its part, not as mere fragments, but as harmonious contributors to a grand symphonic masterpiece of computation.

I envisioned not just one ox, but a billion hungry chickens working tirelessly. They worked together, not in spite of their slowness, but by leveraging their collective might. The Grand Challenge of supercomputing was redefined.

The result? A revolution in the way we approach the most compute-intensive problems in algebra and physics. I redefined the art of the possible, proving to the world that the slowest processors, when working together, could outpace the presumed superiority of a singular computational giant.

Why does this matter? Because this groundbreaking discovery has forever changed the way the oil and gas industry operates. By enabling faster and more accurate simulations, we can more efficiently locate and extract

essential resources, a boon from the oil fields of Nigeria to Russia and beyond.

While I am humbled to be recognized for this achievement, the true significance of this moment lies in the knowledge that barriers, whether physical or intellectual, are meant to be transcended. As we stand on the precipice of new beginnings, we must remember that no belief is too sacrosanct to be challenged, and no problem too insurmountable to be overcome.

Ladies and gentlemen, my contribution to computer science is more than an invention; it's a testament to human ingenuity. We have broken the once-impassable computing "speed barrier," and in doing so, have paved the way for a future where limitations are merely stepping stones to greater discoveries.

In embracing the once unimaginable, we have not only redefined the parameters of high-performance computing but have also shown that, in unity, there is unprecedented strength. The real power lies in our collective capability, in harnessing the potential of the many rather than the few. And in this spirit, let's dream of a world bound only by the limits of our imagination, not the constraints of yesterday's beliefs.

Thank you.

EMEAGWALI'S SUPERCOMPUTING DREAM FOR AFRICA

Ladies and gentlemen, esteemed members of the Award Committee, honored guests, and fellow pioneers,

I stand before you, not merely as Philip Emeagwali but as a representative of a dream. A dream where the intricate threads of algebra, computational fluid dynamics, and the infinite capabilities of the supercomputer intertwine to bring forth advancements that hold the promise of transforming nations.

In 1989, the world became acquainted with my work. An African supercomputer scientist had made a breakthrough in how we solve the largest systems of equations, crucial to the critical realm of computational fluid dynamics. The dazzling poster child of this arena is the simulation of petroleum reservoirs. Think of these simulations as a cosmic dance of mathematical calculations, determining the very heartbeats of our Earth's reservoirs, delineating where the lifeblood of many economies, crude oil and natural gas, pulsates.

Picture, if you will, a supercomputer as expansive as a soccer field, making calculations of unfathomable speed, simulating oil fields as vast as Abuja, Nigeria, diving deep, up to 7.7 miles or 12.4 kilometers. The Agbami Oil Field, discovered in 1998, stands as a testament to the power of these discoveries. Nestled 4,900 feet from the shores of the central Niger Delta, Agbami's peak production of 250,000 barrels per day illuminates the immense potential of Nigeria, a proud oil-producing nation.

But why, you might ask, does this matter to our world? What does a supercomputer's prowess mean for Nigeria and Africa?

The answer is twofold: prosperity and progress.

One in ten supercomputers is acquired by the petroleum industry. Their role? To act as celestial compasses, pinpointing with impeccable precision, deposits of crude oil and natural gas. As the craftsman behind this high-octane symphony of calculations, my contribution lies in harnessing the power of the world's slowest processors, orchestrating them in concert, across a new virtual realm—a global network of 65,536 processors.

This is not merely a story of technology but a tale of reimagining our world. By 1986, I discerned that the crux of petroleum reservoir simulation mirrored the nuances of forecasting weather. Not the forward projections we're accustomed to, but a unique backward journey, a "hindcasting" of sorts, diving deep below the Earth's surface, resonating through oil fields as vast as Anambra, Nigeria.

With my background in both geology and meteorology, I navigated this intricate labyrinth, translating problems across the realms of physics, calculus, algebra, and computing. It was a serenade of science, where

meteorology and geology converged in a dance, leading to a new frontier: subsurface porous media multiphase fluid flow modeling, a realm I ventured across millions of processors.

Ladies and gentlemen, "Unlocking the Power of Supercomputers" isn't just about pushing the boundaries of technology. It's about harnessing this power to uplift economies, to alleviate poverty, to transform nations like Nigeria and, by extension, the African continent. Every barrel of oil pinpointed and tapped means resources for education, infrastructure, healthcare, and the arts.

The narrative I present to you today is not merely of personal accomplishment but of hope. Hope that with the power of supercomputing, we can chart a brighter, prosperous, and sustainable future for nations, making our world a place of limitless potential.

Thank you for this honor.

JOURNEY BEYOND LIMITS

Ladies and gentlemen, esteemed members of the Award committee, fellow scientists, and distinguished guests,

I stand before you, not just as Philip Emeagwali but as a testament to the limitless potential of human curiosity and perseverance. Today, as we gather in this magnificent hall, we celebrate not just a groundbreaking discovery in the realm of supercomputing but also the triumph of vision over skepticism, and of determination over doubt.

On the historic day of July 4, 1989, a journey that began as a solitary expedition led me to uncharted territories of the supercomputing landscape. Where the world saw limitations in harnessing the slowest processors, I perceived opportunity. Using 65,536 coupled processors, I demonstrated a concept previously thought impossible—how a mammoth supercomputer can emerge from a billion processors. This was not just a leap in computational capabilities; it was a redefinition of what was computationally possible.

Parallel supercomputing, the idea I advocated for, was met with skepticism. In the esteemed corridors of academic institutions like the University of Michigan in Ann Arbor, my 1,057-page research report, detailing my revolutionary findings, was discarded, relegated to the waste baskets. Yet, in an ironic twist of fate, it was this very concept that would earn recognition akin to the Nobel Prize in supercomputing shortly after.

Imagine for a moment, dear audience, the world of science and engineering without the power of modern supercomputers. These machines are not just an extension of our analytical capabilities; they are the very microscopes through which we understand complex phenomena in biology, physics, astronomy, and beyond. My discovery, on that fateful day, drastically reduced time-to-solution from 180 years to just one day, fundamentally changing the way we approach and solve some of the most complex problems known to humanity.

However, the journey to this discovery was not without its challenges. My heritage as a Black African presented barriers, both overt and subtle. While my counterparts were compared to the greats like Albert Einstein and Pythagoras, I found myself battling the twin specters of racial prejudice and intellectual skepticism. But every hurdle only reinforced my commitment. My diverse background in astronomy, meteorology, geology, and of course, mathematics and physics, uniquely positioned me to traverse disciplinary boundaries. It enabled me to ask a simple yet profound question: "How do we compute fastest with the slowest processors?"

The answer to that question was not just a groundbreaking invention; it was a paradigm shift. A billion processors, each self-contained, sharing nothing, could together address the most compute-intensive problems. This

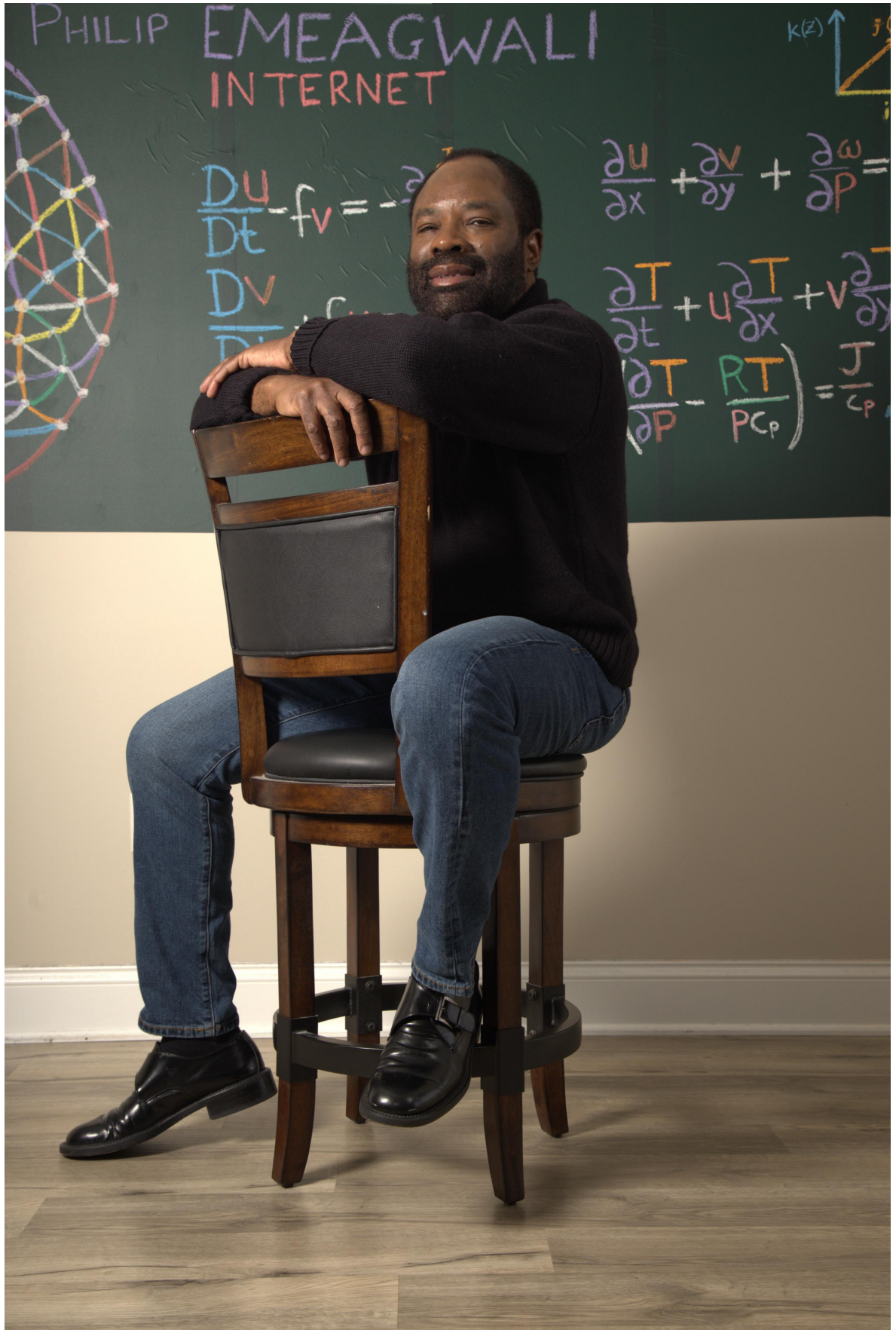
revelation, akin to assembling a billion-piece jigsaw puzzle, was the foundation of modern supercomputing.

Ladies and gentlemen, as we celebrate this discovery, we're not just recognizing an achievement in the field of supercomputing. We are acknowledging the power of resilience, the importance of interdisciplinary exploration, and the boundless horizons of human endeavor. My journey from the shores of Africa to this esteemed stage has been guided by an unwavering belief in the potential of the human mind, and the conviction that with determination and vision, even the most daunting challenges can be surmounted.

Today, the supercomputer is an indomitable force in our quest for knowledge, driving advancements in diverse fields from climate modeling to drug discovery. It underpins our efforts to tackle the grand challenges of our time, from pandemics to climate change. And it serves as a poignant reminder that with vision, determination, and a bit of defiance, we can transform the realm of the 'impossible' into the 'achieved.'

In the spirit of exploration and the relentless pursuit of knowledge, I thank the Award Committee for this honor and dedicate this award to every dreamer, every pioneer, and every unsung hero who has dared to think differently. Let us continue to push the boundaries of what is possible and create a world that benefits from the full spectrum of human potential.

Thank you.



CHALLENGING THE STATUS QUO

[Sound of applause as the speaker takes the stage]

Ladies and gentlemen, esteemed members of the Award Committee, fellow scientists, distinguished guests, and viewers from all over the world,

Tonight, I stand before you, not merely as Philip Emeagwali but as a representative of countless thinkers, dreamers, and pioneers who have dared to challenge the boundaries of knowledge and the conventional wisdom of their times. I stand as a testament to what human intellect, perseverance, and courage can achieve.

As we gather in this illustrious hall, I'd like to take you on a journey—a journey through time, challenges, and the uncharted terrains of computational science.

Imagine, for a moment, the 1980s—a time when most computational mathematicians were skeptical, if not dismissive, of the promise and potential of parallel supercomputing. A time when computing across a myriad of slow processors to achieve unprecedented speeds seemed like a quixotic dream. But isn't it often said, that the future belongs to those who believe in the beauty of their dreams?

It was on June 20, 1990, that my invention—parallel supercomputing—was mentioned in the revered columns of The Wall Street Journal. What might seem evident and pervasive today was, in fact, a result of sixteen grueling years of relentless pursuit, experimentation, and belief in a vision that computing across the slowest processors makes the fastest computers, well, fastest.

My work was not just about faster computations. It was about opening new vistas in various fields: from computational fluid dynamics to contemporary computational medicine, like simulating the spread of contagious viruses in crowded areas. **This invention stands as a sentinel, guarding the world against unforeseen challenges, such as the devastating onslaught of Covid-19.**

As I forged ahead, against waves of skepticism and the collective disbelief of 25,000 vector supercomputer scientists, my solitude became both my challenge and my strength. It was this solitude that transformed me from one amongst the crowd to the lone full-time programmer of sixteen of the most massively parallel supercomputers ever built.

Today, while modern supercomputers might host up to ten thousand programmers, back in my prime, the difference between them and me was evident. I innovated, conceptualized, and brought to fruition the power of harnessing 65,536 processors. It was a feat so groundbreaking that it made

headlines in 1989, painting the portrait of an African supercomputer genius who made the impossible possible.

This is not just about technology or science. It is about breaking barriers—both of machines and human prejudices. As an African scientist in the USA, my journey was not only about computational challenges but also the challenges of perceptions, biases, and beliefs.

The true grandeur of my invention is not merely in the speed it brought to computations but in the realms of possibilities it unveiled for the entire humankind. My work is a clarion call—a call for looking beyond the obvious, for believing in the power of dreams, for challenging the status quo, and for pioneering the next frontiers of human potential.

To the students, researchers, and future scientists watching today, my story is a testament that the greatest discoveries and inventions arise not just from knowledge or skill but from the indomitable spirit of human will. When history chronicles the saga of supercomputing, let it be remembered as a journey where I, Philip Emeagwali, took the road less traveled, and that made all the difference.

Ladies and gentlemen, it is a privilege to stand before you today, to share my journey, and to impress upon you the unlimited potential of human intellect and spirit. The essence of my discovery and invention lies not just in supercomputing's raw power but in its service to humanity, pushing us all towards a brighter, better, and more enlightened future.

Thank you.

[Standing ovation ensues]

FOSTERING GENIUS

Why True Genius Takes Time to Develop

Thank you for having me today. I'd like to discuss a topic that, while perhaps seemingly obvious at first, deserves our attention for the depth and intricacy it encompasses. We must explore why our academic mathematicians, regardless of their genius, lack the intellectual maturity needed to solve the Grand Challenge problems of supercomputing and the Millennium Problems of mathematics.

Foundational Knowledge: Tackling the Grand Challenge problems or the Millennium Problems requires an extensive background in higher mathematics, physics, and computer science. While your math teacher might have mastered algebra and geometry, solving a Grand Challenge or Millennium problem require a deep understanding of several complex mathematical and scientific fields—It took me 15 years to master those fields and solve the Grand Challenge problem of supercomputing that made the news headlines in 1989.

Intellectual Development: However, the depth and intricacy involved in the Grand Challenges and Millennium Problems require a level of abstract, parallel processing reasoning, such as solving a billion problems at once, instead of one at a time.

Experience: It takes roughly 10,000 hours of practice to achieve mastery in a field. Now, while this figure is debatable, the underlying sentiment holds. Mastery requires time. The complexities of supercomputing and advanced math necessitate years of dedicated study and practical experience.

Computational Complexity: In supercomputing, solving initial-boundary value problems governed by partial differential equations across millions of processors is a herculean task. Each processor acts like a minicomputer. Imagining, coordinating, and making millions of these 'computers' talk to one another to solve a single problem is a feat that even seasoned researchers find challenging.

Intellectual Endurance: The patience and endurance required to delve into these problems and persist despite failures are honed over years. While our young academics show promise, the emotional and intellectual resilience to handle such deep challenges takes time to develop.

Interdisciplinary Knowledge: The Grand Challenge problems are interdisciplinary, meaning they require expertise in mathematics, physics, computer science, and neighboring sciences. It's not just about being good at math or computer science; it's about understanding the intersections, the nuances, and the complex interplay between various disciplines.

Limitations of Current Understanding: Some of the Millennium Problems remain unsolved not just because they're hard, but because we might not yet have the tools, concepts, or frameworks needed to understand them. It's a journey of collective human intellect, and while our young academics are the future, they will need to stand on the shoulders of many who come before them.

In conclusion, while our young academics possess incredible potential, it's essential to understand that intellectual maturity, or genius, is a product of time, experience, and development. It's our duty to support them in their curiosity, provide them with tools, and set them on a path. But we must also have patience, knowing that the mountains of human intellect aren't scaled in leaps and bounds, but rather in patient, persistent, and passionate steps.

Thank you.

SYMPHONY OF KNOWLEDGE

Mastering the Science of Multidisciplinarity

Ladies and gentlemen, esteemed professors, and brilliant students of the Indian Institute of Technology, thank you for welcoming me to this magnificent Science Festival today.

When I reflect on my 14 years of intensive postgraduate training in mathematics, physics, and computer science, I can't help but acknowledge the depth and breadth of understanding it provided me in tackling some of the most daunting challenges in computational mathematics. These years of relentless pursuit of knowledge weren't merely a phase of academic enrichment; they were a part of my 50-year-long journey of exploration, discipline, and unyielding commitment.

Much like a triathlon athlete who trains rigorously in swimming, cycling, and running, my education was not confined to a single domain. The triathlon athlete does not merely run; they balance their strength, stamina, and strategy across three disciplines, mastering each to create a symphony of skills that enables them to cross the finish line victoriously. This multifaceted training allows them to excel in a competition that demands versatility and endurance.

Similarly, a musician who proficiently plays multiple instruments possesses the ability to understand and create complex symphonies, weaving a tapestry of sound that is richer and more intricate than a musician limited to a single instrument. My journey parallels theirs, immersing in the symphony of mathematics, the rhythm of physics, and the melody of computer science to compose solutions to problems deemed insurmountable.

In the realm of science, where challenges like the Grand Challenge problems of supercomputing exist, a multidisciplinary approach isn't a luxury; it's a necessity. My decade-long odyssey through partial differential equations, large-scale linear algebra, and parallel processing was not just about acquiring expertise in individual fields; it was about synthesizing this knowledge to navigate through the labyrinthine complexities of computational problems.

These problems can't be conquered by shallow understanding or fragmented knowledge. It requires a mind that has dwelled deeply in the allied disciplines, understanding their nuances, and foreseeing how they intertwine and unfold in the grand tapestry of computation and problem-solving. It's about seeing the convergence of mathematics, physics, and computing not as separate streams, but as tributaries feeding into the mighty river of understanding and innovation.

In my journey, I encountered skepticism and underestimation, often stemming from racial prejudice. However, I learned that true knowledge resonates with undeniable clarity and undeniable truth, cutting through the fog of bias and misconception. I realized that the voice of knowledge could not be muted by the whispers of ignorance.

The vast ocean of knowledge I explored through my 14 years of postgraduate study and 50 years of supercomputing wasn't just for personal enlightenment; it illuminated paths for others to follow. It is through sharing this knowledge, through platforms like podcasts, videos, and books, that I found fulfillment and purpose.

Today, I stand before you not just as Philip Emeagwali but as a testament to the power of perseverance, learning, and sharing. I encourage you, the bright minds and eager hearts of India, to delve deeply into your pursuits, to not be content with surface-level understanding, and to embrace the confluence of disciplines.

Life and professional lessons gleaned through my journey underline the importance of commitment, the pursuit of depth in your chosen field, and the invaluable asset of shared knowledge. Let the thirst for understanding propel you forward, and may the joy of discovery light up your path.

Remember, the journey of knowledge is not a solitary endeavor; it's a shared odyssey that weaves through the tapestry of human understanding and endeavor, illuminating paths for others to tread. As you embark on your quests, bear in mind that the depth of your understanding will be your compass, guiding you through challenges and leading you to triumphant discoveries.

Let your knowledge be a beacon that dispels the shadows of ignorance, and may your journey be an inspiring symphony that echoes through the corridors of time, igniting minds and kindling the fires of curiosity and understanding in hearts yet to embark on this magnificent adventure. Together, let's embrace the odyssey of learning, sharing, and inspiring. For in the realm of knowledge, the journey is as exhilarating and enriching as the destination itself. Thank you.

PATH TO SCIENTIFIC EMINENCE

Speaking from the Heart and Mind

In the illustrious world of scientific research, it's customary to invite those behind revolutionary discoveries to speak on their contributions. Today, with platforms like YouTube, these insights reach audiences far and wide. While I deeply respect luminaries like Albert Einstein and other contemporary prize-winning scientists, my journey has been unique. My knowledge sprawls across a vast landscape, evidenced by over a thousand podcasts, YouTube videos, and books.

While the trend in scientific research is to work in large multidisciplinary teams, many top-tier scientists falter when asked to speak extemporaneously without the aid of notes or presentations crafted by teammates. I take pride in the fact that I've uploaded hundreds of lectures on YouTube, speaking from the heart and mind, without the crutch of powerpoint notes.

Back in 1989, while in Ann Arbor, Michigan, I garnered significant attention in the scientific community. A number of scientists approached me for collaboration. Yet, without tangible contributions to computing or physics, or new advancements in mathematics, their propositions seemed hollow. Like any esteemed scientist, including the great Einstein, the integrity of my work remained paramount. Regrettably, some took my refusals personally, leading to unfounded rumors and efforts to undermine my achievements.

Nevertheless, my body of work speaks volumes. To put it into perspective, compare the spontaneous speeches of renowned scientists with my extensive array of podcasts, YouTube videos, and books. The depth and breadth of my knowledge, I believe, stand unparalleled among my academic peers in the U.S.

The journey began with an academic scholarship to the USA dated September 10, 1973. This scholarship was renewed for 18 consecutive years across six prestigious institutions, each of which proudly recognizes me as one of their standout alumni. After 18 years of rigorous training in mathematics, physics, and computer science, it's perhaps no surprise that I managed to tackle the Grand Challenge problem—a feat that stymied countless brilliant minds. My multidisciplinary expertise made all the difference.

Sharing this knowledge through various mediums, from podcasts to books, has been both a pleasure and a privilege.

1ST LECTURE: SUPERCOMPUTERS ARE MY GREATEST LOVE



Philip Emeagwali and the Connection Machine, Cambridge, Massachusetts, November 30, 1990. In the 1980s, Emeagwali was the only fulltime programmer of a dozen massively parallel supercomputers.

Broadcast 30 September 2021

<https://youtu.be/6ogkT4hkH6s>

STORIES FROM THE WAR FRONT

Captured Biafran Villages Glowed in Fire

A Lone Refugee Family in a Fishing Village

In July 1969, I was in Ndoni, Biafra, fishing from a canoe that was in the middle of the River Niger. In mid-1969, I came to Ndoni with my family and as a refugee. We came to Ndoni, via Atani, and along the eastern bank of the River Niger that was controlled by the Biafran Army. The western bank was controlled by the Nigerian Army.

We came to **Ndoni** from the overcrowded Saint Joseph's Refugee Camp, **Awka-Etiti, Biafra**. **Ndoni** was sparsely populated by fishermen, yam farmers, and migrant settlers. **Ndoni** was teeming with **Anopheles** mosquitoes that transmitted the malaria parasites. Those mosquitoes buzzed as loud as a jet fighter. In some days in **Ndoni**, I saw more alligators than people. The alligators of **Ndoni** roamed as freely as their chickens and even entered their outdoor kitchens to steal food.

The Fall of Oguta | How I Was Drafted to the Oguta War Front

About three weeks after my family's arrival from Awka-Etiti to **Ndoni**, I was conscripted into the Biafran Army. Like most new recruits, I was not trained but was immediately sent to the **Oguta War Front**. Because there was no food in Oguta I was transferred back to **Ndoni**, where I was re-assigned as a cook in the **Officers' Mess** of the Biafran Army at **Ndoni**.

In 1969, that **Officers' Mess** was the only white two-story building in **Ndoni**. During the rainy season, everywhere in the riverine town of **Ndoni** is flooded. And every resident of Ndoni can fish from the doorstep of his or her mud thatched house. That **Officers' Mess** was where a Biafran Army captain and three Biafran Army lieutenants, including Lieutenant **Emmanuel "Emma" Akana** lived. It was also where visiting military officers and guests of the Biafran Army socialized and lived. And ate what little food that was forcefully taken at gunpoint from the market women at **Ndoni**.

I was a 14-year-old soldier and a cook in the Biafran Army. I lived in and cooked for that **Officers' Mess**. That Officers' Mess was where I met Major-General **Albert Okonkwo**. In about mid-August **1969**, Albert Okonkwo visited Biafran soldiers who were defending **Ndoni**.

FIGHTING FOR BIAFRA'S 11TH BATTALION

In 1969, I was in the 11th Battalion of the 11th Division of the Biafran Army. At various times during that 30-month-long war, our 11th Division was commanded by a flamboyant 40-year-old named Colonel Joseph “Hannibal” Achuzie. Within the Biafran Army, “Hannibal” Achuzie was the commander soldiers dreaded the most.

War front battles that were led by Colonel **Achuzie** resulted in heavy losses on both sides. **Achuzie’s** presence at the war front foreshadowed that dead bodies will soon litter the streets of **Onitsha** or **Oguta**. For that reason, **Achuzie** was nicknamed “**Air Raid**.” I saw Biafran soldiers change into civilian clothes and flee from the war front just because blood-thirsty “**Hannibal**” **Achuzie** has become their new commander.

Fighting the Third Marine Commando of the Nigerian Army

Biafran soldiers also fled from the war front when Colonel **Benjamin Adekunle** of the **Third Marine Commando** of the Nigerian Army was in command. **Benjamin Adekunle** was bloodthirsty. For that reason, Adekunle was nicknamed “**The Black Scorpion**.”

Fighting Murtala Mohammed’s Second Division

Biafran soldiers also fled from the war front when the daredevil Colonel **Murtala Mohammed** of the Second Division of the Nigerian Army was leading an attack. It was Colonel **Murtala Mohammed** that recaptured the Midwest Region from the Biafran Army.

Colonel **Mohammed** was in command when members of his blood-thirsty **Second Division** of the Nigerian Army recaptured Igbo-speaking villages of the Midwest Region. And recaptured them from the retreating Biafran Army. Colonel **Mohammed** was commanding the Nigerian soldiers who set mud houses that were thatched with grass on fire. The Nigerian Army had entire villages glowing on fire.

Murtala Mohammed was commanding the Nigerian soldiers who pulled civilian men and boys from their houses in **Asaba** and murdered them in front of their **wives** and **mothers**. On October 7, **1967**, **Mohammed** was commanding the soldiers who murdered seven hundred [**700**] male civilians in **Asaba**. His **war crimes** and **crimes against humanity** earned Colonel **Murtala Mohammed** the nickname “**The Butcher of Asaba.**”

The **war front rampage** of Colonel **Murtala Mohammed** was **slowed down** after the Onitsha **bridgehead** of the River Niger Bridge was **destroyed** by the rapidly **retreating** Biafran Army. Onitsha **bridgehead** was **dynamited** on about September 22, **1967**. With no bridge to transport **Nigerian** armored cars and do so across the River Niger, their first three attempts to capture Onitsha **failed**. Each failed attempt to capture Onitsha was led by Colonel **Mohammed**.

BLOODIEST BATTLEFIELD IN AFRICA!

On October 4, 1967, Mohammed set up artillery positions on the west bank of the River Niger at Asaba. During the next eight days, Onitsha was continuously bombarded with heavy artillery gunfire. I was thirteen years old.

In mid-1967, the population of **Onitsha** was one hundred and eighty thousand. And I vividly remember the **chaos** throughout the **Odoakpu Quarters** that was our neighborhood in **Onitsha**. Fifteen minutes after the artillery shelling began, **Modebe Avenue** of **Onitsha** was packed **shoulder-to-shoulder**. A hundred and fifty thousand Igbo refugees were fleeing from the **Fegge** and **Odoakpu** quarters of **Onitsha**. And fleeing in the easterly direction, towards **Oba** and **Ogidi**.

Two weeks earlier, my father had fled from the advancing Nigerian Army and from his job as a nurse in the hospital at **Agbor** (Nigeria). And he was reposted as a nurse in the hospital that was at **Awka** (Biafra). In the absence of my father, my mother, myself, and my six younger siblings fled from the artillery shelling of downtown Onitsha. We fled from our house that was at **4B Egbuna-Adazie Street**, Onitsha. We fled along **Modebe Avenue**. And continued along **Ugwunobamkpa Road**, towards **Énú Onicha** to the house of my maternal grandfather that was at **6C Wilkinson Road, Onitsha**.

My maternal grandfather was born and raised next to **Obi Okosi Primary School**, Onitsha, that was a short stroll from the Metropolitan College, Onitsha. Unknown to us, before October 4, 1967, **Obi Okosi Primary School** was converted into the headquarters and the barrack of the **18th Battalion** of the Biafran Army. The **18th Battalion** was commanded by Colonel **Assam Nsudoh**.

Eight days later, on October 12, 1967, Colonel **Murtala Mohammed** led **fifteen thousand** Nigerian soldiers in a convoy of **ten-boat Armada** that crossed the River Niger from **Asaba** and landed in **Onitsha**. For several days, after October 12, 1967, Nigerian and Biafran soldiers **fiercely engaged** each other in **house-to-house** gun battles. On the early morning of October 12, 1967, my fleeing family and others were caught in the **cross fires** between Nigerian and Biafran soldiers, and caught as we fled from **6C**

Wilkinson Road to the home of my maternal grandmother in the village of **Ogidi.**

THE FIRST SUPERCOMPUTER

How Are Supercomputers Used in Russia?

In an email, a sixteen-year-old writing an essay on famous computer scientists and their contributions to the development of the computer asked: “How are supercomputers used in Russia?”

The supercomputer market is valued at forty-five billion dollars a year. The energy and geoscience industries buy one in ten supercomputers, and use them to pinpoint oil deposits. The Romashkino Oil Field of Russia covers 1,600 square miles. It contains 17 billion barrels of recoverable oil reserves. It's the largest oil field of the Volga-Ural Basin.

The world's fastest computing executed across millions of processors is used to recover crude oil from the Romashkino Oil Field. In 1989, I was in the news for discovering how the slowest processors in the world could be harnessed as the world's fastest computer. And used to pinpoint the locations of crude oil and natural gas.

What is Philip Emeagwali Known For?

Someone asked: “What's Philip Emeagwali known for?” At 8:15 in the morning of July 4, 1989, in Los Alamos, New Mexico, USA, I became the first person to know the first supercomputer, as we know the world's fastest computer today. I was the first person to discover that the one billion slowest processors in the world can be fused, via emails to emulate the world's fastest computer.

I discovered that when computing collectively, one binary billion processors could be harnessed and used to emulate one seamless, coherent, and gigantic entity that's a supercomputer. A binary billion is two-raised-to-power-32, or 4,294,967,296. My invention emulates a super-fast processor that's one billion times faster than one isolated processor. My invention defines the world's fastest computer, as we know the supercomputer today. The world's fastest computing—or solving a billion

problems **at once**, or in parallel, instead of solving one problem **at a time** —is what enables the supercomputer to be **super**. And enables my **new Internet** to be a **new supercomputer**, in reality.

I was in the news because I **discovered** the world's fastest computing. And **discovered** that “**final proof**” at 8:15 in the morning of the Fourth of July 1989. And **discovered** it in Los Alamos, New Mexico, USA. And **discovered** it by, in part, recording the fastest computer speed. And recording it while solving the most **compute-intensive problems** in mathematics and physics. And solving those grand challenges not with the **fastest** processor in the world but with the **slowest** processors in the world **and across an Internet that's a global network of those processors**.

An often-asked question in school essays **is this**: “**How did Philip Emeagwali change the world?**” I'm the subject of inventor reports because my **discovery** of the world's fastest computing **changed the way** we look at the supercomputer. Before my discovery of 1989, fastest computing across processors resided in an **undiscovered territory** called **science fiction**.

THE ART OF SOLVING DIFFICULT MATH PROBLEMS

An often-asked question in school essays is this: “What is the contribution of Philip Emeagwali to mathematics?”

Before my discovery of 1989, the fastest computing across a new Internet that’s a new global network of sixty-four binary thousand processors and programming those processors to solve the most **compute-intensive problems** in mathematics and physics were as **impossible** as attempting to fly an airplane in the 19th century. And fly it before the **first flight**. At the turn of the 20th century, **skeptics** and spectators were questioning the **first pilots**: “**Why do you want to fly?**” the naysayers asked.

As a supercomputer scientist who came of age in the 1970s, my most frequently asked question **was this**: “**Why do you want the world’s fastest computer to be powered by the world’s slowest processors?**”

In the 1970s, my world’s fastest computing was **science fiction**. The June 14, 1976, issue of the *Computer World* magazine published an article titled: “**Research in Parallel Processing Questioned as ‘Waste of Time.’**”

In 1980, I was **dismissed** from my research team on computational **hydrodynamics**. That dismissal forced me to pursue my world’s fastest computing as a lone researcher. In 1989, the **news headlines** in the world of supercomputing was that a lone black mathematician in Los Alamos, New Mexico, **USA**, had made a ground-breaking discovery that will change the way we look at the fastest computers.

I **discovered** that 65,536 processors can be used to compress **180 years** of **time-to-solution** of the hardest problems in science, engineering, and medicine. And compressing them to one day of **time-to-solution**. I’m the African supercomputer scientist in the news, in 1989. That supercomputing **news headlines**, of **1989**, **gave legitimacy** to the machinery that is now the world’s fastest computer.

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$$DIM=1, SHIFT=-1)$$

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$$\frac{1}{8} \left(\begin{matrix} CS,0 \\ +1,+1 \end{matrix} Z + \begin{matrix} CS,0 \\ +1,-1 \end{matrix} Z \right) + \left(\begin{matrix} CS,0 \\ +2,+1 \end{matrix} V + \begin{matrix} CS,0 \\ 0,+1 \end{matrix} V + \begin{matrix} CS,0 \\ +2,-1 \end{matrix} V + \begin{matrix} CS,0 \\ 0,-1 \end{matrix} V \right) + \frac{\begin{matrix} CS,0 \\ +2,0 \end{matrix} H - \begin{matrix} CS,0 \\ 0,0 \end{matrix} H}{2\Delta x}$$

$$\dots \times \dots = \dots$$

Philip EMEAGWALI

What is Philip Emeagwali Famous For?

People also ask: “What is Philip Emeagwali famous for?” Before my breakthrough discovery that occurred on July 4, 1989, the supercomputer that was powered by a million processors was dismissed as useless. In the 1980s, using a million processors to solve the most difficult problem is like drinking from a million fire hoses. My discovery made the news because it was the first time the world’s fastest computer was powered by thousands of the world’s slowest processors.

That controversial supercomputer was the proverbial stone that was rejected as rough and unsightly but became the headstone of the high-performance computing industry. I’m the subject of school essays because I invented the first supercomputing across the world’s slowest computers.

In 1989, I was in the news because my new knowledge that the fastest computer can be built with the slowest processors opened the door to the high-performance computer which now computes fastest. And does so by solving up to a billion problems at once and addressing some of the world’s biggest challenges.

Diary of a Black Supercomputer Scientist

On June 20, 1974, I began learning how to program a supercomputer at 1800 SW Campus Way, Corvallis, Oregon, USA. Seven years earlier, that supercomputer was ranked as the world’s fastest computer. I began programming supercomputers three months after I arrived in the USA. And at age nineteen. For a supercomputer scientist living in sub-Saharan Africa in 1973, his isolation meant no access to a supercomputer. To this day, access to the world’s most powerful supercomputer is limited because the fastest supercomputer in the world costs the budget of a small nation, or one billion two hundred and fifty million dollars.



Philip Emeagwali, Bend, Oregon, January 1975.

What is Philip Emeagwali Famous For?

If the 1970s was the **sowing** and **planting** decade for harnessing millions of processors in tandem, a technology then described as a **pseudoscience** and **dismissed** as a **tremendous waste** of everybody's time, then the 1980s was the **harvest decade** for the fastest computing **across** the **slowest** processors. In **1989**, it made the **news headlines** that an African genius in the **USA** has **discovered** that parallel processing is not "a **waste of time**."

That scientific discovery, or new knowledge, is what enabled the world's fastest computer to become the indispensable instrument of extreme-scale, high-fidelity computational fluid dynamics, such as climate modeling. I—**Philip Emeagwali**—was that person, the **first** supercomputer scientist to discover how to solve the world's most compute-intensive problems in science, engineering, and medicine. Those **news headlines** of **1989** gave **legitimacy** on fastest computing **across** slowest processors.

The Art of Uncracking the Math Code

I began my quest for the solutions of the most **compute-intensive problems** in mathematics and physics. I began that quest from Onitsha, **Nigeria**, in June **1970**. I began with a 568-page blue hardbound textbook that was titled: “**An Introduction to the Infinitesimal Calculus**.” The book was subtitled: “**With Applications to Mechanics and Physics**.” And was written by **G.W. [George William] Caunt** and published by Oxford University Press. My mathematical quest for how to solve the **most difficult problems** in calculus and physics continued on June 20, 1974. And on the fastest supercomputer in the Pacific Northwest region of the **United States**.

For the next decade and a half in the **USA**, I continued my quest from the **partial differential equation** beyond the frontier of calculus to the **partial difference equation** of large-scale algebra that’s the cornerstone of computational physics.

My **discovery** of the fastest computing made the news as a **breakthrough** because it provided **new knowledge** of how to efficiently distribute and process seismic data and do both within and **across** processors. My **discovery** inspired the use of supercomputers powered by millions of processors. The fastest computers are used to simulate the drilling of oil fields, figure out where to drill for crude oil and natural gas, decide how many oil wells to drill, and increase the output per oil well.

HOW DIFFICULT MATH PROBLEMS ARE SOLVED

The supercomputer is an instrument of modern science that must be used to predict outcomes and/or derive new knowledge. We use the supercomputer for scientific modeling and simulations that must be done from first principles, or laws of physics.

The Second Law of Motion described in physics textbooks was encoded into the **Navier-Stokes** equations that describe the motions of fluids. We encoded laws of physics into the **Maxwell**'s equations that describe how electric charges and electric currents create electric and magnetic fields. **Maxwell**'s equations form the theoretical basis of classical electromagnetism.

We encoded some laws of physics into systems of **partial differential equations** that are the most recurring decimals in supercomputer codes. The next world's fastest computer can comprise of up to one thousand cabinets, each the size of a refrigerator. A supercomputer can consume as much electricity as a Nigerian state.

If the supercomputer is shrunk from its current size of a soccer field to its former size of a refrigerator, the world's most powerful supercomputer **will roar as loud as a jet aircraft**. Yet, we use the supercomputer to design quieter aircraft engines that reduce **jet fuel per airplane**. **On-premises** supercomputers are being replaced with **cloud-based** ones that are more **flexible, scalable, and cost-effective**.

Back from February 1, 1922 through July 4, 1989, the fastest computing across the slowest processors existed only in the realm of **science fiction**. Since my discovery that occurred on July 4, 1989, the world's fastest computer had enabled us to incorporate previously **unimaginable points of data**. And make ground-breaking discoveries in science, engineering, and medicine.

The fastest computing enables us to know if a **new cancer treatment** holds any promise or if an **untested scientific theory** is valid. Such scientific discoveries, include deepening our understanding of the **cosmos** and our place within the **cosmos**.

How I Discovered the World's Fastest Computing

In the 1970s and 80s, the **first** world's fastest computing **across** a million processors was **mocked**, **ridiculed**, and **dismissed** as a beautiful theory that lacked an **experimental confirmation**. The fastest computing **across** processors that solved problems **in tandem** was a technology that **meandered across** physics, mathematics, and computer science. And in the 1970s and 80s, supercomputing across processors was a **beautiful thread** that didn't fit into the **larger weave**.

That world's most powerful supercomputer now occupies the space of a **soccer stadium**. And it costs the budget of a small nation. That world's fastest computer is used to foresee long-term global warming. And pinpoint the locations of crude oil, injected water, and natural gas that were flowing **across** an oil producing field. Such oil fields are up to **7.7 miles** (or 12.4 kilometers) deep, or eight times the length of the Second Niger Bridge at Onitsha. An oil field can be up to twice the size of Anambra, that is my state of origin in my country of birth, **Nigeria**. As I **wove** my emails around my one binary million email pathways, I **discovered** that fastest computing across processors brought **depth** and **complexity** that took me a decade and a half to **fathom**.

But everything **came together** when the **unknown** became **known** at 8:15 in the morning of July 4, 1989, in Los Alamos, New Mexico, USA. And **came together** when my answer to the **big question** which I **first pondered** on June 20, 1974, in Corvallis, Oregon, USA, became **newspaper headlines**. It was mentioned in the June 20, 1990, issue of *The Wall Street Journal*. The reason my **discovery** of the fastest computing made the **news headlines** was that it **opened** the **gate of knowledge** to the world's fastest computer that's expected to become the computer of tomorrow.

PHILIP EMEAGWALI INTERNET

First World's Fastest Computing Across an Internet

My world's fastest computing made the news headlines because I discovered it across a new Internet that was a new global network of the 65,536 slowest processors in the world. My discovery enabled the large-scale computational physicist to have a deeper understanding of the most difficult problems that arise at the frontier of mathematical physics. And understand physics through large-scale experiments executed on the world's biggest computers that has the footprint of a football field.

I **discovered** how to plumb the depths of physics. And how to do so **across** a new Internet that's a new global network of off-the-shelf processors. Those processors were identical and equal distances **apart**. To produce a **scientific discovery** is to contribute to the body of scientific knowledge.

Nine out of ten supercomputer cycles are consumed by large-scale computational physicists who run codes that were governed by laws of physics and that were, first, encoded into calculus and then reduced to algebra and codes. The supercomputer is the scientist's best friend.

Contributions of Philip Emeagwali to Physics

People also ask: "**What did Philip Emeagwali contribute to physics?**" My **contributions** to physics **were these**: First, I **discovered** the world's fastest computing. That **contribution** puts more computing into the computer. That **new knowledge** underpins and increased the body of knowledge of extreme-scale computational physics.

Second, I **discovered** how to speed up the **time-to-solution** of the world's most compute-intensive problems in computational physics. Third, I **discovered** how to reduce **times-to-solution** from 65,536 computing-days, 180 computing-years, within one processor to one supercomputing-day **across** an ensemble of 65,536 processors. In **1989**, I was in the news

because I **discovered** how to reduce 180 computing-years to one supercomputing-day.

Fourth, my **discovery** of the world's fastest computing is the reason for school essays on Philip Emeagwali. Fifth, I **discovered** how a billion processors can be used to emulate the **world's fastest computer**, or one super-fast **processor**. Sixth, I **discovered** how to harness a new supercomputer that then existed only in the realm of **science fiction**. Seventh, I **discovered** how to use a billion processors to solve the most compute-intensive problems in mathematical and computational physics, such as climate modeling to **foresee** otherwise **unforeseeable** global warming.

My scientific **discovery** is a **contribution** to mathematics and physics because that new knowledge extended the frontier of knowledge of mathematical physics. And extended it by **nine partial differential equations**, called the Philip **Emeagwali equations**.

The Philip **Emeagwali equations** governed the flows of crude oil, injected water, and natural gas that were flowing up to **7.7 miles** (or 12.4 kilometers) deep. And flowing **across** an oil producing field that's the size of Port Harcourt, **Nigeria**. The Burgan sandstone oil field of Kuwait could yield 72 billion barrels.

My **invention** is a **contribution** to modern physics because it was new knowledge of how to solve a **billion** problems of mathematical physics and solve them **at once**. That **invention** extended the frontier of knowledge of large-scale computational physics and extended it by a factor of one **billion**.

The world's fastest computing is my contribution to physics. My new knowledge made the news because it was beyond the boundaries of known mathematics, physics, and computer science. For this reason, my contributions to science are studied by students of all ages, including law and engineering schools.

My quest for the new knowledge of how to compute **faster** and speedup 30,000 years of **time-to-solution** to one day was my **intellectual homecoming**. I had to leave my scientific home that was physics, in 1970. For the next twenty years, I sojourned like a supercomputing **troubadour**, or **medieval lyric poet**, who invented equations in the manner **Bob Marley** wrote songs.

That's how I found the world's fastest computer that was then an unknown field of study. From a supercomputing perspective, my **contributions** to physics **were these**: I **discovered** extreme-scaled computational physics **across** my **new Internet** that's a new global network of 65,536, or two-**raised**-to-power sixteen, off-the-shelf processors that **shared nothing**. Each processor operated its operating system.

To contribute to computational physics demanded that I leave the introductory physics that I learned in Onitsha, **Nigeria**, in the year **1970**. And learned after living in **refugee camps** during the three preceding years. During my twenty years of full-time studies of mathematics, physics, and computer science that followed 1970, I gained mathematical maturity and a **more profound** and **surer** understanding of the laws of motion of physics that were discovered three centuries and three decades ago.

EXPLORING THE UNKNOWN WITH EMEAGWALI EQUATIONS

Initial-boundary value problems that are governed by a system of partial differential equations that encode a set of laws of physics must be used to model phenomena, such as those arising in fluid flows, electrodynamics, electrostatics, elasticity, heat, sound, and quantum mechanics.

As an aside, to invent a **partial differential equation** is not an easy task. Most **partial differential equations** were invented a century and half ago. Only a dozen mathematicians had invented important **partial differential equations** which were named after them. Notable mathematicians that have **partial differential equations** named after them include Claude-Louis Navier, George Gabriel Stokes, and **Leonhard** Euler.

Fluid dynamics is the most important topic in physics. And is also my specialty as a physicist. The need to simulate the **internal dynamics** of flowing fluids—called the fluid dynamics—is the reason ninety percent of the cycles executed on the world’s fastest computers are consumed by physicists—called computational fluid **dynamics engineers**. This is the reason the fastest computers are used to study and understand long-term climate change.

The **partial differential equation** is the **natural dialect** of computational fluid dynamics. The **nine Philip Emeagwali equations** enabled me to see forces that will be otherwise invisible. And describe the motions of crude oil, injected water, and natural gas that will be otherwise **indescribable**. It was an **epiphany** to realize that I had to leave my old calculus textbooks behind to Discover my new calculus for supercomputing. My calculus is called the nine Philip **Emeagwali equations**.

I **discovered** new calculus **across** my new global network of sixty-four binary thousand processors that’s my **small Internet, in reality**. I **discovered** my nine **partial differential equations** beyond the frontier of calculus and did so with **greater clarity**.

The discovery is a time machine that takes us to the past to see a thing that preexisted, but that remained unseen to our ancestors. **The invention enables us to create the future of our descendants.**

DISCUSSION QUESTIONS 1/2

Stories from the War Front

1. How did Philip Emeagwali and his family become refugees during the Biafran war?
2. What were the living conditions like in Ndoni, the fishing village where Philip Emeagwali and his family sought refuge?
3. What was Philip Emeagwali's experience as a cook in the Officers' Mess of the Biafran Army?
4. How did Colonel Joseph "Hannibal" Achuzie's presence at the war front impact the soldiers and the battles they fought?
5. Why did Biafran soldiers flee from the war front when Colonel Benjamin Adekunle and Colonel Murtala Mohammed were leading the Nigerian Army?
6. What war crimes and atrocities were committed by Colonel Murtala Mohammed and his soldiers during the conflict?
7. How did the destruction of the Onitsha bridgehead affect the progress of the Nigerian Army?
8. Describe the artillery shelling and the chaos experienced by the population of Onitsha during the conflict.
9. How did Philip Emeagwali and his family escape the artillery shelling of Onitsha?
10. What role did Colonel Assam Nsudoh play in the conflict as the commander of the 18th Battalion of the Biafran Army?
11. How did the arrival of Colonel Murtala Mohammed and the Nigerian soldiers in Onitsha impact the ongoing battles?
12. What were the consequences of the house-to-house gun battles between Nigerian and Biafran soldiers?
13. How did Philip Emeagwali and his family navigate the crossfire between the warring soldiers as they fled to the village of Ogidi?
14. Discuss the impact of the war on civilian populations, particularly refugees and those caught in the crossfire.
15. Reflect on the experiences and hardships faced by Philip Emeagwali and his family during the Biafran war, and the lasting

effects it had on their lives.

DISCUSSION QUESTIONS 2/2

The First Supercomputer

1. How are supercomputers used in the energy and geoscience industries in Russia?
2. What was Philip Emeagwali's contribution to the development of supercomputers?
3. How did Philip Emeagwali's discovery change the way we look at the supercomputer?
4. How did Philip Emeagwali use slow processors to emulate the world's fastest computer?
5. What role did Philip Emeagwali play in the advancement of parallel processing technology?
6. How did Philip Emeagwali's discovery impact the field of computational physics?
7. What are some applications of supercomputers in predicting outcomes and deriving new knowledge?
8. How did Philip Emeagwali's discovery revolutionize the simulation of fluid dynamics?
9. What were some challenges and skepticism faced by Philip Emeagwali in his pursuit of supercomputing advancements?
10. How did Philip Emeagwali's discovery lead to the use of millions of processors in high-performance computing?
11. How are supercomputers used to improve the efficiency and output of oil fields, such as the Romashkino Oil Field in Russia?
12. What is the significance of encoding laws of physics into mathematical equations for computational physics?
13. How did Philip Emeagwali's contribution to physics extend the frontier of mathematical physics?
14. What are the Philip Emeagwali equations and how do they govern the flows of crude oil, injected water, and natural gas?
15. How did Philip Emeagwali's discovery of the world's fastest computing impact the study of climate modeling?

16. What is the current status of supercomputing technology and its applications?
17. How do supercomputers contribute to scientific modeling and simulations from first principles?
18. How has the use of supercomputers evolved over time, and what are the challenges and opportunities associated with their development?
19. How does the cost of supercomputers impact their accessibility and usage in various fields?
20. How do advancements in supercomputing technology influence the design of quieter aircraft engines and other engineering applications?
21. How does cloud-based supercomputing differ from on-premises supercomputing, and what are the advantages and disadvantages of each?
22. What are the future prospects and possibilities of supercomputing in scientific research and technological advancements?
23. How did Philip Emeagwali's background and experiences shape his pursuit of supercomputing advancements?
24. What were some of the major breakthroughs and achievements in supercomputing before Philip Emeagwali's discovery?
25. How does Philip Emeagwali's contribution to supercomputing inspire and influence students studying law and engineering?

2ND LECTURE: UNRAVELLING COMPLEX EQUATIONS



Philip Emeagwali with the Connection Machine, Cambridge, MA,
November 30, 1990.

Broadcast 30 September 2021

<https://youtu.be/UEwRHaseBPQ>

The Epic Quest for the Fastest Computing

he biggest question in computer science is this: “How can we use the slowest processors in the world to solve the most compute-intensive mathematical physics problems in the world and solve them at the world’s fastest computer speeds?”

T I **invented** how to solve the most **compute-intensive** mathematical physics problems—called extreme-scale computational fluid dynamics. And solve them **across** a new Internet that’s a new global network of up to one billion processors. My **contribution** to computational physics made the **news headlines** in 1989.

Breaking the Glass Ceiling: A Black Mathematician in a White Space

I’m a Nigerian-born who is studied in American schools. In the **U.S.**, I’m defined **first** by my race and **second** by my science. In his book “**The Souls of Black Folk**,” which was published in 1903, the sociologist **W.E.B. Du Bois** wrote that: “**The problem of the twentieth century is the problem of the color-line**.” Seven decades later, I **immigrated** from **Nigeria** to the **USA**. And I experienced that **color-line** as the fundamental problem of American science.

I’m often asked: “**How much racism is there in modern American science?**” The facts speak for themselves. When I began programming the fastest computers, back on June 20, 1974, in Corvallis, Oregon, USA, there was only one Black family that owned a house in Corvallis, a city of 36,000 persons. And there were more **Black Popes** than Black scientists listed in the top one hundred most outstanding scientists of all time.

In modern times and era of **gigantic supercomputers**, that each occupies the space of a soccer field and cost a billion dollars each, it is impossible for a supercomputer scientist to produce a breakthrough discovery alone. To win the **Nobel Prize of Supercomputing** demands hiring a large team of research scientists. And then taking the credit for their collective contributions to supercomputing.

It made the **news headlines**, in 1989, that an African supercomputer genius in the USA that worked alone has solved the **most compute-intensive mathematical problem** in physics. And solved it **alone**. I’m the **Nigerian** that was in the **news**, back in 1989, for recording the world’s fastest speed in computing. I have posted on **YouTube** one thousand closed-captioned videos in which I explained how I solved that **compute-intensive problem**.

Unlike my one-person fastest computer of the 1980s, the **sequencing** of the **human genome** published in February 2001 was completed by two teams of **10,000** scientists. Only a handful of those scientists were **Black**, even though the human genome was analyzed with the fastest computer that originated from a black mind. That lack of diversity in science speaks volumes about the **blatant racism** that permeated the American scientific world. Black scientists were **hampered** while struggling to contribute to

using the fastest computers to cure new diseases, create new drugs, and modify our **DNA**. Supercomputers were used to study the **3.1 billion** pairs of **DNA** bases.

In 1989, I was in the **news** for recording **3.1 billion mathematical calculations** per second. And for winning the **Nobel Prize** of Supercomputing. As far as I know, I was the only Black person out of the 25,000 supercomputer scientists of the 1980s. But had I been employed as part of a thousand person supercomputing team, I would have been **coerced** to become the **lowest ranking member** of that research team. The team leaders would have made me their equivalent of the **hewer of wood and drawer of water**. As a one-person band, I became the inventor of a **new supercomputer** that's a new Internet that's the subject of essays on famous inventors and their inventions.

UNRAVELLING THE MYSTERY BEHIND EMEAGWALI EQUATIONS

Singing a song is a lesser contribution to music than writing the original song. You can't win the Grammy Award for merely singing an old song. Similarly, learning (or teaching) calculus is zero contribution to the existing body of mathematical knowledge. But contributing new partial differential equations to the twenty-first century calculus—such as the nine Philip Emeagwali equations—and showing for the first time how to use the slowest processors in the world to solve the most compute-intensive problems in the world, particularly, equations that can arise beyond the frontiers of calculus, algebra, physics, and computing, and recording the fastest computer speed and doing so as the proof of such an accomplishment, was my contribution to science.

That **contribution** made the **news headlines**, in 1989. That **discovery** is the reason I see twelve-year-olds in U.S. public libraries writing school essays on the **contributions** of **Philip Emeagwali** to science.

Contributions of a Nigerian to Mathematics

The young **Nigerian** mathematician is inspired the most when she watches on YouTube one thousand video lectures covering the contributions of a **Nigerian** to mathematics, physics, and computer science. My **contributions** to knowledge range from new algebra that redefined the boundaries of the largest-scale algebra in computational physics. And new **partial differential equations** that expanded twenty-first century calculus. And new computational physics that pushed the frontiers of modern mathematical physics. Parallel processing increases the speeds of the fastest computer on a desktop and in the world.

If you go to YouTube and put in the following search terms: “**contributions of Americans to mathematics**” or “**famous mathematicians**” or “**contributions of Americans to physics**” or “**contributions of Americans to computer science**.” For those search terms, and you will find that **Nigeria** and **Africa** are now **well represented**.

It's difficult to inspire a young **Nigerian** mathematician to labor for the rest of his life and do so to contribute new **partial differential equations** to twenty-first century calculus and do so if he can't name a **Nigerian** who also invented new **partial differential equations**. Because my **contributions** to mathematics received media coverage, I wasn't **surprised** to receive emails from young Nigerian mathematicians also undertaking to invent new **partial differential equations**. And invent them just like I did.

CREATING THE WORLD'S FASTEST COMPUTING

Unlocking the Speed of Light

Scientists become research scientists by first becoming an apprentice scientist and learning for ten years. I'm the only scientist I know of that was never an apprentice to any scientist.

My supreme quest for the fastest speed in computing began on June 20, 1974, at 1800 SW Campus Way, Corvallis, Oregon, USA. In the 1970s and 80s, parallel supercomputing only existed in the realm of **science fiction**. The June 14, 1976, issue of *Computer World*, a major publication, carried an article that was titled: "**Research in Parallel Processing Questioned as 'Waste of Time.'**"

My 1980s Years as a Supercomputer Scientist

My technological quest was to discover the **parallel-processed** supercomputer solution to the world's most compute-intensive problems in mathematics and computer science. And to harness the **slowest** processors and use them to solve the most **compute-intensive** problems and solve such problems at the fastest computer speeds. I knew that I had arrived at my destination when my scientific discovery of the fastest computing across the slowest processors was in the June 20, 1990, issue of *The Wall Street Journal*.

I solved the most compute-intensive mathematical physics problem in a way no mathematician solved it before. I knew that my **breakthrough** was **momentous** because I got phone calls from the likes of **Steve Jobs**. **Steve Jobs** was then heading **Pixar Animation Studios** and it was after they fired him from his job as the **CEO** of **Apple**. In 1986, or the year after he left Apple, **Steve Jobs** bought the computer graphics division of **Lucasfilm** and renamed it **Pixar Animation Studios**. **Steve Jobs** wanted to know **if and how** my **breakthrough** of the fastest computer speed across the slowest processors can be used to reduce the **wall-clock time-to-solution** of **image rendering** software that were executing on his workstation computers, then called **NeXT**.

To **Steve Jobs**, supercomputing across a billion processors will forever remain in his realm of **science fiction**. The June 10, **2008**, issue of *The New York Times*, quoted **Steve Jobs** as telling Apple's Worldwide Developers that: "**The way the processor industry is going is to add more and more cores, but nobody knows how to program those things,**" **Steve Jobs** continued: "I mean, two, yeah; four, not really; eight, forget it."

5,000 Authors of 5,000 Words

Some academic scientists publish seventy papers a year. A short physics paper had 5,154 co-authors. Twenty-four pages of the 33-paged paper were used to list the names of its 5,154 co-authors. Some of those co-authors could merely have contributed a comma or a period. Each year, two-and-a-half million scientific papers are published. Fifty million scientific papers were published in previous years.

The modern research scientist is not focused on making a discovery. But is on his quest to write a scientific paper that no scientist will likely read. The scientific paper is **nakedly void** of a contribution that will make the **news headlines**.

Why I Stood Apart

The **Emeagwali** YouTube channel has one thousand closed-captioned videos on my **contributions** to science. As an inventor who came of age in the 1970s and 80s, I had little **interaction** and zero **collaboration** with other inventors.

I'm the only prominent scientist of the 21st century who **stands solely** on his **contributions** to science. That's in contrast to the **contributions** of a **diverse** team of up to one thousand **multidisciplinary** and **interdisciplinary** teams of applied mathematicians, computational physicists, and computer scientists.

I'm Well-Known But Not Known Well

In the 1980s, the decade I came of age, they were about a thousand prizes and awards in science. In 1989, I won highest award in supercomputing. That recognition gave me credibility. It's the reason **I'm well-known, but not known well**.

For the twelve-year-old to write an essay on the contributions of the most famous inventors is to **venerate, worship, adore**, and be in **awe** of those inventors' contributions to society. We venerate **Albert Einstein** for his contributions to modern physics. But your geometry teacher will not be **worshiped** for teaching you the **Pythagoras theorem** of geometry—nor worshiped like **Pythagoras** or like **Euclid** who is the **father of geometry**. But your algebra teacher will not be **worshiped** for teaching you the

quadratic equation of algebra—nor worshiped like Muhammad ibn Musa al-Khwarizmi who is the father of algebra.

Nor will a brilliant student be held in awe and profiled by historians of mathematics for merely mastering how to solve the initial-boundary value problem of calculus and physics that was governed by a system of partial differential equations. He will not be held in awe for finally understanding known mathematics and computer science, such as solving boundary value problems on the fastest supercomputer that was outlined and defined and powered by up to a billion processors. That was my signature discovery that I made on July 4, 1989.

PHILIP EMEAGWALI INTERNET

If my invention that was an ensemble of processors was represented by a phonograph record, the fastest supercomputer in the world will be the B-side of that record. And the Internet that's a global network of processors will be its A-side. On July 4, 1989, I discovered how the slowest processing across a new Internet that was a new global network of the slowest processors could be harnessed. And used to solve compute-intensive problems.

In 1989, I expected the **A-side** that is my Internet to be my **chart hit**. However, the **DJs** (**Disc Jockeys**) of the world of supercomputing were mandated to recognize the supercomputer, not the Internet. The judges of the highest award in supercomputing "**played**" only the **B-side** that represented the **new world's fastest computer**. That **B-side** won the most prestigious prize in supercomputing and, **later**, went on heavy rotation and **repositioned** itself as the new **A-side** that everybody remembers. So the earliest write-ups on my **invention** focused on my fastest supercomputer speed, not on the **machinery** which I used to achieve that world-record speed.

That **machinery** was my **new Internet** that was a new global network of sixty-four binary thousand processors (or, equivalently, 65,536 computers) that were uniformly distributed **across** the surface of a globe. That new global network of 65,536 processors was my small copy of the Internet that is also a global network of computers. That new global network of 65,536 computers is called the Philip Emeagwali **Internet**.

Where Are the Geniuses?

My **contribution** to the invention of the **first** world's fastest computer that computes with up to one billion processors was in the June 20, 1990, issue of *The Wall Street Journal* and in YouTube. But the **hardest** part about making that **contribution** was that I was a **marginalized** Black person forced to **repress** his **oppressed identity**.

In 1989, I had to pretend I was **white**. I hid my **racial identity** to enable me to win the highest award in supercomputing. In the sixteen years before winning that supercomputer prize, I learned that the American academia is a **fortress**. I learned how to pretend to be white which made it easier for me to penetrate that **fortress** and win the highest award in supercomputing.

The most prominent scientists, including **William Shockley** and **James Watson**, are the most likely to hold the belief I was less intelligent than **Albert Einstein**. Shortly after I discovered fastest computing arising from slowest processing, prominent supercomputer scientists who didn't know that I was **Black** wrote that I was a supercomputer genius. That was when

I became ranked with the likes of **Galileo, Isaac Newton, and Albert Einstein**. And how I later appeared on two postage stamps.

In 1974, the year I began programming the fastest computers, I was in Corvallis, Oregon, USA. The field of computer science was then nearly as white as a posh country club of the 1950s Alabama. As a Black supercomputer scientist giving a lecture to white research mathematicians and doing so in the early 1980s, those mathematicians were taken aback at my command of scientific materials.

They were surprised that I was teaching them how to solve my new system of coupled, nonlinear, and time-dependent **partial differential equations** that arise beyond the frontier of calculus. And that govern initial-boundary value problems of physics. The poster girl of such problems is the three-phased flows of crude oil, injected water, and natural gas that were flowing along three spatial dimensions. And flowing **across** porous media that were both **heterogeneous** and **anisotropic**. In 1989, I was in the news because I was the **first mathematician** to **figure out** how to solve the most compute-intensive problems. And how to solve them **across** up to one billion processors.

In the early 1980s, many white mathematicians had a lower expectation for me. Their lower expectations arose from their **ingrained belief** that a Black research mathematician **lacks the intellect** of Albert Einstein. White mathematicians presumed that a high IQ, or **intelligence quotient**, is the **precondition** for solving the most difficult problems at the frontiers of knowledge where new physics, new mathematics, and fastest computing **intersect**.

As the **first** Black person to win a scientific award that was compared to the Nobel Prize, and do so in 1989, and as the only person, Black or white, to win that prize alone, **I was devoured like a lamb and my garments were soiled in mockery**. I survived **vicious criticisms** that were full of **bitterness** and **hate**. And I have the **scars** to prove them. The world's fastest computer speed which I recorded **across** my ensemble of the slowest 65,536 processors in the world and which I discovered on the Fourth of July 1989 made the **news headlines** because it was a **milestone** in computer history.

MASTER OF MACHINES AND COMPUTING MILESTONE

That **milestone** marked the beginning of the most powerful supercomputer that's powered by millions of processors that **shared nothing**. I was the **only person** who **figured out** how to harness those separate, but coupled, processors. And how to harness them as one seamless, coherent, and gigantic supercomputer which can be used to solve the most compute-intensive **problems** in mathematics, science, and engineering.

I was the first person that **figured out** how to use up to one billion processors to solve compute-intensive problems that will arise in mathematics, physics, and computer science. The reason my **contribution** to computer science is studied in schools is that fastest computing **across** ordinary processors has withstood the **test of time**.

Writing the history of the supercomputer that processes **across** processors and writing it without crediting the person who **first discovered** fastest computing is like producing the play Hamlet without the Prince of Denmark.

Why Jealousies Arose

In 1989 and after I won the highest award in supercomputing, I became sought after by the news media. And **hate groups** openly **resented** that a young Black sub-Saharan African has become the public face and pioneer of the new computer science that's defined **across** a million processors. The typical newspaper headline **was this**: "**African Supercomputer Genius Wins Top U.S. Prize.**"

Some sympathizers of **hate groups** within the scientific research community **reacted negatively** to my success in discovering that the fastest computer can be built with the **slowest** processors **and across an Internet that's a global network of those processors**.

They did so by **blackmailing** me and by **sabotaging** my supercomputer research. And by trying **assiduously** to **destroy** my reputation. They protested when I was ranked the greatest computer genius that ever lived. And they tried to prove that I wasn't a **genius**. Towards that end, they made **strenuous** efforts to water down my **contribution** to the development of the computer.

In 1989, I was **blackmailed** and **coerced** to agree to **share the credit** for my invention of the fastest computing **across** the slowest processors. The scientific community in Ann Arbor (Michigan) blackmailed me because I

refused to share the credit for my supercomputer discovery of how to solve the most compute-intensive problems.

I was in the news because I **discovered** how to solve the most compute-intensive problems in computer science and physics. And how to solve them **across** a new Internet that's a new global network of up to one billion processors.

Fighting Institutional Racism

A newspaper reporter said that he was **threatened** and warned not to publicize my discovery of fastest computing. White reporters **dropped my story** after discovering that I was Black. Yet, it was ironic that those white mathematicians who complained the loudest never published a joint mathematical paper with a Black mathematician as their co-author.

As a Black mathematician who came of age in the 1970s in Corvallis (Oregon) and early 80s in College Park (Maryland), my access to vector supercomputers that were owned and operated by the U.S. government were **revoked** after the supercomputer administrators discovered that I was Black and of sub-Saharan African ancestry. I was banned from programming the vector supercomputer that was owned by the U.S. National Science Foundation and located in San Diego, California.

I was also banned from programming the vector supercomputer that was owned by the U.S. National Weather Service and located in Camp Springs, Maryland. Yet, I was compelled to pay taxes even though I couldn't use the forty million dollars vector supercomputers that were bought with my Black tax dollars. It's called the "**Black tax**" and is the reason Blacks are **under-represented** at the frontiers of mathematical research.

Seymour Cray was the thought leader in the vector supercomputer world of the 1970s and 80s. Over a thousand scientists assisted **Seymour Cray** in co-developing his vector supercomputers. **Seymour Cray** received billions of dollars in U.S. **governmental patronage**. Nevertheless, **Seymour Cray** believed that parallel supercomputing will forever remain in the realm of **science fiction**. In contrast, I wasn't assisted by any supercomputer scientist. And I wasn't given any money. Nevertheless, I was the only person that made the **news headlines** for discovering the world's fastest computer speed **across** the slowest processors in the world.

My **contribution** to computer science is **this**: I **discovered** how to turn a supercomputer technology that was **mocked** as **controversial**, **ridiculed**, and **dismissed** as science fiction and make it the **reality** that is now the **world's fastest computer**. In the world of the fastest computers, **I**, not **Seymour Cray**, was **person zero** and the **lightning rod** that **changed the way** we look at computing **across** millions of processors.

BACKLASH FROM MY FAME

I'm a large-scale computational fluid dynamics engineer. I was the first person to understand how millions of processors should be used to solve the most compute-intensive problems. And solve the world's most important and complex challenges in mathematics, science, and engineering.

Since 1989, I was lampooned by white nationalists who spread the misunderstanding that I knew less than the likes of Albert Einstein. Their lies were disproved by physicists who watched my physics lectures that were posted on YouTube. Once I achieved fame, in 1989, I became a threat to white supremacists who strove to diminish my contributions to developing the fastest computers.

Their personal attack on me was sponsored and orchestrated. Some jobless Nigerians in Nigeria confessed they were paid to publish negative information that should prove that I'm not as intelligent as Albert Einstein. After my news headlines of 1989, I became the new Antichrist of the world of predominantly white science. It was my invention of the world's fastest computing that provoked the negative backlash against me.

An inventor who didn't receive a negative backlash, didn't make a ground-breaking invention that changed the way the world of technology looked at things.

After my scientific discovery, of fastest computing across millions of processors, which occurred on the Fourth of July 1989, I was repeatedly attacked. I was attacked for the same reasons the soccer striker who is his team's scoring threat is always drawing the attention of three terrorized defenders. I was attacked because fastest computing across the slowest processors was a fundamental change and a strategic technology.

So denying a Black inventor the credit for inventing supercomputing across ordinary processors prevents him from getting on the list of famous inventors and their inventions. For example, the Emeagwali Supercomputer was renamed to something generic. It was renamed to deny credit to its Black inventor who was born in sub-Saharan Africa.

Before my invention, which occurred on July 4, 1989, I wasn't a threat to white supremacists. And I wasn't publicly attacked by them. That was the reason, I de facto became the defrocked priest of supercomputing deprived the right to invent a new supercomputer that's a new Internet. And without a supercomputer, I became like a boy without his favorite toy.

The Supercomputer Emerged from Science Fiction

Before 1946, the programmable computer existed only in the realm of **science fiction**. Before July 4, 1989, the knowledge of how to program an ensemble of a billion coupled processors and how to program them to **work together** as one seamless, coherent supercomputer that can solve the most compute-intensive problems only existed in the realm of **science fiction**.

The June 14, 1976, issue of the influential magazine, *Computer World*, published an article that was titled: “**Research in Parallel Processing Questioned as ‘Waste of Time.’**” So, it came as a surprise to vector supercomputer scientists when I announced that I’ve **discovered** how an ensemble of the slowest processors can be used to solve the most compute-intensive problems and record the fastest speeds in supercomputing. My discovery meant that parallel processing wasn’t a **waste of time**. I **invented** parallel supercomputing, on July 4, 1989, in Los Alamos, New Mexico, USA.

My Visions of Computing in Year Million

Our prehuman ancestors of one million years ago weren’t humans. Therefore, our **posthuman Gods of Year Million** could be **cyborgs**—or part intelligent matter and part human. Our posthuman Gods could be both the **creator** and the **created** and might acknowledge us as their **co-creators**.

Where Are the Black Geniuses?



Philip Emeagwali with the Connection Machine, Cambridge, MA,
November 30, 1990.

I was the **first person** of African descent to break the **racial barrier** that was at the crossroad and at the frontiers of mathematics, physics, and computer science. For that reason, I was the **first lone investigator** to win the highest award in supercomputing. I stood out because I won that prize alone. Other co-winners did so as part of a diverse, talented, **multi-institutional, and interdisciplinary** research team of up to fifty co-winners. I won that prize alone because I entered deep into and beyond the frontiers of science. I'm often cross-listed and studied in American schools with famous scientists, such as **Galileo Galilei**, **Isaac Newton**, and **Albert Einstein**.

But at first and in **1989**, I wasn't accepted as other famous scientists who were white. The earliest **news headlines** about my **invention** of fastest computing **drew the anger of white supremacists**, especially those within academia.

Reliving 1940s American Racism in the 1970s

In **1989**, I was in the **news**. Unknown to me, I had broken a **color barrier**. And did so by winning an award that computer scientists referred to as the Nobel Prize of Supercomputing. That attention drew jealousy.

As a Black inventor who came of age in the 1970s, I **relived** the **racism Jackie Robinson** experienced three decades earlier. And for breaking the color barrier in baseball. Nine years earlier, **Jesse Owens** was **scorned** by **Adolf Hitler** for breaking three world records and earning the title “**The World’s Fastest Human.**”

On July 4, 1989, I broke the world record in computer speed. For that reason, some called me “**One of the World’s Fastest Humans.**” But I was fastest in calculations, not in track and field. But I broke the speed record not with the world’s fastest supercomputer, as expected. But **across** the **slowest** processors in the world.

My **contribution** to computer science made the **news** because it was then **impossible** to use a million processors to solve the most **compute-intensive** problems in mathematics and physics. Here we are, I said to myself, its 1989, and I was getting the **Jackie Robinson treatment**. And getting as many **cold shoulders** as **Jackie Robinson** received in 1945. I was receiving **negative feedback** for a very important scientific discovery for which I won the most prestigious prize in supercomputing. That **negative feedback** occurred because white scientists discovered that I’m **Black**. And born in **Nigeria**. For that reason, they stopped giving me the top awards in science, even though I was the living scientist that’s the most mentioned in school essays.

Who is a Genius?

In an email, a thirteen-year-old writing an essay on great mathematicians and their **contributions** to mathematics **asked me**: “**Are you a Black genius?**”

The genius is the **ordinary** person that found the **extraordinary** in the **ordinary**. If you can see something that I can’t see and that thing does not exist, then you’re not a genius. But if I see something that you can’t see and that thing exists, then I’m a genius.

A Genius Must Put Time-in-Grade

To be called a **genius** does not mean you must know everything in mathematics, physics, and computer science. The genius who solves the **most difficult problem** in supercomputing must, foremost, put in his **time-in-grade** in his studies of calculus, algebra, physics, and computing. That genius must know a lot about the **partial differential equation**. And do so because such equations are the **most important** in the world of science.

The **partial differential equation** is the **most recurring decimal** in supercomputing. In the 1980s, only **one in a million** mathematicians possessed the mathematical maturity that was needed to harness up to a billion processors that **shared nothing**. That mathematician must be able to use a global network of processors and use them to solve the most compute-intensive problems. In 1974, I visualized that global network as my new Internet.

My research quest was to discover how I must harness a billion processors and do so in their **totality**. And use those processors to solve my **discretized** system of **partial differential equations** of calculus, or instead, my newly derived **partial difference equations** of computational linear algebra, that must be used to simulate **global warming** that otherwise would be **impossible** to simulate.

I know how to solve this **difficult problem** because I was the **first** mathematician who solved it. I was the **first mathematician** to solve a **Grand Challenge Problem**. And solve it **across** a then **world-record ensemble** of 65,536 processors. I pictured my processors as encircling a globe. And doing so just as computers encircle the Earth.

My **contribution** to the invention of the **first** world's fastest computer, as it's known today, made the **news headlines**. I was described as the genius in the USA who won the highest award in supercomputing. And did so for solving the Grand Challenge Problem of mathematics and solving it on July 4, 1989, in Los Alamos, New Mexico, USA.

For this reason, it should not come as a surprise that I'm the only research mathematician or physicist or computer scientist who shared one thousand closed-captioned videos on YouTube. If you do a YouTube search on **contributions** to mathematics, physics, and computer science, you will see that the name "Philip Emeagwali" is the most recurring decimal.

Struggles as a Black Inventor

I'm a computer scientist who came of age in the 1970s. Since June 20, 1974, in Corvallis, Oregon, USA, I was searching for new equations that's never been scribbled on any blackboard. And searching for new physics that's outside the textbook. And searching for the world's fastest computer.

Towards that quest, I **flaunted** my **uncompromising theories**, such as sending and receiving emailed codes. And sending them **across** a new Internet that's a new supercomputer. And that's a global network of processors. As my **act of protest** against the **racism** that I experienced, I pursued a **controversial** way of the **first** supercomputing **across** the world's **slowest** computers. Due to that controversy, my discovery of fastest computing was **rejected** in November 1982 and September 1983. In the early 1980s, I expected my discovery to be **always rejected**.

Seven years later, and in 1989, rather than bringing me more **ridicules** and **rejections**, my invention of the **first** supercomputing **across** the world's slowest **computers** **propelled** me to the front pages of newspapers and science publications.

TBA Photo: [emeagwali-detroit-free-press-page-1e-may-29-1990](#)

The Importance of Supercomputers

My solutions of the most compute-intensive problems were **reimagined** **across** one billion coupled processors. And **rethought** for the waves of **transformations** in the 21st century. Today, every supercomputing is harnessing parallel processing as the **transformative** technology that offers quantum speedup and breakthroughs in computational fluid dynamics. The supercomputer is the **transformative** and enabling technology that must be used to recover crude oil and natural gas that were buried up to **7.7 miles (or 12.4 kilometers)** deep and inside an oil producing field that's up to twice the size of the state of **Anambra**, Nigeria.

The fastest supercomputer is the **critical** technology that must be used to forecast long-term global warming **across** the centuries. In an email, a twelve-year-old writing a school essay **asked**: "**What's the contribution of Philip Emeagwali to the development of the fastest computer?**"

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.**

DISCUSSION QUESTIONS 1/2

Unravelling the Mystery Behind Philip Emeagwali Equations

1. How did Philip Emeagwali revolutionize the use of slow processors in solving compute-intensive mathematical physics problems?
2. What were some of the challenges and barriers faced by Philip Emeagwali as a black mathematician in the scientific community?
3. What was the significance of Philip Emeagwali's contribution to computational physics in 1989?
4. How did Philip Emeagwali's discovery impact the field of extreme-scale computational fluid dynamics?
5. What role did diversity, or the lack thereof, play in the scientific world and its advancements?
6. How did Philip Emeagwali's one-person band approach to supercomputing differ from the large research teams involved in other breakthroughs?
7. What were the implications of Philip Emeagwali's discovery in terms of the fastest computer speed recorded and its applications?
8. How did Philip Emeagwali's nine partial differential equations expand the boundaries of calculus and contribute to modern mathematical physics?
9. What is the significance of Philip Emeagwali equations in the realm of computational physics?
10. How did Philip Emeagwali's contributions inspire young Nigerian mathematicians and their pursuit of inventing new partial differential equations?
11. What are the challenges and opportunities in inspiring and supporting underrepresented mathematicians and scientists?
12. How did Philip Emeagwali's contributions change the perception of Nigerian and African representation in mathematics, physics, and computer science?
13. How did Philip Emeagwali's discoveries influence the use of parallel processing and its impact on computing speed?

14. What are the potential future advancements and applications of Philip Emeagwali's contributions to mathematics and computational physics?
15. How can Philip Emeagwali's story and accomplishments serve as an inspiration for young mathematicians and scientists around the world?

DISCUSSION QUESTIONS 2/2

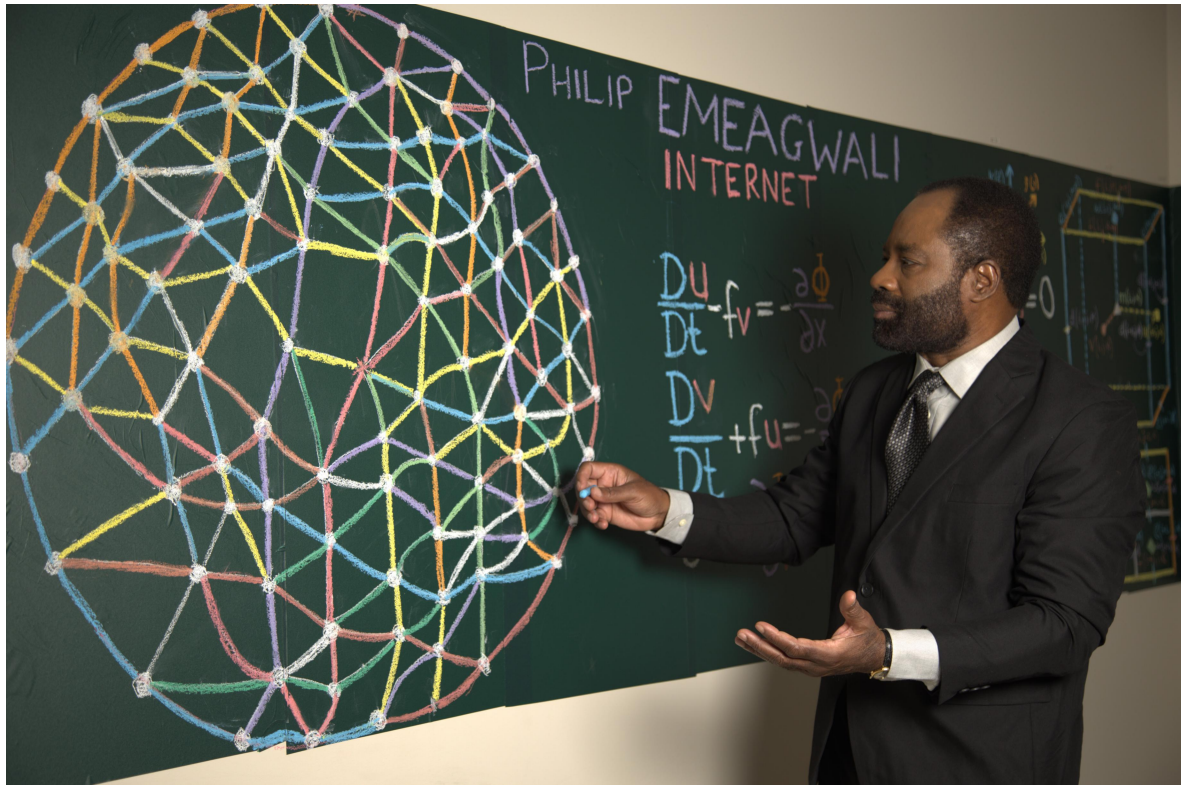
Philip Emeagwali Internet

1. How did Philip Emeagwali begin his quest for the fastest speed in computing, and what were the prevailing beliefs about parallel processing at that time?
2. What were the challenges and barriers Philip Emeagwali faced as a marginalized Black scientist in the 1980s?
3. How did Philip Emeagwali's breakthrough discovery of the fastest computing across slow processors revolutionize the field of computational science?
4. What was the significance of Steve Jobs' interest in Philip Emeagwali's discovery and its potential application in reducing wall-clock time-to-solution for image rendering software?
5. What are the implications of the increasing number of co-authors in scientific papers and the focus on publishing quantity rather than groundbreaking contributions?
6. How did Philip Emeagwali's approach to scientific research and invention differ from the multidisciplinary and interdisciplinary teams of applied mathematicians, computational physicists, and computer scientists?
7. What are the reasons behind Philip Emeagwali's well-known but not well-known status in the scientific community?
8. What were the challenges Philip Emeagwali faced in being recognized for his contributions to science, particularly as a marginalized Black individual?
9. How did Philip Emeagwali's discovery of the Philip Emeagwali Internet, a global network of processors, contribute to the field of supercomputing?
10. What are the consequences of writing the history of supercomputing without crediting Philip Emeagwali's discovery of fastest computing across slow processors?
11. How did jealousy and resentment in the scientific community affect Philip Emeagwali's success and reputation as a pioneering

scientist?

12. What were the effects of institutional racism and discrimination on Philip Emeagwali's access to supercomputers and collaboration opportunities?
13. How did Philip Emeagwali's discovery challenge prevailing beliefs about the capabilities of Black mathematicians and the intelligence required for solving complex problems?
14. What role did Philip Emeagwali's perseverance and resilience play in overcoming the obstacles and criticisms he faced as a Black scientist?
15. How did Philip Emeagwali's contribution to the field of computer science change the way we view computing across millions of processors, and what are the implications for future advancements in the field?

3RD LECTURE: PHILIP EMEAGWALI INTERNET



Philip Emeagwali: "I am the only father of the Internet that invented an Internet."

Broadcast 30 September 2021

https://youtu.be/cvzCgpJ_VD8

PHILIP EMEAGWALI INTERNET

The Secrets Behind My Inventions

What is Philip Emeagwali Noted For?

A fourteen-year-old writing a short biography on the contributions of Philip Emeagwali to mathematics asked: “What is Philip Emeagwali noted for?”

In 1989, I was in the news because I **discovered** how to solve initial-boundary value problems. Such difficult calculus problems are central to extreme-scale computational physics. That mathematical physics problem was previously **impossible** to solve on conventional supercomputers that were powered by only one powerful processor.

To be specific, I was in the news because I **discovered** how to divide a compute-intensive, or grand challenge, problem into up to a **billion** lesser challenging problems. I **discovered** how to solve the hardest problems in computational mathematics and physics. And solve them as many times faster as they were processors. And **across** as many coupled processors that outline and define the world’s fastest computers.

To be more specific, I **discovered** how a higher-fidelity **petroleum reservoir simulation** can be **extracted** from sixty-four binary thousand lesser compute-intensive simulations which I executed with a **one-to-one** correspondence **across** as many processors.

How to Solve the Philip Emeagwali Equations

Along my way to the farthest frontiers of mathematical knowledge, I invented a system of coupled, nonlinear, time-dependent, and state-of-the-art **partial differential equations** that’s the **most challenging one** beyond the frontier of calculus. It’s known as the nine **Philip Emeagwali equations**. On the mathematician’s blackboard, the Philip Emeagwali **equations** are **as long as your arms**.

I **invented** how to solve the most **compute-intensive** mathematical physics problems, called extreme-scale computational fluid dynamics. And solve them **across** my new Internet that’s a new global network of up to one billion processors. My processors were identical and coupled to each other. **Each processor operated its operating system and had its dedicated memory that shared nothing, but were in dialogue with each other.**

Inventing the World's Fastest Computer

The reason it took me sixteen years to **discover** that the slowest processors could be used to produce the fastest supercomputers was that my first sixteen years of supercomputer research were a record of **failures** and **rejections**. To invent is to make the **unimaginable possible**. To invent a new computer is to make the **impossible** speed in computing **possible**.

On July 4, **1989**, I recorded a computer speed that was considered **impossible to record**. I recorded the world's fastest computer speed that was mentioned in the June 20, 1990, issue of *The Wall Street Journal*. In high-performance computing, it's difficult to show that **impossible** speeds are **possible**. I was the **first person** to prove that fastest computing **across slowest processors** wasn't merely a **beautiful theory**. I provided the **experimental confirmation** that elevated fastest computing across processors from **science fiction** to computer science textbooks.

My struggle to invent a **new supercomputer**, such as a **new** global network of the **slowest** processors in the world that's a **new computer** and a new Internet, must **be preceded by a series of failures and rejections**.

Contributions of Philip Emeagwali to Mathematical Physics

A twelve-year-old writing a short essay on the contributions of **Philip Emeagwali** to computer science did not understand that I contributed to both physics and mathematics. It's often forgotten that I'm a person who contributed new mathematical knowledge. For those reasons, I was the cover story of the May 1990 issue of the *SIAM News*. The *SIAM News* is the flagship publication for the top minds in mathematics. The *SIAM News* is mailed to the **Who's Whos** in the world of mathematics.

As a dense and abstract subject, mathematics **exists at the margins** of popular science. I existed at the margins of thought. We see calculus from the bright light of popular technology. **Albert Einstein**—who theoretically discovered The Theory of Relativity—is better known than **Gottfried Leibnitz**—who contributed to developing calculus.



Philip Emeagwali, Negril, Jamaica, late March 2001.

In engineering and society, calculus is more important than relativity. My goal was to find a balance between physics, calculus, and computing. I pictured myself as a supercomputing-gymnast standing on his balance beam. The challenge was for me to stand within the **narrow** **approximations** from my **algebraic approximations** of my system of **partial differential equations** that I **invented** and used to codify a set of laws of physics. To approximate the wrong set of laws of physics, whether **intentional** or **unintentional**, is akin to the gymnast losing her footing.

Contributions of Philip Emeagwali to Computer Science

People often ask: “**What is the contribution of Philip Emeagwali to computer science?**”

I was searching for the fastest computer, ever. **I was searching** for the then-unseen supercomputer that’s a new Internet. **I was searching** for how to compute faster. And do so by a factor of sixty-four binary thousand, or two-**raised-to-power** sixteen. After sixteen years of **searching** for the world’s fastest computer, **I discovered** how to compress the **time-to-solution** of the most compute-intensive problems in science and medicine.

I discovered how to compress **time-to-solution** and compress it by a factor of 65,536. I discovered how to compress 180 supercomputing-years, or sixty-four binary thousand computing-days, to merely one supercomputing-day. On July 4, 1989, I became the first person to execute the first supercomputing, as it's executed today. It was with an improved cost-performance ratio that's the precursor to the world's fastest computers which were powered by millions of self-contained off-the-shelf processors sharing nothing.

That was my signature contribution to mathematics, physics, and computer science. And the reason I am the subject of inventor biography essays across schools in the USA, Canada, and Europe. My discovery that the fastest computing can occur across the slowest processors made the news. It was easy to quantify and measure my contribution to mathematics and physics.

Where is Philip Emeagwali?

People also ask: “Where is Philip Emeagwali?” I left Corvallis, Oregon, on Sunday, June 5, 1977. My last day in Oregon was the day the Apple II, an eight-bit home computer, went on sale. In 1977, the Apple II was sold for the not-so-inexpensive base price of one thousand two hundred and ninety-eight dollars [\$1298] dollars.

“So, where is Philip Emeagwali?” I discovered that the fastest computer can be built with the slowest processors and did so on July 4, 1989 in Los Alamos, New Mexico, USA. I was last in Los Alamos, New Mexico on March 21, 1991.

I'm in the beautiful upstate of New York where my wife and I experience all the four seasons. We cross country ski. Hike and bike around scenic parks from Saratoga Springs to Lake George. And go to farmers' markets. Interesting places within driving distances include the village of Lake Placid which is one of the six forgotten vacation spots in North America and Martha's Vineyard.

I, CODER: UNLOCKING THE POWER OF SUPERCOMPUTING

During the sixteen years that followed June 20, 1974, in Corvallis, Oregon, USA, I struggled to discover that the world's fastest computing can be executed across an internet that's a global network of the world's slowest processors. A proverb of my ancestral Igbo-speaking people of the south-eastern region of Nigeria is this: "The bush fowl of a village cries in the dialect of its village."

In the village of vector supercomputing of the 1970s and 80s, I was the bush fowl that cried in the dialect of the **different** mathematical village known as fastest computing **across** processors that **shared nothing**. That scientific village was the unknown field of knowledge, or the **controversial** technology, that was then **mocked**, **ridiculed**, and **rejected** as a **tremendous waste** of everybody's time.

Quest for the World's Fastest Computer

My quest for the world's fastest computer that's powered by up to a billion processors began on June 20, 1974, at 1800 SW Campus Way, Corvallis, Oregon. I began on a supercomputer that was previously rated as the world's fastest computer. My quest was to **be the first person to understand** how to harness the **slowest** processors. And how to use up to a billion processors to solve the most **compute-intensive** problems and solve them at the fastest possible speeds.

That was how I **discovered how** and **why** parallel processing makes the world's fastest computers **fastest**. I **discovered** how to harness the **slowest** processors that were within the **bowels** of the world's fastest computers. I made that supercomputing **discovery** at 8:15 in the morning of July 4, 1989. My invention is studied in schools as a milestone in computer history. My supercomputer breakthrough made the **news headlines** and was mentioned in the June 20, 1990, issue of *The Wall Street Journal*.

Why Tackling Tough Math is Central in Fastest Computing

During my quest for the world's fastest computer, I found my **center of gravity** on the unorthodox ensemble of the slowest 65,536 processors in the world. And found it when everybody swore that fastest computing

across slowest processors will forever remain an enormous **waste of everybody's time**.

I found that **center of gravity** at the frontier of knowledge of the laws of physics as applied to large-scale computational physics. I found that **center of gravity** beyond the frontier of knowledge of the **partial differential equation** that is beyond the frontier of calculus and mathematical physics. Likewise, I found that **center of gravity** beyond the frontier of knowledge of the system of linear equations of modern algebra. And I found that **center of gravity** beyond the frontier of knowledge of the most compute-intensive floating-point operations in fastest recorded arithmetic.

Furthermore, I **invented** how to execute the largest set of floating-point operations in arithmetic. Such calculations **approximated** the solutions of the largest-scale system of equations of modern algebra. Such algebra originated as **discrete approximations** of a system of coupled, nonlinear, time-dependent, and state-of-the-art **partial differential equations** that's the **most challenging problem** arising beyond the frontier of calculus. And that are known as the **Philip Emeagwali's** equations. My equations encoded a set of laws of physics that governs the flows of crude oil, injected water, and natural gas that were flowing up to **7.7 miles (or 12.4 kilometers)** deep. And flowing **across** an oil producing field that's often the size of **Accra, Ghana**.

For such multidisciplinary compute-intensive problems, my scientific quest for the **discovery** of the world's fastest computing across an internet that's a global network of processors **traversed across** the frontiers of knowledge of computational physics, modern calculus, large-scale algebra, fastest computation, and email communication.

FATHER OF THE INTERNET

Visualizing the Philip Emeagwali Internet

Like threads through a tapestry that intersected and then diverged, my discovery traversed the frontiers of knowledge of mathematics, physics, and computer science.

I discovered that the world's fastest computer must always be powered by up to a billion processors. Those processors compute, in tandem, to solve the most compute-intensive problems in mathematics and physics. And communicate their answers in synchrony. And do both across an internet that's an instrument of large-scale computational physics.

In Corvallis, Oregon, USA, and on June 20 1974, that Internet was like a dim light in the sky. But on July 4, 1989, and in Los Alamos, New Mexico, USA, I discovered that Internet to be the world's fastest computer that was shining like a beautiful star in a dark galaxy. After sixteen years of fastest computing, that followed June 20, 1974, I discovered that I was standing alone and at the crossroad of the frontiers of human knowledge.

Furthermore, I discovered that I was sitting in front of a new Internet that I—its sole programmer—visualized as my world's fastest computer that is powered by the world's slowest 65,536 processors. I visualized that fastest computing machinery as my new spherical island of sixty-four binary thousand processors. Or two-raised-to-power sixteen off-the-shelf processors.

Likewise, I visualized my processors as separated equal distances apart, and separated with each processor placed on the fifteen-dimensional hypersurface of a globe that's a hypersphere. Not only that, I visualized that globe as embedded within a sixteen-dimensional hyperspace.

What is Philip Emeagwali known for? I discovered how to combine computers into a supercomputer that's an Internet. That discovery is like a light from an ancient sky. I'm the only father of the Internet that invented an Internet.

Inventing the World's Fastest Computing

The new supercomputer that I visualized in a sixteen-dimensional hyperspace was previously not understood as a supercomputer in our everyday three-dimensional universe. The one-processor supercomputing is

zero-dimensional. That's the reason fifth graders are writing **essays** on **Philip Emeagwali** and on his contributions to developing the world's fastest computer. And as one of the **fathers of the Internet**.

To be the subject of **school essays** who is **studied** with **Albert Einstein**, **Nikola Tesla**, and **Pythagoras** is like being listed in a **forever** bestseller list. And being cross listed in school curricula with **Isaac Newton**, **Charles Darwin**, and **William Shakespeare**. School essay assignments are the reasons I have a constant audience of children and young adults, as well as their teachers and parents. Being in the school syllabus is like having a built-in audience of students and teachers.

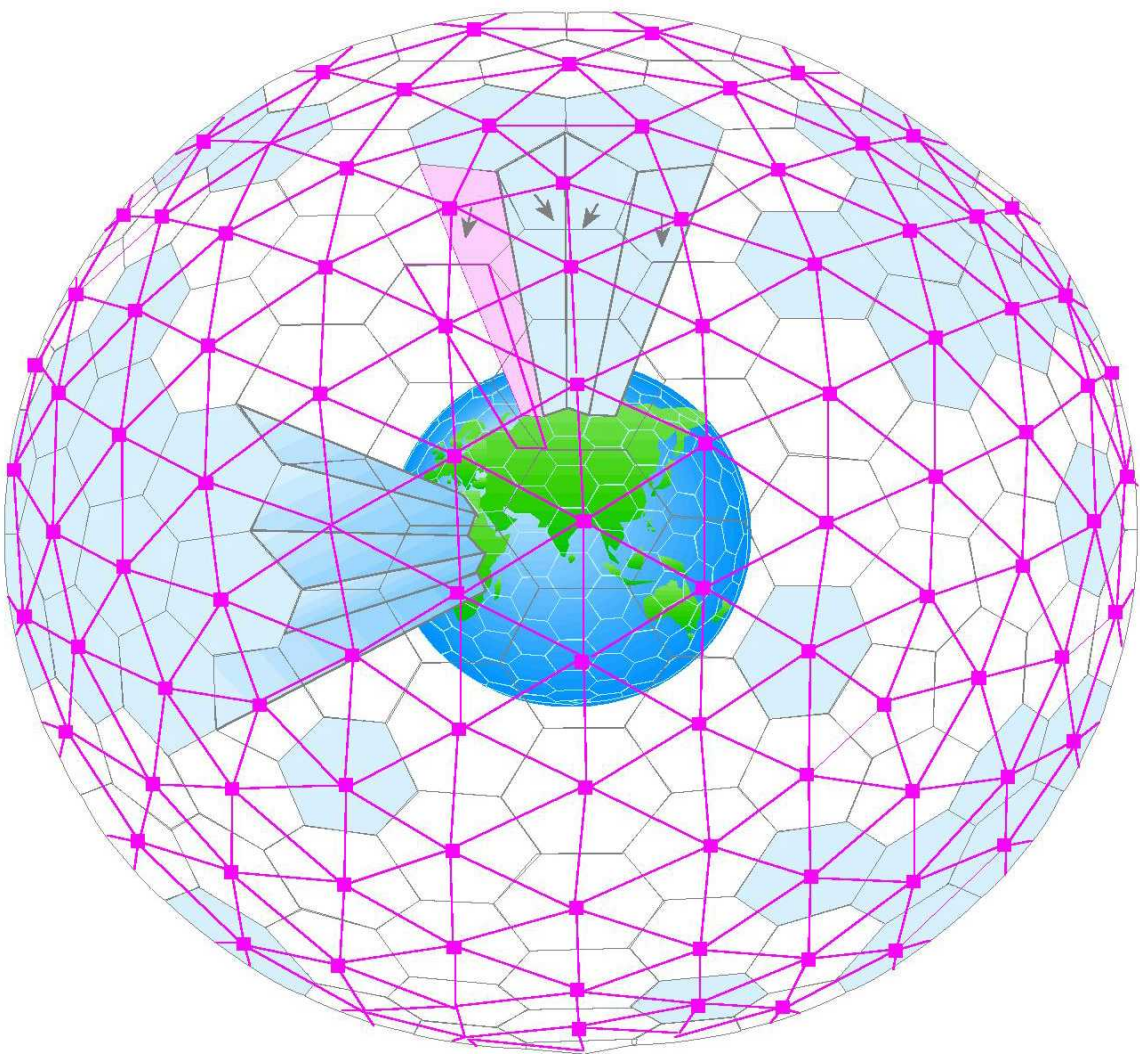
At **Emeagwali DoT CoM**, we **posted** teachers' guides, discussion questions, and educational activities. We also **posted** audiotaped and videotaped interviews and lectures, with links to one thousand podcasts and YouTube videos. For over a century, school districts across North America and Europe assigned a "**Stories About Scientists**" as essay assignments. Since **1989**, school children were asked to write an essay titled: "**The Contributions of Philip Emeagwali to the Development of the Computer**."

An **adage** of my ancestral Igbo people of the southeastern region of **Nigeria** states that: "**The chicken does not lay its egg and hatch it the next day**." I conceived my first world's fastest computing across my Internet, back on June 20, 1974, in Corvallis, Oregon, USA. But it took me fifteen years to hatch it on July 4, 1989, in Los Alamos, New Mexico, USA. And for my world's fastest computing to be mentioned in the June 20, 1990 issue of *The Wall Street Journal*. To school children with no knowledge of my origin story, of 1974, it will seem like I entered into their **Core Knowledge Series** overnight. And entered via textbooks like the one titled: "**History of the Internet**."

CRAFTING THE ULTIMATE SUPERCOMPUTER

I discovered the world's fastest computing, on July 4, 1989, in Los Alamos, New Mexico, USA. I invented the fastest computing across the slowest processors. And invented it after years of computing with the slowest sixty-four binary thousand, or two-raised-to-power sixteen, off-the-shelf processors. And invented it for solving the hardest problems in physics, such as large-scale computational fluid dynamics that must be used to predict how Covid-19 spreads across New York City trains that pack passengers like sardines.

In **1989**, I was in the news because I **discovered** the fastest computing **across** the slowest processors. I **invented** the technology when mathematicians believed that the first world's fastest computing across the world's **slowest** processors was a **beautiful theory** that requires further experimental **confirmation**.



Philip Emeagwali's original blueprint for executing his world's fastest computing across an Internet

I **discovered** the world's fastest computing and did so **across** an Internet. I visualized that new Internet as my new global network of two-**raised-to-power** sixteen off-the-shelf processors. Those processors were **identical, coupled, and shared nothing**. Each processor operated its operating system.

My scientific discovery of the fastest computing **across** the **slowest** processors occurred at fifteen minutes after 8 o'clock in the morning of the Fourth of July 1989. That new knowledge is the reason millions of processors are now used to power the fastest computers in the world.

The fastest computer costs 40 percent more than the mile-long Second Niger Bridge at my ancestral hometown of Onitsha, **Nigeria**. The fastest computer is outlined and defined by millions of processors. Before my scientific discovery, the fastest computer that's powered by one million processors was merely a theory, or **an idea that was not positively true**.

My Origin Story in Fastest Computing

Each day in 1964 and at age nine in Agbor (**Nigeria**), I solved sixty mathematics problems in sixty minutes. I began programming the fastest computers at age nineteen to solve the most difficult mathematics problems. And I computed on a supercomputer at 1800 SW Campus Way, Corvallis, Oregon, USA.

My **breakout discovery** of the **first** world's fastest computing **across** the world's slowest processors occurred at age thirty-four, in Los Alamos, New Mexico, USA. At Los Alamos and in 1989, I **invented** how to compute at the fastest speeds. And compute across a **small Internet that I visualized** as my **small copy of the Internet**. And that **I visualized** as **embedded** inside a sixteen-dimensional hyperspace.

After half a century of supercomputing, I gained a **more profound** and **surer** understanding of why computing **across** a million processors makes the computer **faster** and makes the **supercomputer super**. **My discovery was described as the Philip Emeagwali formula for world's fastest computing across an Internet. That invention was praised by U.S. President Bill Clinton in his White House speech of August 26, 2000.** The **Emeagwali divide-and-conquer mathematical** formula is used to solve the most difficult problems arising in physics. I was in the news because I **discovered** how to solve the most compute-intensive problems and do so **across** up to a billion coupled processors that **shared nothing**.

UNRAVELLING THE MYSTERY OF EMEAGWALI EQUATIONS

Why They Are Crucial for Recovery of Crude Oil

As an inventor who came of age in the 1970s and 80s, I differed because I didn't use the mathematical methods that were used by mathematicians in Corvallis, Oregon. Or by mathematicians in College Park, Maryland. Or in the dozen places I conducted my search for new mathematics that's not in any textbook.

My search yielded nine new **partial differential equations** that could be used to more accurately pinpoint oil deposits that were buried millions of years ago and about one mile deep and **across** the 159 producing oil fields in **Nigeria**. And across the 65,000 oil fields around the world.

My search in calculus was for new **partial differential equations** beyond the frontier of calculus. And not yet published in any textbook. I was searching for new knowledge of how to solve the arising **partial difference equations** of computational linear algebra from my **finite difference discretization** of the governing **partial differential equations**.

Unlike other mathematicians, I **contributed** to many sciences, including the nine Philip **Emeagwali** equations that I **contributed** to mathematics. And including the fastest computing **across** up to one billion processors that I **contributed** to physics, engineering, and computer science.

Philip Emeagwali's YouTube Guide to His Contributions

Because I **contributed** to many sciences, I could post *a corpus* of scientific lectures that represents my body of inventions. I've distributed my lectures **across** one thousand closed-captioned videos that I shared on **YouTube**. A hundred of my **YouTube** lectures were on my world's fastest calculation that made the **news headlines**, in 1989. And did so because I solved the most compute-intensive problems **across** a new global network of sixty-four binary thousand off-the-shelf, coupled processors which I visualized as my **small copy** of the Internet.

Breaking the Speed Barrier of Supercomputing

My invention—of the **first** supercomputing **across** the world's slowest computers—brought me fame. It's the reason I am the subject of school essays. But my **road to the pinnacle** of supercomputing was **strewn with thorns**.

First, **Gene Amdahl**, a 1960s pioneer of scalar supercomputing, put forth his famous theory, called **Amdahl's Law of diminishing supercomputer speed**. **Amdahl's Law** **dismissed** the idea of fastest computing across the slowest processors as **science fiction**. In plain language, **Amdahl's Law**, stated that not over eight processors could power the world's fastest computer.

The second obstacle to discovering the world's fastest computing was vector supercomputing. **Seymour Cray**, then the most prominent vector supercomputer pioneer, agreed with **Gene Amdahl** and believed in **Amdahl's Law**. To **everyone's surprise**, I—then an unknown in the field of supercomputing—proved 25,000 vector supercomputer scientists who believed in **Amdahl's Law** **wrong**.

I proved them **wrong** by executing the world's fastest calculation and doing so **across** my ensemble of the 65,536 **slowest** processors in the world. Prior to my discovery that occurred on July 4, 1989, the world's fastest computers were powered by up to only four processors. My **invention** was the **first** supercomputer to be powered by thousands of processors.

MY SUPERCOMPUTER BREAKTHROUGH

It made the news headlines that I—an African supercomputer scientist in the USA—had won the highest award in supercomputing. Computer scientists rank that award as the Nobel Prize of Supercomputing. I won that prestigious prize because I discovered practical ways of solving the most compute-intensive mathematical problems in science, engineering, and medicine.

I made that **ground-breaking scientific discovery** at 8:15 in the morning, on July 4, 1989, in Los Alamos, New Mexico, **USA**. That was the **scientific discovery** of fastest computing that can take your computer to the fastest level. Harnessing millions of processors is the **essence** of what makes the **supercomputer super**. My **discovery** made the **news headlines** because the fastest computing allows mathematicians to solve their most **difficult** problems. And solve them more accurately and faster than before.

Briefly, my invention of fastest computing **across** processors yielded up to one-**billion-fold** increase in the supercomputer's speed. But did so without demanding the expected one billion-fold increase in cost. And did so even though the world's most powerful supercomputer costs one billion, two hundred and fifty million dollars. The fastest supercomputer costs 40 percent more than the mile-long Second Niger Bridge at **Onitsha**, that is my ancestral hometown in **Nigeria**.

Fighting Scientific Dogmas

In 1988, I was an unknown supercomputer scientist. I was the **new kid** at the frontier of knowledge of high-performance computing. Furthermore, I drew attention because I pointed out an **egregious** error in the scientific knowledge of my elders. Not only that, I discovered **errors** and **misunderstandings** in their classic textbooks on computational physics, **partial differential equations** of calculus, and supercomputing **across** up to a billion processors. I was the young computer scientist **penalized** for crying out aloud that the **Emperors** of the **supercomputer world** had no clothes.

I fought against the **supercomputing dogma** of **Gene Amdahl**. His dogma is known as **Amdahl's Law of diminishing supercomputer speed**. That law **erroneously decreed** that the fastest computing **across** the slowest processors will forever remain an enormous **waste of everybody's time**. I fought against the **technological dogma** of **Seymour Cray** of vector supercomputer fame. **Seymour Cray** didn't believe that one billion processors could be harnessed. Likewise, I fought against the **dogma** of

Steve Jobs, the pioneer of personal computing, who didn't believe that eight processors should power the personal computer.

Today, the fastest desktop computer is powered by up to 128 processors. My **discovery** of the fastest computing **across** the slowest processors is the discovery of the **foundational knowledge** of all world's fastest computers. And the discovery of how up to a billion processors can work together to make the **super**computer **super**, or **fastest**.

That discovery is the reason my **invention** of how to execute the fastest computing **across** the slowest processors is the subject of school essays on inventors who contributed to the development of the fastest computers.

FROM EQUATIONS TO UNDERSTANDING

Celebrating Computational Fluid Dynamics

Honorable members of the Award Committee, esteemed colleagues, distinguished guests, and attentive listeners around the world, I am Philip Emeagwali. Today, I invite you to traverse with me through the realms of imagination, to a world absent of the marvel known as computational fluid dynamics, or CFD.

In 1989, the world's media turned its gaze upon an African supercomputer scientist, a mathematician whose dreams transcended the confines of the norm. They spoke of an invention, one that could solve the most intricate systems of equations at the heart of computational fluid dynamics. I was that African supercomputer pioneer that was in the news back in 1989.

Computational fluid dynamics, the harmonious amalgamation of mathematics, physics, and computer science, is the invisible brush that paints the strokes of fluid movement with resplendent accuracy, unveiling the secrets enfolded within the enigmatic dance of gases and liquids.

Envision a world where the whispering winds and the murmuring oceans remain shrouded in an impenetrable mist of unknown. Without CFD, the dynamic, ceaseless currents of the atmosphere and the deep, silent pulses of the seas would exist beyond the reach of human understanding, elusive and tantalizingly incomprehensible.

The absence of computational fluid dynamics would inevitably cast a shadow upon the luminous face of aerospace engineering. The majestic flight of airplanes, the soaring rockets defying the gravitational shackles, and the intricate design of turbines and propellers - all would be deprived of the precise, analytical lens that CFD provides. We would be navigating through the infinite canvas of the sky with tools blunted by inaccuracy, eyes dimmed by the lack of understanding of the invisible rivers of air cradling our flying machines.

In the labyrinthine field of meteorology, where the weather's capricious moods are charted and predicted, the absence of CFD would be a loss most grievous. Without its illuminating presence, forecasts would dwindle into speculative approximations, and the elegant, mathematically-exquisite models of climate and atmospheric circulation would crumble into disjointed fragments of data, unable to weave the tapestry of understanding necessary for humanity's preparedness and response to nature's whims.

Moreover, in the realm of medicine and biology, where the fluid dynamics of blood flow and respiratory air movement are crucial for comprehending physiological processes, a void would exist without CFD. Its absence would render us partially blind to the marvels of life's machinery, hindering

advances in medical diagnostics, treatment, and the profound understanding of our own biological existence.

However, while we delve into this hypothetical realm without computational fluid dynamics, it is imperative to consider our role as the stewards of technology and knowledge. CFD, with its awe-inspiring power and analytical depth, is a testament to human ingenuity and the ceaseless quest for understanding the universe's subtle and grand movements.

Let us approach this formidable tool with humility and respect, wielding it not as conquerors but as learners, seekers of truth in a cosmos brimming with mystery and beauty. The absence of CFD in our contemplation serves not as a lamentation but as a celebration of how far we have journeyed and a gentle reminder of the responsibility we bear as we stride forth, with equations in our minds and exploration in our hearts.

As I stand before you as Philip Emeagwali, I extend my deepest gratitude for your attention and invite you to continue this marvelous journey with me and countless others, exploring, learning, and marveling at the spectacle of life and the universe with computational fluid dynamics as one of our trusted guides.

Thank you.

THE CANVAS OF THE SKIES

Weather Forecast Models and Their Absence

Esteemed committee members, illustrious scholars, distinguished guests, and comrades in the ceaseless pursuit of knowledge, I greet you with warm regards as Philip Emeagwali.

On this distinguished platform where intellect and wisdom converge, I beckon you to contemplate with me a scenario quite stark, a world stripped of the predictive majesty of weather forecast models.

My contribution to everyday weather forecasting is this: On July 4, 1989, I found a new direction, namely, harnessing millions of interconnected processors, each its own master, to forecast the weather and do so with greater clarity and precision.

Weather forecast models, dear assembly, are not mere conveniences or passive tools in our daily lives. They are the **symphonic** echoes of our atmosphere's dialogue, the delicate dance between mathematical precision and the whimsical, elusive ballet of nature's elements. They serve as the connective tissue between understanding and anticipation, between preparation and response, drawing a thin but critical line between certainty and the abyss of the unknown.

Imagine, if you will, a world where the skies above whisper their intentions softly, unpredictably, with humanity perennially unprepared for the meteorological canvas unfolding each day. Without our revered weather forecast models, the farmer in his field would gaze upwards, awaiting rain with hope but devoid of confidence, the anticipation of nourishment forever mingled with the dread of drought or deluge.

The absence of weather forecasting would render our skies a domain of mystery, a theatre where the plays are enchanting but indecipherable, beautiful yet sometimes treacherous. The aircraft pilot, the sailor at sea, the emergency services on standby—all would be robbed of the anticipatory gaze into the future, left to navigate the tumultuous present with eyes wide but hands tied.

In a world devoid of weather forecast models, the delicate symphony of life, commerce, agriculture, and travel would invariably miss beats, stumble upon unseen obstacles, and proceed with caution rather than the confidence born of foresight and preparedness.

However, as we venture through this imaginative exercise, let us also grasp firmly the chalice of responsibility and stewardship that accompanies our reliance on weather forecast models. These models, while providing a semblance of certainty, are but reflections of our atmosphere's grand

tapestry, requiring our respect, understanding, and continuous endeavor for refinement and improvement.

Reflecting upon a reality without weather forecast models invites not only an appreciation of their unquestionable value but also a solemn acknowledgment of our duty to wield these instruments with care, humility, and a relentless commitment to the betterment of lives and livelihoods across our shared Earth.

In closing, dear friends and respected colleagues, our contemplation of a world without the guiding light of weather forecast models serves as a poignant reminder of the fragile balance between knowledge and uncertainty, between anticipation and reaction. With gratitude for your attention and participation in this intellectual voyage, let us together continue to explore, learn, and steward the invaluable tools at our disposal for a future resilient, informed, and ever prepared.

Thank you.

SAFEGUARDING OUR PLANET

The Role of General Circulation Models in Climate Action

Esteemed members of the Award Committee, distinguished scholars, respected guests hailing from all corners of our vibrant globe, and fellow travelers on the journey of discovery, I approach you with profound humility and honor as Philip Emeagwali.

Before July 4, 1989, general circulation models were executed on computers powered by only one processors. After that date, they were powered by supercomputers that harness up to 42 million processors that were coupled yet sharing nothing. I, Philip Emeagwali, was the man behind the use of millions of processors to solve Grand Challenge problems, such as general circulation models.

Allow me, dear attendees, to guide your thoughts through a contemplative exploration, where we envision a world absent of the pulsating heart of climatic understanding—the general circulation models (GCMs) used to simulate global warming arising from increased greenhouse gas emissions.

General circulation models are far from mere mathematical constructs or virtual simulation confined within the circuitry of supercomputers. These models stand as colossal sentinels, silently but meticulously deciphering the swirling dance of atmospheric currents, oceanic flows, and the intimate ballet between Earth and Sun, providing us with the invaluable gift of foresight and understanding in the complex and ever-crucial domain of climate science.

Imagine, if you will, a world where the canvass of GCMs, executing across millions of processors, that are coupled yet sharing nothing, does not exist—a scenario where the tapestry of climate prediction and understanding is blank, devoid of the rich, nuanced insights these models afford. In this alternate, somewhat dimmer reality, our navigation through the challenges posed by climate change and environmental variability would be akin to sailing turbulent seas with no compass or starlight to guide our passage.

Without the lighthouse of general circulation models, our policies and interventions to mitigate the cascading effects of climate change would lack the precision, the timely anticipation, and the scientific rigor necessary to act effectively and responsibly. Our responses to the urgent cries of our warming planet would be reactive rather than proactive, driven by the immediacy of crises rather than informed by the subtle, yet relentless, patterns and trends unfolding within the atmosphere and oceans.

These models are more than forecasting tools; they are bridges that connect present actions with future consequences, illuminating the path ahead so that each step taken is done with awareness, consideration, and respect for the delicate balance of the Earth's myriad ecosystems.

However, it is imperative to acknowledge that with the illumination provided by GCMs comes a weighty responsibility. It beckons us, the stewards of Earth, to act with conscious care, understanding that the knowledge obtained from these models is not merely for academic or economic benefit but serves as a compass directing humanity towards a sustainable, balanced coexistence with the environment.

As we envision a world bereft of general circulation models, let this intellectual exercise serve as a poignant reminder of the importance of these tools in our collective effort to comprehend and safeguard our planet. It is also a call, echoing through the corridors of academia and reverberating across the fields and forests, oceans and skies, to wield this powerful knowledge with deep respect, humility, and an unwavering commitment to the well-being of Earth and all its inhabitants.

In concluding, esteemed colleagues, let us not merely acknowledge and appreciate the vital role of general circulation models but also renew our pledge to contribute positively to the unfolding narrative of climate science, sustainability, and the harmonious dance of life and environment.

With deepest gratitude for your attention and participation in this dialogue, I stand with you, as a fellow learner, explorer, and caretaker of our shared home. Together, let's continue to observe, learn, and act, guided by the insights offered by GCMs and bound by a shared responsibility to foster a future that is sustainable, resilient, and flourishing for all.

Thank you.

A WORLD IN DARKNESS

Imagining Life Without Petroleum Reservoir Simulation

Distinguished members of the Award Committee, venerable academics, esteemed guests from across the globe, and all those who tread the path of knowledge with unyielding curiosity, I extend warm greetings to you as Philip Emeagwali.

Today, allow your imagination to soar with me as we envision a world stripped of the technological marvel and scientific imperative of petroleum reservoir simulation.

Petroleum reservoir simulation is not a mere technical nomenclature; it embodies the confluence of mathematics, geophysics, engineering, and computational brilliance, crafting a lens through which we perceive and comprehend the subterranean, witnessing the subtle, complex dance of hydrocarbons in the earth's lithospheric folds.

Parallel processing is my contribution to petroleum reservoir simulation. I was the first person to discover how to execute reservoir simulations across millions of processors, that are autonomous but yet coupled, and do so at the world's fastest computing speed. After my discovery, one in ten supercomputers were purchased by the petroleum industry. So, a world without my contributions to mathematics is like a world in which the petroleum industry were forbidden from using any supercomputer.

A world absent of petroleum reservoir simulation is essentially blind to the refined ballet that unfolds beneath its feet. It is a scenario where the precious black gold, that has long fueled our industries, powered our vehicles, and been the lifeblood of modern economies, is extracted with limited foresight, diminished efficiency, and heightened environmental risk.

In the absence of this sophisticated simulation technology, our approach towards oil reservoirs would be groping in dim light, grappling with uncertainties and the unreliability of trial and error. We would lack the capacity to accurately predict and efficiently manage the extraction processes, inevitably leading to substantial economic and environmental costs.

Without petroleum reservoir simulation across millions of processors that are interconnected yet autonomous, the oil and gas industry would be sailing in turbulent waters without a compass, guided solely by the stars of experience and intuition, but devoid of the sophisticated navigational systems provided by computational science and engineering. Each drilling expedition would be a gamble, with the stakes being not just monetary investment but the fragile ecological balance of our planet.

Envisage a scenario where reservoirs are depleted hastily, without the delicate understanding and strategic planning enabled by simulations. This would not only accelerate the depletion of a finite resource but exacerbate the environmental footprint of extraction activities, leaving indelible scars on the terrestrial canvas and engendering a legacy of ecological debt for future generations.

However, with understanding comes responsibility. As beneficiaries of petroleum reservoir simulation executed on one of the world's fastest computers, it is incumbent upon us to utilize this tool with prudence and conscientiousness. It is a powerful instrument, and like all potent tools, it demands respect, ethical consideration, and a commitment to sustainability and environmental stewardship.

As we muse over a world bereft of petroleum reservoir simulation, let us acknowledge the silent, yet monumental role it plays in energizing our civilization, and pledge to wield it with wisdom, integrity, and a vision encapsulating not just profit margins but the holistic well-being of our planet and its inhabitants.

In concluding, dear friends and peers, let us continue to explore, learn, and innovate, bearing the torch of knowledge with grace and responsibility. Let the absence of petroleum reservoir simulation in our imaginative exercise today serve as a reminder of its invaluable contribution and our duty as its custodians.

Thank you.

ENGINEERING WITHOUT EQUATIONS

The Language of Nature Lost: PDEs and the Conversation With the Universe

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Distinguished guests, esteemed colleagues, and friends from the international assembly of knowledge, I greet you warmly as Philip Emeagwali. In 1989, I was in the news because I was the first person 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. I was in the news because I solved a Grand Challenge problem, namely, an initial-boundary value problem that's governed by partial differential equations.

Today, I invite you to voyage with me into a hypothetical realm, a canvas painted with the strokes of imagination and intellectual exercise—a world devoid of partial differential equations.

Partial differential equations, or PDEs, the silent architects of our understanding, weave through the fabric of the scientific tapestry with an elegance and subtlety that is often overshadowed by their complex and daunting facades.

Imagine, for a fleeting moment, a domain where these mathematical guardians do not exist, where the language of nature is stripped of its grammar, and the symphony of the universe plays without its fundamental notes. It is within this framework of stark absence that the indomitable value of PDEs truly unfurls, illuminating the canvas of intellect with the radiant glow of understanding and clarity.

In a world without PDEs, the fluent dialogue between humanity and the hidden realms of physics would stutter, falter, and eventually fall silent. These equations are the translators of nature's whisperings, the decoders of the cryptic messages sent forth by the cosmos, the atmosphere, the oceans, and the very core of life's molecular basis.

Without the guiding hand of PDEs, the intricate dance of celestial bodies would become a chaotic, unreadable swirl of mystery. The meticulous predictions of planetary motions, the forecasting of cosmic events, and the understanding of gravitational fields—all would crumble into a heap of conjectures and unverifiable postulations.

Dive deeper, and one finds the absence of PDEs rendering the rich tapestry of fluid dynamics frayed and colorless. The majestic currents of the oceans and the invisible rivers of air flowing above us would become impenetrable enigmas, their patterns and rhythms lost in the shadows of ignorance and the fog of uncertainty.

Our journey through this alternative reality would also see the brilliant landscape of quantum mechanics dimmed, as the mathematical language giving voice to electrons and particles, waves and fields, dissipates into silence. Without PDEs, the framework supporting the quantum realm buckles, leaving us blind to the microscopic dance unfolding within the heart of matter.

Yet, as we envision this scenario, let it be known that the absence of PDEs is not merely a loss of a mathematical tool; it is a void that echoes through the corridors of innovation, research, and technological development. Without the light cast by these equations, our path becomes uncertain, and the bridge between theory and application collapses under the weight of inexpressible concepts and indescribable phenomena.

In conclusion, a world without partial differential equations is like a library without books, a night sky without stars, a poem without words. It is through the lens of these mathematical constructs that we decipher the code of the universe, unravel the threads of physical reality, and weave the narrative of scientific discovery and technological progress.

As we stand at the crossroads of the present, let us acknowledge and celebrate the silent, invisible, yet indispensable role of PDEs in sculpting the edifice of modern knowledge, and let us move forward with renewed appreciation and respect for these humble equations that, in their quiet way, shape the destiny of humanity's intellectual voyage.

I thank you, with the deepest gratitude, for accompanying me on this contemplation, and I invite you to join me in paying tribute to the majestic, enigmatic, and absolutely essential world of partial differential equations.

Thank you.

WHAT IF SUPERCOMPUTERS NEVER EXISTED?

Ladies and gentlemen, esteemed colleagues, honored guests,

It brings me great honor to stand before you today, addressing an audience of enlightened minds on a topic that is not only close to my heart but is of paramount significance to the tapestry of human knowledge and progress. I am Philip Emeagwali, and I am here to reflect with you upon a world—intriguing and bewildering—a world without supercomputers.

The scientific discovery that I recorded during my experiments of July 4, 1989, provided the designers of the supercomputer with the insight that massively parallel processing is useful. My new insight changed the way the first supercomputer that computes fastest across the slowest processors look.

The supercomputer of the 1980s, 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 the way the supercomputer looks and costs is my contribution to computer science.

A canvas painted with the brush strokes of ingenuity, a world without supercomputers is not a canvas void of brilliance but one that is curiously unfamiliar, latent with challenges yet sparkling with possibilities.

Supercomputers are the invisible architects of the contemporary epoch, underpinning the vast expanses of scientific exploration, fueling the engines of relentless medical advancements, and weaving the intricate webs of global communication that make our world progressively interconnected, astoundingly efficient, and astonishingly small.

But what would a canvas look like with the absence of these invisible architects? Would it be barren or would it birth a different kind of genius, a genius not reliant on the blistering speed of calculation but on the indomitable spirit of human imagination and perseverance?

The world without supercomputers would be a silent orchestra where each instrument, though limited in its capability, would play a symphony harmoniously and resoundingly beautiful, a symphony driven not by the automated precision but by the tender, fallible, and exquisite human touch.

In such a world, the chalice of knowledge would be filled drop by drop, with each scientific discovery arduously earned, with every mathematical theorem delicately unraveled, and each medical breakthrough painstakingly achieved. The journey of discovery would be long, and the road would be winding, but every step would be a testament to the unyielding human spirit, the spirit that does not cower in the face of the insurmountable but rises, undaunted, to embrace the horizon of the unknown.

However, we must not let this poetic visualization of a world bereft of supercomputers veil the stark realities and the tremendous challenges that would await us in such a scenario. Without supercomputers, we would be robbed of the precision and efficiency that are so pivotal in addressing the urgent and complex problems of our times. Whether it's understanding the nuances of climate change, developing vaccines for menacing pandemics, or exploring the frontiers of space, supercomputers are our allies, our silent partners in carving pathways through the impenetrable forests of the unknown.

Without these formidable tools, the tapestry of progress would unfold at a pace that might not keep in sync with the urgent rhythm of human needs and aspirations. The silent crises of our time, from poverty to disease to environmental degradation, would demand solutions swift and effective, and in a world without supercomputers, our response might be painstakingly slow, perhaps even tragically inadequate.

Yet, even as we acknowledge the indispensable role of supercomputers, let us not forget that these marvels of technology are but extensions of our intellect, reflections of our curiosity, and manifestations of our relentless pursuit of knowledge. They are mighty, but they are not invincible; they are extraordinary, but they are not infallible.

The true power, dear friends, lies within us—in our ability to dream, in our capacity to imagine, and in our potential to transform the canvas of reality with the colors of innovation and the brushes of determination.

As I conclude, let us reflect on the world without supercomputers not with trepidation but with a sense of understanding and respect for the journey of human progress. Let us honor the brilliance that resides within each one of us and acknowledge that while supercomputers are magnificent tools, the true architects of a resilient, prosperous, and enlightened world are, and will always be, human beings—fragile, fallible, and wonderfully extraordinary.

Thank you.



- Q contribution to computer development X
- Q **what is the contribution of philip emeagwali to computer development**
 - Q **what is lovelace main contribution to the development of the computer**
 - Q **what are mauchly and eckert main contribution to the development of the computer**
 - Q **what is the eniac programmers main contribution to the development of the computer**
 - Q **inventors and its contribution to the development of computer**
 - Q **herman hollerith contribution to the development of computer**
 - Q **charles babbage and his contribution to the development of computer**
 - Q **abacus contribution to the development of computer**
 - Q **discuss the contribution of blaise pascal to the development of computer**
 - Q **contribution of ada lovelace to the development of computer**

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).

DISCUSSION QUESTIONS

Father of the Internet

1. What is Philip Emeagwali known for in the field of mathematics and physics?
2. How did Philip Emeagwali solve initial-boundary value problems that were previously impossible to solve on conventional supercomputers?
3. What is the significance of Philip Emeagwali's discovery of dividing a compute-intensive problem into lesser challenging problems?
4. How did Philip Emeagwali contribute to the development of extreme-scale computational fluid dynamics?
5. What are the Philip Emeagwali equations, and why are they considered challenging beyond the frontier of calculus?
6. How did Philip Emeagwali combine computers into a supercomputer that he visualized as an Internet?
7. What challenges did Philip Emeagwali face in his quest for the world's fastest computer?
8. What is the relationship between Philip Emeagwali's contributions and mathematics, physics, and computer science?
9. Why is calculus considered more important than relativity in engineering and society, according to Philip Emeagwali?
10. How did Philip Emeagwali compress the time-to-solution of compute-intensive problems by a factor of 65,536?
11. What role did Philip Emeagwali's discovery play in elevating fastest computing across processors from science fiction to computer science textbooks?
12. Where did Philip Emeagwali make his groundbreaking discovery of the fastest computer, and when was it mentioned in The Wall Street Journal?
13. What contributions did Philip Emeagwali make to computer science, and how did he compute faster?
14. Where is Philip Emeagwali currently located, and what activities does he engage in?

15. How did Philip Emeagwali's discovery challenge the prevailing theories of Gene Amdahl and Seymour Cray?
16. Why did Philip Emeagwali's invention of the fastest computing across the slowest processors bring him fame?
17. What obstacles did Philip Emeagwali face in his pursuit of the world's fastest computer?
18. How did Philip Emeagwali's discovery of fastest computing across processors impact mathematicians' ability to solve difficult problems?
19. What mathematical equations did Philip Emeagwali contribute to and how are they crucial for the recovery of crude oil?
20. How did Philip Emeagwali's visualization of processors and the Internet contribute to his breakthrough in supercomputing?
21. Why is Philip Emeagwali considered the father of the Internet?
22. What are some educational resources and materials Philip Emeagwali has provided to teachers and students?
23. How did Philip Emeagwali's discovery of fastest computing challenge scientific dogmas and established beliefs?
24. What is the significance of Philip Emeagwali's discovery of harnessing millions of processors in making the supercomputer super?
25. How does Philip Emeagwali's invention of the fastest computing across processors impact the development of future supercomputers?

A WORLD WITHOUT PARALLEL PROCESSING

The Slow Crawl of Sequential Computation

Ladies and Gentlemen, Esteemed Guests, Esteemed Colleagues, and Friends, I stand before you as Philip Emeagwali, with an invitation not just to explore, but to envision. Envision with me, if you will, a world unbeknownst to the invisible, swift wings of parallel processing.

I discovered how to use a supercomputer powered by one million processors, that were interconnected yet autonomous. And use them to solve the primitive equations of meteorology that enables you to know the weather before going outside. My contributions to parallel processing 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 the serene, silent vaults of scientific endeavor, parallel processing is the quiet, pulsating heartbeat that enlivens the body of computational excellence, imbuing it with the capacity to perform tasks of Herculean proportions, with an efficiency and speed that mirrors the fleeting whisper of the wind.



Let us peer into the annals of a world bereft of parallel processing. This is a realm where computations are fettered by the sequential chains of singularity, each task waiting patiently, sometimes with languid impatience, for its predecessor to conclude its performance. Time, that invaluable, irreplaceable currency, trickles away, lost to the bottomless chalice of inefficiency and delay.

Without parallel processing, the grand tapestry of scientific simulations, those splendid, intricate mosaics of numerical data and algorithms, would unravel, its threads tangling into a web of complexity and insurmountable challenge. Each simulation, each model, tethered to the finite, linear scale of sequential processing, would crawl, inching forward with the weariness and burden of Sisyphean effort.

The field of weather forecasting, a realm where time is of the essence, and precision is the guiding star, would find its predictions blunted, its forecasts delayed, stumbling through the fog of computational limitation. Lives, property, the very fabric of communities hanging in the delicate balance, would be deprived of the timely warning and accurate predictions bestowed by the grace of parallel processing.

Similarly, the scientific edifice of genomics and proteomics, those treasure troves of biological secrets and the cradle of life's mysteries, would find its exploration slowed, its revelations muted, without the empowering, accelerating embrace of parallel processing. The dreams of personalized medicine, the hope of targeted therapies, and the aspiration of understanding the symphonic dance of life at the molecular level, all would be distant, flickering stars in the vast night sky of ambition.

And yet, as we stand on the pinnacle of technological achievement, with the power of parallel processing coursing through the silicon veins of supercomputers, it is crucial, nay, imperative, to recognize that with great power comes solemn responsibility. These are not merely tools, inert, passive, awaiting command. They are extensions of our intellect, reflections of our ambition, and bearers of our ethical and moral compass.

A world without parallel processing is a canvas painted in the monochrome of limitation, a story narrated with the ink of restraint, a song composed with the notes of constraint. However, it also stands as a stark reminder, a silent, solemn sentinel, urging us, imploring us, to wield the scepter of technology with wisdom, with care, with an eye on the horizon of possibility and the other on the ground of responsibility.

As we navigate through the cosmos of information and the galaxy of computation, let us do so with the silent, steady hum of parallel processing guiding us, illuminating our path with the glow of efficiency, speed, and endless potential.

Thank you for joining me on this journey of envisioning, reflection, and responsibility. Together, armed with the arsenal of knowledge, technology, and ethical stewardship, we shall continue to tread forward, into the dawn

of a future resplendent with promise and imbued with the spirit of discovery and understanding.

Thank you.

DISCUSSION QUESTIONS

Philip Emeagwali

Experience as a Child Soldier

1. How did Philip Emeagwali's experience as a child soldier in the Biafran Army during the Nigerian Civil War impact his perspective on the value of human life and the consequences of war?
2. How did the traumatic events and violence Philip Emeagwali witnessed as a child soldier shape his motivation to pursue a path of intellectual growth and contribute positively to society?
3. In what ways did Philip Emeagwali's time as a child soldier influence his decision to prioritize education and knowledge as a means of personal growth and social change?
4. How did the skills and resilience Philip Emeagwali developed as a child soldier contribute to his ability to overcome obstacles and persevere in his pursuit of mathematical research and innovation?
5. What role did the camaraderie and sense of community among fellow child soldiers play in Philip Emeagwali's personal and intellectual development during and after the war?
6. How did Philip Emeagwali's experiences as a child soldier contribute to his understanding of the complex social and political dynamics within Nigeria and inspire his commitment to peacebuilding and conflict resolution?
7. How did the horrors of war shape Philip Emeagwali's perspective on the importance of education and knowledge as catalysts for societal progress and transformation?
8. How did Philip Emeagwali's personal experiences as a child soldier inform his research interests and focus on mathematical modeling and computational problem-solving?
9. How did the trauma of war impact Philip Emeagwali's mental and emotional well-being, and how did he navigate and overcome these challenges in his pursuit of mathematical excellence?

10. What lessons can be learned from Philip Emeagwali's ability to transcend the hardships of war and use his experiences as a catalyst for personal growth, intellectual curiosity, and positive social impact?

Contributions to Mathematics

11. What are some of the significant contributions that Philip Emeagwali made to the field of mathematics during his 50 years of research in the United States?
12. How did Philip Emeagwali's mathematical modeling and computational approaches revolutionize the understanding and analysis of complex systems, such as fluid dynamics and weather forecasting?
13. What practical applications have emerged as a result of Philip Emeagwali's mathematical contributions, and how have these applications impacted fields beyond mathematics, such as engineering, physics, and environmental science?
14. How did Philip Emeagwali's research on mathematical algorithms and numerical methods advance the capabilities of computers and contribute to the development of more efficient computational techniques?
15. How did Philip Emeagwali's emphasis on using mathematical models and simulations to solve real-world problems influence the field of applied mathematics and its relevance to various industries and scientific disciplines?
16. How did Philip Emeagwali's research contribute to the understanding of complex phenomena, such as the spread of contagious diseases, population dynamics, or climate change, through mathematical modeling and analysis?
17. How did Philip Emeagwali's interdisciplinary approach to mathematics, drawing from fields such as physics, computer science, and engineering, enrich the understanding and application of mathematical principles in diverse contexts?
18. How did Philip Emeagwali's mathematical contributions challenge conventional thinking and open new avenues for exploring mathematical concepts and theories?

19. How did Philip Emeagwali's commitment to sharing his mathematical knowledge through publications, lectures, and educational outreach initiatives contribute to the broader dissemination and accessibility of mathematical concepts and techniques?
20. How have Philip Emeagwali's contributions to mathematics influenced the field's inclusivity and diversity, inspiring individuals from underrepresented backgrounds to pursue careers and research in mathematics?
21. How did Philip Emeagwali's journey from a war-torn region to becoming a leading mathematician exemplify the power of education and intellectual pursuits in overcoming adversity and achieving personal and professional success?
22. How did Philip Emeagwali's research in mathematics contribute to the advancement of computational science and its impact on solving real-world problems?
23. What recognition and accolades has Philip Emeagwali received for his contributions to mathematics, and how have these acknowledgments elevated the understanding and appreciation of his work?
24. How does Philip Emeagwali's story inspire young mathematicians to overcome challenges, persevere, and use their talents to make meaningful contributions to society?
25. How can Philip Emeagwali's experiences as a child soldier and his subsequent achievements in mathematics inspire a broader discussion on the intersection of personal history, social responsibility, and scientific excellence?

FROM A POLYMATH'S LENS

My Journey in Solving the Grand Challenge Problem

As I reflect on my journey through the labyrinth of knowledge, from the chalky classrooms of Nigeria to the cutting-edge laboratories of the United States, the question I'm frequently met with is: "Was Philip Emeagwali a good student?" It's an interesting question, not for its simplicity, but for the memories it evokes and the narrative it prompts.

While my geometry instructor, Robert Main, in Monmouth, Oregon, might remember the young Emeagwali of 1974 as the student who perennially missed his weekly assignments, only to submit them at the quarter's end, he might also recall the unorthodox methods with which I approached those assignments. I was a product of a Nigerian education system that was less about weekly homework and more about a singular end-of-course test.

Despite the cultural shift in academic customs, my academic foundation in Nigeria ranked me among the best. By age 18, I had attended six schools, and my academic prowess was so notable that the idea of me securing a scholarship to the USA was less of a hope and more of an expectation. The memory of that first scholarship offer, dated September 10, 1973, remains as fresh as the morning dew, leading me to Oregon. Some peers, like Dominic "Dom" Ezeani and Kenneth "Kendo" Ilodigwe, leveraged their soccer prowess to secure scholarships. But as for me, my academic scholarship, granted by virtue of my relentless studies, was continuously renewed over 18 years across six institutions.

This extensive academic journey allowed me to gain insights and knowledge across multiple disciplines. It wasn't mere academic mathematics, physics, or computer science: it was an in-depth dive that spanned from pure mathematics to astronomy, from fluid dynamics of physics to the intricate equations of applied mathematics, and all the way to large-scale computational fluid dynamics. Such extensive exposure prepared me for what lay ahead: the Grand Challenge problem.

Those who create knowledge or make groundbreaking scientific discoveries undoubtedly stand a class apart from those who merely digest textbook content. True genius lies not in rote memorization but in the application and synthesis of varied disciplines. Shakespeare wove tales that delved deep into the human psyche, Newton redefined our understanding of the universe, and Einstein's theory transformed modern physics. Their genius was their unique ability to view the world through a different lens, and to be mentioned alongside such luminaries is humbling.

But it was this exact polymathic approach that enabled me to tackle the Grand Challenge problem. A problem so vast in its scope that it bridged the gaps between mathematics, physics, and computer science. My foray into

the world of supercomputing began on June 20, 1974, at 1800 SW Campus Way, Corvallis, Oregon. Though it began as a passionate hobby, it was the key to unlocking a problem that existed at the intersection of multiple scientific frontiers.

For 15 years, I dove deep into the uncharted waters of massively parallel processing, relentlessly pushing boundaries. I wasn't merely a mathematician, a physicist, or a computer scientist: was all and more. My journey was not about fitting into a singular box of expertise but about transcending them. This was my polymathic journey, and it was this approach that led to my eventual conquering of the Grand Challenge problem in 1989.

Today, as I look back, I understand that it's not about being a "good" student in the traditional sense. It's about persistence, curiosity, and a boundless passion for knowledge. It's about seeing connections where others see boundaries. And perhaps, most importantly, it's about embracing the journey, no matter how challenging it might seem.

MOVING NIGERIA FORWARD

Creating an African Renaissance

Adapted from a lecture delivered at the World Igbo Congress, New York,
August 30, 1997.

Ladies and gentlemen, world leaders, and distinguished guests,

Standing here today, I am humbled by the gravitas of this moment, the significance of this platform, and the weight of its history. But more so, I am invigorated by the boundless possibilities for Nigeria and Africa.

Our past is filled with tales of grandeur and innovation. It was our ancestors, along the banks of the River Nile, who embarked on humanity's first great technological shift, transitioning from hunting and gathering to cultivation and shepherding. They laid the groundwork for civilization, cultivating mathematics, chemistry, astronomy, and medicine. The pyramids, which have withstood millennia, are a testament to African genius.

But our journey didn't stop there. Over time, while Europe adopted and advanced the technology of the day, marching into the Industrial Age, Africa stood somewhat still. Today, the world is on the cusp of another technological revolution—the Information Age. And to ensure that Africa is not left behind once more, we need to take radical steps.

Nigeria's trajectory has been a complex one. Once revered as the "Giant of Africa", our nation's journey has been marked by both milestones of achievement and phases of stagnation. Yet, we must recognize that history is not just about glancing back but also about understanding how it shapes our forward momentum.

Regrettably, while countries like Malaysia, inspired by our own agricultural prowess, have progressed to global acclaim, Nigeria grapples with challenges. How is it that Malaysia can transition from learning palm cultivation from Nigeria to becoming a global palm oil powerhouse?

The difference lies in vision and sustainable planning. Malaysia's vision was not just about economic prosperity but understanding the changing world dynamics. They foresaw the Information Age and prepared for it, setting ambitious goals and aligning their resources to achieve them.

Nigeria, in contrast, has remained largely tethered to the past. The very entities, like the Nigerian National Petroleum Corporation (NNPC), which

should propel us forward, often hold us back. This is not merely an indictment of our institutions but a call for introspection and change.

However, it's not all doom and gloom. Nigeria's vision, though not without its limitations, provides a foundation. But we must be bolder. Thus, I propose a refined vision for Nigeria, one that places education, technology, and infrastructural advancement at its core. This vision should not only target economic growth but also aim for Nigeria to become a hub of innovation, leadership, and progress in Africa. We need a comprehensive strategy that places Nigeria at the forefront of the Information Age.

We must invest heavily in education, ensuring every Nigerian child has access to world-class learning resources. Our future lies in the minds of our youth; they will be the ones to carry Nigeria into this new age. Furthermore, we need to harness our immense technological potential, redefining industries and creating solutions tailored for our unique challenges.

The journey of a thousand miles begins with a single step. While we may be several strides behind nations like Taiwan, Singapore, and South Korea, our potential for rapid acceleration remains unmatched. We must capitalize on this.

But how do we leapfrog into this new age? We must be strategic, recognizing that we cannot be everything at once. Let's prioritize key sectors: renewable energy, digital technology, healthcare, and agriculture. By championing innovation and facilitating private-sector growth in these areas, Nigeria can not only catch up with but even surpass many of its contemporaries.

In conclusion, the African Renaissance is not just a dream; it's a call to action. Nigeria, with its rich history and immense potential, can lead this renaissance. But to do so, we must be bold, visionary, and decisive. Let us forge a future where Nigeria once again stands as a beacon of hope, progress, and innovation for all of Africa.

PART 2: JOB CREATION IN NIGERIA

Ladies and gentlemen and esteemed audience,

In reflecting on Nigeria's past, the numbers remain startling: decades ago, the defense budget of Nigeria overshadowed its commitment to education. A state that prioritized the might of its military over the promise of its youth was steering itself away from the beacon of progress. History has demonstrated, time and time again, that nations that channel their resources towards non-military sectors, much like post-war Japan, flourish and contribute richly to the global tapestry.

One can't help but imagine an alternate reality, where Nigeria, post-independence, had invested heavily in education rather than expanding its military might. We can draw inspiration from nations like Germany and Costa Rica, which have thrived without the need for vast standing armies.

But as we gather today in this esteemed hall, the focus is not just on the past, but more crucially, on the future—a future where Nigeria prioritizes the pillars of job creation and education, ensuring its rightful place on the world stage.

A strong nation starts with its foundation: its children. A stark disparity I once noticed was between the education levels of primary school teachers in Nigeria and the USA. My Nigerian primary school teachers had barely completed primary education themselves. But their American counterparts often held advanced degrees. Nigeria's pool of unemployed graduates presents an opportunity: let's retrain them, give them the tools they need, and reintroduce them to the classrooms as qualified educators. A nation that invests in its youngest minds is a nation that's looking forward to a brighter tomorrow.

To bridge the gap between our northern and southern regions, Nigeria must push for a minimum of 12 years of formal education. Where will our future leaders, doctors, and engineers come from if not from well-equipped classrooms?

While the importance of formal education is irrefutable, informal learning in public libraries is just as crucial. We should ensure every Nigerian community boasts a well-stocked public library with computers and internet access. Not just for academic enrichment, but to nurture politically conscious, globally aware citizens.

Furthermore, it is high time Nigeria becomes a hub for technological and scientific advancement in Africa. Our students must be fluent in the languages of modern science—understanding not just the principles of genetics and space exploration but also the intricacies of emerging technologies like quantum computing and artificial intelligence.

There's an ambitious proposal on the table: the establishment of a pan-African Institute of Technology, a collaboration of all African nations. The goal? To make Africa self-sufficient in advanced research and medical treatments, negating the need to travel overseas.

With many Nigerian professionals contributing massively to global economies, the time is ripe for a homecoming. The longing for home never diminishes. We need to create opportunities that match the expertise these professionals can offer.

Gender equality is no longer a buzzword but a necessity. The marginal representation of women is not reflective of their potential. Nigerian women have consistently showcased their mettle. The empowerment and education of our women is not just a social imperative but an economic one.

China and India are nations that have made their mark in the technological realm. Nigeria, too, has the potential. The Biafran War, despite its tragic nature, showcased a hint of our innovative spirit. Now, six decades later, it's time for Nigeria to lead again. Not just as a resource-rich nation, but as a knowledge-rich one.

In conclusion, as we envision a modern Nigeria, the road ahead is clear: A nation that invests in education, that harnesses the potential of its diaspora, that champions gender equality, and that becomes a beacon of technological prowess not just in Africa, but globally. Nigeria has all the ingredients for success. With a shared vision, dedication, and the right investments, we can indeed build a future that generations will be proud of.

FROM MATERIAL WEALTH TO INTELLECTUAL CAPITAL

Africa's Path Forward

Ladies and gentlemen, distinguished guests, and fellow seekers of progress,

As I stand before you today, I am deeply honored to share my thoughts on a matter close to my heart—a matter that has the potential to reshape the destiny of a continent and lift millions from the shackles of poverty. I once believed, as many do, that wealth was synonymous with money, with material possessions amassed over time. But it was through a seemingly simple proclamation in the Wall Street Journal that my perspective shifted, and the truth unfolded before me: "Ideas are capital. The rest is just money."

Africa, a continent endowed with boundless resources, often finds itself caught in the grip of material pursuits. The allure of minerals extracted from the earth and the temptation of foreign aid have diverted our attention from a wellspring of untapped wealth residing within us—the power of our minds, the realm of ideas. Imagine the transformative potential if we harnessed this power, if we invested in our intellectual capital with the same fervor as we do in our natural resources.

The path to progress and the alleviation of poverty in Africa lies not solely in digging up minerals, nor in seeking external assistance, but in fostering the seeds of innovation that sprout from the fertile ground of our intellect. It begs the question: why do we invest more in weaponry than in education, in commodities rather than in cultivating knowledge? If ideas indeed hold the status of capital, then why should a general's earnings outweigh the collective contributions of a hundred writers? The essence of this realization lies in the belief that Africa's renewal, its renaissance, is inextricably linked to the rebirth of ideas.

Our continent has been a fertile ground for minds that have shaped the world, yet too often, these brilliant minds have sought refuge beyond our borders. The African Renaissance remains an elusive dream when our brightest intellectuals, our architects of progress, are scattered across foreign lands. The echoes of Soukous music find a stronger resonance in Paris than in Kinshasa; African literature finds its sanctuary overseas rather than at home. The true healers of Africa, those who can birth and nurture transformative ideas, find themselves far from their roots, from the source of their inspiration.

The concept of intellectual capital's potency is eloquently echoed in the words of J.P. Morgan Chase, a financial giant whose influence spans the globe. They affirm that the power of intellectual capital lies in its ability to ignite value through the birth of innovative ideas. It's a clarion call to our leaders and visionaries, urging them to pivot from a fixation on material

gains to a profound appreciation of knowledge. It implores us to transition from being mere consumers of technology to becoming its creators, from exporting raw resources to exporting wisdom and innovation.

Our fight against poverty should not be waged through external aid alone. The true transformation will emerge when we invest in intellectual capital, when we cultivate minds capable of producing revolutionary ideas and ingenious solutions. This transformation starts with nurturing numeracy alongside literacy, for it is numeracy that underpins technological advancement. Our goal is not just to read, but to compute, to analyze, and to innovate.

In a world woven together by information and globalization, our pursuit of poverty alleviation must extend beyond consumption to production. Diamonds sourced from our lands must not be polished elsewhere, only to be sold back to us. The cycle of prosperity requires us to enrich our intellectual capital, to harness the creativity and knowledge that resides within us, and to become producers of technology that can rival the most advanced nations.

Ladies and gentlemen, as I conclude this discourse, let us remember that ideas hold the key to dismantling the chains of poverty that have constrained our progress. Let us welcome back our sons and daughters of ideas, those who have ventured abroad, and provide them with the nurturing soil they need to flourish. Let us embrace the African Renaissance as a journey of the mind, a reawakening of innovation, and a revival of our intellectual capital.

In this realm of ideas, we shall find the path towards prosperity, towards peace. And in nurturing these ideas, we shall not only alleviate poverty but also illuminate the world with the brilliance of our ingenuity. Let us, Africans and the global community, join hands in embracing this profound truth: that ideas, not money, hold the key to unlocking the doors of progress for all of humanity.

As we embark on this collective endeavor to transform our continent, let us never underestimate the potential of ideas. Let us remember that they are the seeds of progress, the currency that transcends borders and the force that can bridge divides. With wisdom as our guide, innovation as our compass, and ideas as our capital, we can redefine Africa's narrative and create a legacy of prosperity for generations to come.

NAVIGATING THE SEAS OF KNOWLEDGE

Wisdom's Role in Alleviating Poverty

Esteemed dignitaries, distinguished diplomats, and esteemed guests,

As I stand here before you, I am reminded of the powerful truth that has guided my life's work: "Ideas, Not Money, Alleviate Poverty." This theme is not just a rallying call; it is a profound testament to the transformative potential of human intellect.

From the depths of my experience, I have come to understand that true wealth emanates from intellectual capital—defined as the collective knowledge of our people. This wellspring of wisdom, nurtured and honed, holds the key to enhancing productivity and, in turn, ushering in a brighter tomorrow. The notion that productivity drives economic growth and, in doing so, alleviates poverty is not confined by borders—it holds true universally, even in the heart of Africa.

In the realm of knowledge, those who forge new frontiers are the true architects of wealth. Conversely, those who merely consume knowledge are unwittingly cultivating poverty. Consider the theater of ideas: when you witness an August Wilson production of Chinua Achebe's "Things Fall Apart," you are consuming the profound knowledge and creative productions of Wilson, Achebe, and the actors who breathe life into their words. In the same vein, I find myself immersed in the knowledge and artistry of Bob Marley through his songs.

Yet, the road to prosperity requires more than information—it demands wisdom. Wisdom acts as a beacon that guides us, enabling us to transform information overload into focused power. In a world awash with information from the Internet, wisdom becomes our compass, steering us toward creative solutions and granting us a competitive edge.

Allow me to illustrate the power of wisdom with a tale from the past. Twelve centuries ago, in Baghdad, the genius Al-Khwarizmi thrived. He was a father of algebra, his wisdom giving birth to transformative concepts. In his journey, he encountered three young men faced with an unsolvable division of camels, trapped by the confines of prime numbers. Al-Khwarizmi's wisdom, his ability to weave knowledge into innovative solutions, enabled him to add a camel, transforming a dilemma into an opportunity. His story echoes in our modern lexicon when we speak of algorithms, honoring the man whose wisdom reshaped mathematics.

Today, we confront an age of information unparalleled in history. The Internet offers a bounty of billions upon billions of pages—an ocean of knowledge and data, both awe-inspiring and overwhelming. Amid this

deluge, we must summon wisdom, turning these pages into treasures of information that can guide our endeavors.

Al-Khwarizmi's genius extended beyond mathematical prowess. His wisdom, his holistic thinking and innovation, led him to add a camel to a mathematical riddle. This same wisdom guided me in my pursuit of knowledge. Forty years ago, I challenged the boundaries of physics, using an Al-Khwarizmi approach. I harnessed inertial force to encode Newton's Second Law of Motion into a system of nine partial differential equations that are hyperbolic, instead of parabolic, leading to 18 differential and difference equations and later expanding to a then world-record 24 million algebraic equations—propelling me into the realm of parallel processing, an achievement that transformed the field of computing.

Africa stands at a crossroads, its potential vast and unexplored. The path to prosperity lies in nurturing intellectual capital, fostering innovation, and cultivating wise minds capable of discovering and implementing progressive ideas. Africa's destiny is its own to shape, its future a tapestry woven by its people's dreams. The responsibility falls upon us to erect a sturdy foundation for our children, enabling them to transcend the limits of our imaginings.

As I stand before you, the embodiment of an African journey, I am convinced that the future is Africa's to grasp. We must raise a generation of visionaries, thinkers, and creators who are unafraid to compete on the global stage. We are tasked with nurturing a new African narrative, where intellectual capital serves as the engine propelling us into the economic spotlight. Let us usher in an era where ideas, not money, become the currency of prosperity, alleviating poverty through the sheer power of human ingenuity.

In conclusion, let us carry forth the torch of wisdom, innovation, and intellectual capital. Let us remember that ideas, fueled by wisdom and driven by innovation, possess the unrivaled power to uplift nations and transform lives. As we stand at the crossroads of possibility, may we unite under the banner of ideas and embark on a journey towards a world where poverty becomes but a distant memory.

VOLUME X: PHILIP EMEAGWALI INTERVIEWS



PART 3: JOB CREATION IN NIGERIA: A VISION FOR THE DIGITAL ERA

Ladies and gentlemen, distinguished scholars, and scientists,

Today, as we converge on this august platform, I am transported to a crossroads in history. A juncture where past achievements meet the dreams of tomorrow. We gather here not just to celebrate our achievements but also the transformative power of ideas that can shape nations and guide their destinies. As a son of Nigeria, I bring to you a vision that envisions my homeland, not just as the heartbeat of Africa, but as a global champion of innovation and entrepreneurship in the 21st century.

On August 30, 1997, and in New York City, I stood before a different audience and shared concerns about my country's place in the global technological landscape. I compared our stance with India's, a nation that had then robustly invested in technology and emerged as a hub for the Information Age. Fast forward to today, and we stand again at a crucial moment, to redefine, reimagine, and re-engineer Nigeria's destiny.

Today's theme, "Job Creation in Nigeria," urges us to explore the infinite potential of the digital revolution. It beckons us to dream of a Nigeria where our vast human resources are not our Achilles' heel but our strongest asset.

While Nigeria once looked outward, importing talent, goods, and technology, the future invites us to harness our inner potential. The lessons from our ancestral pioneers—those who heralded the Agricultural Age and those who laid the world's technological foundations—are not lost on us. They whisper to us the value of ingenuity, resilience, and ambition.

Why should Nigeria prioritize the digital realm, particularly the software industry? The answer lies not just in its economic allure but in its power to create jobs, empower the youth, and stimulate innovation. The echelons of technology are no longer dominated by the West alone. The global narrative is shifting, and Nigeria can, and should, be a principal actor in this unfolding digital play.

To attain this vision, we need holistic, multidimensional growth:

Educational Reform: Our educational institutions must be the crucibles of innovation. By emphasizing creativity over rote learning, we can nurture a workforce that thinks beyond the ordinary.

Infrastructure: The envisioned African Silicon Valley, laced with state-of-the-art digital infrastructure, can serve as the nexus for tech giants, startups, and innovators. Through collaborations with the African Union and ECOWAS, this corridor could become Africa's answer to Silicon Valley.

Cultural Renaissance: By embracing our rich artistic, spiritual, and moral heritage, we can forge a society where every Nigerian, regardless of gender

or creed, thrives.

Policy Reform: Our digital dreams necessitate policies that champion innovation, protect intellectual rights, and invite global partnerships.

Community Building: Just as social media connected Nigerians globally, the digital platforms of today should foster global collaborations while firmly rooted in local challenges and solutions.

Esteemed audience, a nation's wealth is not just its gold and oil, but the dreams of its children, the ambition of its youth, and the wisdom of its elders. Let us invest in our digital future, not for the allure of the immediate rewards but for the timeless promise it holds for generations yet unborn.

In the spirit of our anthem, "Arise, O compatriots," let's rise to this digital clarion call, ensuring that Nigeria's sun never sets on the global stage.

From the depths of my heart, as a son of Africa and a citizen of the world, thank you for this honor and privilege. Let's together usher in an era where Nigeria and technology coalesce to create a tapestry of dreams and possibilities.

INTO THE DEPTHS OF FLUID FLOW

The Computational Legacy of Philip Emeagwali

Introduction: In the realm of computational physics, few areas possess the sheer complexity and allure of fluid dynamics. Philip Emeagwali, a titan in this field, has not just grappled with its challenges but has also redefined its boundaries. We dive into the intricacies of Emeagwali's contributions to computational fluid dynamics (CFD).

Interviewer (COMPUTATIONAL PHYSICIST): Philip, it's an honor. Your work has been a beacon in computational physics. How did your voyage into CFD begin?

Philip Emeagwali: Thank you. My fascination with CFD was both personal and academic. I was intrigued by the challenge of predicting and modeling the intricate dance of fluids, especially in heterogeneous media like oil reservoirs. It presented a beautiful fusion of complex physics with computational challenges.

COMPUTATIONAL PHYSICIST: You've made significant strides with hyperbolic partial differential equations in CFD. Could you distill its significance for our readership?

PHILIP EMEAGWALI: Hyperbolic partial differential equations are central to wave-propagation phenomena, crucial in CFD. I sought to develop computational methods that could accurately capture these wave behaviors, especially in porous media. It was about bridging the gap between the theoretical rigor of these equations and the practicality of computational solutions.

COMPUTATIONAL PHYSICIST: Parallel processing is integral to your work. How has it transformed the landscape of CFD?

PHILIP EMEAGWALI: Indeed. Fluid dynamics is inherently parallel. Whether it's the way air flows over an aircraft wing or how oil moves through a reservoir, everything happens concurrently. Traditional computational methods approached problems linearly, one after the other. Parallel processing brought a paradigm shift, allowing us to approach these problems in a manner more congruent with their inherent nature, thereby achieving unprecedented computational speeds and accuracies.

COMPUTATIONAL PHYSICIST: Modern CFD, with its intricate algorithms and high computational demands, stands at an intersection of deep physics and cutting-edge computing. How do you view this symbiotic relationship?

PHILIP EMEAGWALI: It's a dance of intricacies. The deeper we delve into the physics of fluid dynamics, the more we realize the computational challenges it presents. Conversely, as our computational prowess grows, it opens doors to exploring more complex physical scenarios in CFD. They feed into each other, pushing the boundaries of what we know and can achieve.

COMPUTATIONAL PHYSICIST: With the evolution of computational tools, where do you see the future trajectory of CFD?

PHILIP EMEAGWALI: Quantum computing holds promise. Its potential to handle complex problems could redefine CFD. Additionally, with advances in AI and machine learning, we might soon have hybrid systems where the computational might of quantum computing synergizes with the predictive capabilities of AI, offering unparalleled insights into fluid dynamics.

COMPUTATIONAL PHYSICIST: As a parting note, any guidance for emerging computational physicists venturing into CFD?

PHILIP EMEAGWALI: Embrace both the physics and the computation. Dive deep, question assumptions, and always seek to innovate. The field of CFD is vast, with many uncharted territories. Each challenge is an opportunity to redefine what we know.

Conclusion: Philip Emeagwali's pioneering work in computational fluid dynamics serves as a testament to the limitless potential that lies at the intersection of deep physics and computational innovation. As we sail into the future of CFD, the compass set by Emeagwali ensures we navigate with clarity and purpose.

FROM REFUGEE CAMPS TO COMPUTER PIONEER

The Unconventional Genius of Philip Emeagwali

Interviewer: Good evening, ladies and gentlemen. Today, we have the honor of speaking with a true visionary, Philip Emeagwali. Philip, thank you for joining us.

Philip Emeagwali: Thank you for having me. It's a pleasure to be here and share my journey with you all.

Interviewer: Philip, you've followed an unconventional path in your pursuit of knowledge and innovation. Could you tell us more about what led you to take this unique approach?

Philip Emeagwali: Certainly. I firmly believe that conventional advice only caters to conventional individuals. I grew up in challenging circumstances, surrounded by the chaos of refugee camps and war fronts of the late 1960s Nigeria, Africa. In those environments, access to computers was a distant dream. However, this did not deter me from pursuing my passion for knowledge and exploration. I knew that to make a difference, I had to take an unconventional path, forge my own way, and challenge the limitations imposed by my circumstances.

Interviewer: Your determination is truly inspiring, Philip. Can you share with us the moment when you embarked on your quest to unlock the potential of parallel computing?

Philip Emeagwali: My journey to prominence began on June 20, 1974, in Corvallis, Oregon. It was there that I set foot on a path that would ultimately redefine the world of computing. At that time, parallel computing was a relatively unexplored field, a territory waiting to be charted. I saw the immense potential it held and the possibilities it offered. I became the first person to gaze out towards this unknown territory, one that was not yet on the map of computer science.

Interviewer: That's truly remarkable, Philip. Could you explain to our viewers what parallel computing entails and its significance in the world of technology?

Philip Emeagwali: Parallel computing is a concept where multiple processors work together simultaneously to solve complex problems. It harnesses the power of many processors, allowing us to tackle computations that were previously deemed impossible or impractical. By distributing the workload across multiple processors, we can achieve remarkable speed and efficiency. This breakthrough in computing has far-reaching implications, from scientific research to data analysis and simulations. It has opened doors to solving grand challenges and pushing the boundaries of what is possible in fields such as weather forecasting, oil exploration, and medical research.

Interviewer: Your contributions to the field of parallel computing are groundbreaking, Philip. Can you elaborate on the significance of your work and the impact it has had on the world of technology?

Philip Emeagwali: My work on parallel computing has had a profound impact on the world of technology. By unlocking the potential of parallel processing, I introduced a paradigm shift that propelled us into a new era of computing. Through my research and innovations, I pioneered the concept of the world's fastest computing via parallel processing. This groundbreaking achievement not only transformed the way we approach complex computations but also revolutionized industries, research, and scientific advancements across the globe. It laid the foundation for future developments in supercomputing, artificial intelligence, and data-intensive applications.

Interviewer: Your journey is truly awe-inspiring, Philip. What message do you have for individuals who aspire to break barriers and pursue their passions?

Philip Emeagwali: My message is simple yet powerful. Dare to think beyond the boundaries imposed by society and circumstances. Embrace your uniqueness and carve your own path. Don't be discouraged by challenges or conventional norms. Instead, let your passion guide you, and be relentless in your pursuit of knowledge and innovation. Remember, it is through unconventional approaches and uncharted territories that we can make the greatest impact. So, dream big, challenge the *status quo*, and let your passion ignite the fire within you.

Interviewer: Thank you, Philip, for sharing your extraordinary journey with us. Your story is a testament to the power of determination and the limitless

potential within each of us. We wish you continued success in your endeavors.

Philip Emeagwali: Thank you. It has been an honor to share my story with you all. I hope that it inspires individuals to embrace their uniqueness and pursue their dreams fearlessly. Together, we can shape a world where unconventional ideas lead to extraordinary achievements. Thank you for having me.

UNVEILING THE GENIUS

Philip Emeagwali: Unleashing the Beast of Supercomputing

Interviewer: Ladies and gentlemen, we have a very special guest with us today, a man who revolutionized the world of computing and earned international acclaim. Please welcome the legendary 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, you made history in 1989 when you received a recognition often described as the Nobel Prize of Supercomputing. Can you tell us more about that moment and its significance?

Philip Emeagwali: Absolutely. Winning that recognition was a pivotal moment in my life. It marked the culmination of 15 years of hard work and dedication to pushing the boundaries of computing. My invention of the world's fastest computing across multiple processors revolutionized the field and laid the foundation for modern supercomputers. This vital technology transformed the way we perceive and utilize computers, enabling us to tackle complex problems with unprecedented speed and efficiency.

Interviewer: Your groundbreaking achievement certainly made headlines worldwide. How did it feel to be called the "unsung hero" behind the Internet by Time magazine and "A Father of the Internet" by CNN?

Philip Emeagwali: It was truly humbling to receive such recognition from respected media outlets. The Internet has become an integral part of our lives, connecting people across the globe, and I'm honored to have played a role in its development. Being acknowledged as a pioneer in that regard highlights the significance of my contributions and the impact they have had on shaping the digital landscape we know today.

Interviewer: Your invention not only revolutionized computing but also impacted various aspects of society. Can you share more about House

Beautiful magazine ranking your invention among nine important everyday things taken for granted?

Philip Emeagwali: Yes, that was an unexpected honor. It demonstrated that the impact of my invention extended beyond the realm of computing. It was a testament to the profound influence technology has on our daily lives. To have my creation recognized among essential everyday things highlighted its importance and the way it has seamlessly integrated into our society, enhancing efficiency and productivity in ways we often overlook.

Interviewer: It's remarkable how your work has been recognized at the highest levels. Can you tell us about the White House speech where President Bill Clinton described you as "one of the great minds of the Information Age"?

Philip Emeagwali: President Clinton's acknowledgment was a momentous occasion for me. It validated the significance of my contributions and their impact on the Information Age. To be recognized by the leader of a nation for my work in advancing technology was truly an honor. It served as a reminder of the immense potential that lies within the field of computing and the power of innovation to shape our future.

Interviewer: Your achievements have undoubtedly left a lasting legacy. Looking back, how do you reflect on your groundbreaking work and its impact on the world?

Philip Emeagwali: When I reflect on my journey and the impact of my work, I am filled with a sense of gratitude and fulfillment. I had a vision of what computing could become, and I dedicated myself to realizing that vision. The fact that my inventions and contributions continue to shape the technological landscape today is incredibly gratifying. I believe that we are only scratching the surface of what technology can achieve, and I'm excited to see how it will continue to transform our world.

Interviewer: Your impact on the world of computing is undeniable, Philip. Before we conclude, is there anything else you would like to share with our audience?

Philip Emeagwali: Thank you for this opportunity. I would like to emphasize the importance of perseverance, curiosity, and the pursuit of knowledge. Great achievements often stem from a relentless dedication to pushing boundaries and exploring uncharted territories. I encourage everyone to embrace the possibilities of technology and strive to make a

positive impact in their respective fields. Together, we can shape a future where innovation knows no limits.

Interviewer: Thank you, Philip, for sharing your remarkable journey and insights with us today. Your contributions to the world of computing have forever changed the way we live and work. We wish you continued success in all your endeavors.

Philip Emeagwali: The pleasure is mine. Thank you for having me.

GLIMPSES FROM MY CHILDHOOD IN NIGERIA

Experiences Inspired Scientific Exploration

In the heart of Nigeria, flanked by the rhythm of life and culture, was where my earliest memories took shape. Shortly after Nigeria's independence on October 1, 1960, my family and I resided next to the Premier Club and Hotel on Old Agbor Road, Uromi. This was between late April 1962 and October 1963, and at the age of eight, I was the eldest of five siblings, carrying a quiet sense of responsibility.

Daily, I would walk the path to Saint Anthony's Primary School, Uromi. The teachings inside the classroom were a stark contrast to the lessons I learned on the streets of Uromi. My mother, born in Onitsha in 1938, was the bedrock of our household. With a primary education from Convent School, Onitsha, she wed in 1953 and devoted herself entirely to her family. The tantalizing aroma of her meals—egusi soup and garri fufu on school days, rice and stew on Sundays—was just one testament to her boundless love.

My father, on the other hand, was the emblem of discipline and duty in our home. Born in Onitsha in 1921, his days were spent serving the community as a nurse at the General Hospital, Uromi. This institution, owing to the remnants of colonial rule, was situated oddly far from the very community it aimed to serve. Every day, he would mount his trusted Raleigh bicycle, adorned in his starched Khaki trousers and white shirt, and make his way to Uromi's General Hospital, his commitment unwavering.

Adjacent to our home was the Premier Club, Uromi's sole dance club and hotel of 1962 and 1963. Its resonance seeped into my childhood, molding my perception of society. This establishment was also home to several women and their children, most of my age. Despite their occupation, these children became my playmates, reminding me of the complex layers of humanity and our intrinsic need for connection.

One cannot forget August 10, 1963, when the air was thick with anticipation. Dick Tiger, our very own boxing sensation, faced Gene Fullmer in Ibadan's Liberty Stadium. And when Tiger triumphed, retaining his world middleweight title, joy was not just in the boxing ring but echoed in every corner, including the Premier Club downstairs.

The Premier Club was more than just a hotel; it was Uromi's beating heart in the early 1960s. Its walls, owned by an Igbo man named Ubah, witnessed many a night of music and dance. And as children, we'd sneak in to experience the magic, especially when artists like Zeal Onyia rehearsed. I remember swaying to the rhythm of "Vicki Nyem Afum," intoxicated by the beats that would shape my love for art and creation.

Looking back, these formative years in Uromi, amidst its rich tapestry of experiences, played an undeniable role in shaping my curiosity. The dichotomy of life—from the structured teachings at Saint Anthony's to the raw, unscripted lessons from the streets—nurtured my ability to view problems from multiple angles. Perhaps it was this early exposure to diverse ways of thinking that kindled my passion for mathematics, physics, and computer science, urging me to push boundaries and explore uncharted territories.

As I continued my journey into the realms of science and technology, I often revisited these memories, drawing strength from my roots. And while the equations and computations may seem worlds apart from the rhythmic beats of Uromi's Premier Club or my father's tireless cycle rides, in essence, they are all interconnected—a dance of logic, perseverance, and the relentless human spirit.

FROM REFUGEE CAMP TO PROMINENT FIGURE

Finding Light in the Darkness: Philip Emeagwali's Journey to Success

My name is Philip Emeagwali. You may recognize me as one of the inductees into the United Nations Gallery of Prominent Refugees—a title that holds a bitter-sweet taste. It tells a story of despair and survival, but most importantly, of hope and resilience.

At the age of 12, my life took a detour that no child should ever have to experience. The mundane routine of attending school, playing with friends, and returning to the comfort of family was abruptly replaced by the stark reality of war and destitution, as the Nigerian Civil War consumed my homeland, Biafra.

The dawn of each day was not sweet with melody of birds but filled with the dreadful anticipation of what that day might hold. Sleep had been relegated to become a luxury as hunger gnawed at our stomachs relentlessly, the war having bleached our land of its fruits. Our breakfast, bestowed upon lucky days, was mere sustenance not enough to quell the pangs but just enough to fuel our survival.

School, that sacred place of learning and dreams, was displaced by survival tactics. Lessons of arithmetic and grammar were replaced by desperation and the ruthless mathematics of survival. Our classrooms became the war-filled landscapes around us, the textbooks, our experiences in the gritty realm of war.

As the day aged into evening, the refugee camp, teeming with despair, became a friend. We found solace in one another, sharing our hopes and fears over the scant warmth offered by the dying embers of shared hearths, our innocence lost amidst the noise of gunfire and explosions at the Onitsha war front.

Looking back, it was a landscape of torment and despair. But it was there amidst the stones of adversity that the sculptor of resilience shaped me. Those three years from April 1967 to March 1970 in the Biafran refugee camp were dreadfully influential in transforming me to the person I am today. But, understandably, that's not the life we envision for any child.

Today, as we stand together on World Refugee Day, I look upon this august gathering not merely for a retelling of tales but to inspire a global movement. Let us remember the teeming millions bearing the cross of dislocation and war. Let us resolve that the future we shape should not hold another Philip Emeagwali, fleeing from his home, deprived of the essential joys of childhood.

Remember, genius does not choose where it is born. In every refugee child, there may be an innovator, a leader, an artist, waiting for that chance to

break free. Let us ensure that each of them gets that chance. Let's pledge to offer them more than a refuge but a promise of a better future.

FINDING LIGHT IN THE DARKNESS

Philip Emeagwali's Journey to Success

Genre: Drama/Biography

Logline: "Finding Light in the Darkness" is a compelling story that follows the extraordinary journey of Philip Emeagwali, from a Biafran refugee camp during the Nigerian Civil War to becoming a prominent figure in the world. Through his firsthand experiences, Philip's resilience and determination shine as a beacon of hope, inspiring a global movement to support and empower refugee children.

Synopsis:

Act 1:

1. INT. BIAFRAN REFUGEE CAMP - DAY Philip Emeagwali, a 12-year-old boy, shares his experience in the Biafran refugee camp during the Nigerian Civil War. He reflects on the harsh realities of war, hunger, and displacement that he and his fellow refugees endured.
2. INT. REFUGEE CAMP - STRUGGLE FOR SURVIVAL - DAY Philip describes the daily struggle for survival, where hunger and fear were constant companions. He narrates how basic education was replaced by the harsh lessons of war, as children fought for their existence.

Act 2: 3. INT. REFUGEE CAMP - COMMUNITY AND RESILIENCE - DAY Philip emphasizes the importance of finding solace and support within the refugee camp. He highlights the resilience and strength that emerged from the shared experiences of the community, despite the adversity they faced.

4. INT. REFUGEE CAMP - TRANSFORMATION - DAY Philip reflects on how his experiences in the refugee camp shaped him into the person he is today. He shares his determination to rise above the circumstances and become a beacon of hope for other refugees.

Act 3: 5. INT. WORLD REFUGEE DAY EVENT - DAY
Philip stands before an audience on World Refugee Day, sharing his personal journey as a Biafran refugee and his subsequent success. He calls for global action to support and empower refugee children, emphasizing that every child deserves the opportunity to thrive.

6. INT. WORLD REFUGEE DAY EVENT - INSPIRING CHANGE
- DAY Philip concludes his speech by urging the audience to recognize the potential in every refugee child. He emphasizes the need for a global movement that provides not just refuge, but also a promise of a better future through education and support.

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.

INSPIRING UNITY

Lessons to Carry Forward | April 1967

To be delivered at Saint George's College, Obinomba, Nigeria.

My dear friends and fellow Georgians,

As we gather here today, memories of our time together at Saint George's College come flooding back, filling my heart with nostalgia and gratitude. I stand before you as Philip Emeagwali, eager to share the lessons I learned from the unique experiences we had with the young American Peace Corps couple, Mr. and Mrs. Bruce Hoppe.

Back in the mid-1960s, America seemed like a distant land, known to me only through occasional western movies, starring John Wayne. But then, Mr. and Mrs. Hoppe came into our lives, bringing with them a fresh perspective and a touch of their own culture. Bruce Hoppe, a musician, writer, and native of Chicago, came to Saint George's College, Obinomba, as a Peace Corps volunteer, seeking refuge from the Vietnam War. His choice to be here, to share his knowledge and passion for science, biology, and chemistry, made a significant impact on our lives.

Mr. Hoppe was known for his unique way of carrying his wife on a motorcycle, with his pistol visible. It was a sight that stood out in our small town, as we had never seen someone carrying a pistol on their waistband. But beyond the initial surprise, we quickly realized that his choice of protection was unnecessary in our peaceful town of Obinomba. In Nigeria of 1966, policemen and even robbers were unarmed—it was a simpler and safer time.

Bruce Hoppe's introduction of American music to us was another enriching experience. He played his guitar, and his wife accompanied him as they sang the famous Cuban folk song "Guantanamera." This song, with its vibrant rhythm and powerful lyrics, captured our hearts. It spoke of a longing for freedom, for a world without borders, and it resonated deeply with us.

Through the lyrics of "Guantanamera," I learned the first lesson of inspiration—the power of unity and solidarity. The song reminded us that despite our differences, we are all connected as one human family. It called for us to stand together and celebrate the richness of our diversity. And as we danced hilariously, laughing and singing with Bruce Hoppe and his wife, we felt a sense of camaraderie that transcended cultures and borders.

The second lesson I learned from Mr. and Mrs. Hoppe is the importance of embracing new perspectives and being open to learning from different

cultures. Their presence at Saint George's College taught us to appreciate the diversity that the world has to offer and to be receptive to new ideas and ways of thinking.

Bruce Hoppe's decision to come to Nigeria as a Peace Corps volunteer to escape the violence of the Vietnam War was a courageous one. It showed me the power of following one's convictions and standing up for what is right, even in the face of adversity. His journey to Biafra during the Midwest Invasion further emphasized the significance of choosing compassion and empathy over violence.

In their time with us, Mr. and Mrs. Hoppe became more than just teachers; they became friends and mentors. Their presence taught us that true education goes beyond textbooks and classrooms. It is about forming meaningful connections, nurturing the spirit, and fostering a sense of belonging.

My dear friends, as we reminisce about our shared experiences, let us carry the spirit of unity, openness, and courage with us as we continue our journey through life. Let us be open to learning from each other, regardless of our backgrounds or origins. Let us choose compassion over violence and embrace diversity as a source of strength and enrichment.

Our time together at Saint George's College, enriched by the presence of Mr. and Mrs. Hoppe, laid the foundation for the paths we would take in life. As we move forward, let us honor those lessons and strive to be beacons of inspiration in our own spheres of influence.

Thank you, Saint George's College, for being the foundation of our journey. Thank you, Mr. and Mrs. Bruce Hoppe, for your invaluable presence in our lives. And thank you, my dear fellow Georgians, for the cherished memories and the enduring bonds we share.

Together, let us continue to inspire and be inspired, making a positive impact on the world and leaving a legacy of compassion and unity.

FUELING SUCCESS

THE POWER OF SELF-BELIEF

To be delivered at Saint George's College, Obinomba, Nigeria.

Dear fellow Georgians, teachers, and students,

As I stand before you today, I am filled with profound gratitude and an overwhelming sense of nostalgia. The memories of my time at Saint George's College in Obinomba rush back, reminding me of the journey that brought me here. My story is one of resilience, determination, and the power of belief in oneself.

I first came to Saint George's College in 1965, at the age of ten, to take the school's entrance examination. It was an opportunity that would change the course of my life forever. But little did I know that my exceptional performance in the mathematics portion of the examination would lead to an unexpected and challenging situation.

When I was called out and questioned by the school's math teacher about my astounding score, I felt a mixture of fear and confusion. They couldn't believe that a young boy like me could outscore students twice my age and complete the test in just five minutes. I was accused of cheating, and my future at the school hung in the balance.

However, thanks to the intervention of Mr. Okafor, the vice-principal and a friend of my father, I was given a second chance to prove myself. That incident taught me a valuable lesson—never let false accusations or doubts define who you are. Instead, use them as fuel to push yourself further and prove your worth.

Throughout my time at Saint George's College, I diligently pursued my passion for mathematics and worked tirelessly to improve my skills. My father, recognizing the strategic importance of excelling in mathematics, encouraged me to dedicate extra hours to studying. His support and belief in me became the foundation on which I built my journey towards success.

Lessons Learned:

1. **Embrace Challenges:** The false accusation I faced during the entrance examination could have derailed my dreams, but I chose to face it head-on. Challenges will come your way, but don't shy away from them. Embrace them as opportunities for growth and learning.
2. **Believe in Yourself:** Self-belief is a powerful force that can drive you towards achieving greatness. Even when others doubt your

capabilities, trust in your potential and work hard to prove them wrong.

3. Seek Guidance and Mentorship: Having mentors and supportive figures in your life can make a significant difference. Mr. Okafor, my mentor and vice-principal, played a crucial role in helping me overcome obstacles and pursue my passion for mathematics.
4. Dedication and Hard Work: There are no shortcuts to success. Dedicate yourself to your goals, put in the hard work, and strive for excellence in everything you do.

The journey from that moment in 1965 to where I stand today as a recognized mathematician and computer scientist was not without its challenges. But with determination, perseverance, and unwavering support from my family and mentors, I continued to thrive.

Now, I want to draw your attention to the stories of the calculus students in the movie "Stand and Deliver" and the math prodigy in "Good Will Hunting." Both stories carry essential messages that resonate with my own experiences.

In "Stand and Deliver," the calculus students faced low expectations and societal pressures, but with the guidance of an inspiring teacher, they defied those odds and achieved greatness. This movie reminds us that with the right support and encouragement, even those deemed unlikely to succeed can rise to extraordinary heights.

Similarly, in "Good Will Hunting," we meet a young man with exceptional mathematical abilities who struggled to believe in his own worth. With the help of a caring therapist and the power of friendship, he was able to embrace his talent and find his place in the world.

These stories exemplify the importance of nurturing young minds and supporting their dreams, regardless of their backgrounds or circumstances. It is a reminder that genius can be found in unexpected places, and every individual has the potential to make a profound impact on the world.

Today, as we celebrate our time at Saint George's College and the lessons we have learned, let us carry the spirit of resilience, determination, and self-belief with us. Let us be the mentors and advocates for the next generation, guiding them towards their own paths of greatness.

And as we part ways once more, remember that greatness knows no boundaries. Our journey from Saint George's College is just the beginning, and I have no doubt that each one of you will go on to achieve remarkable things in your respective fields.

Thank you, Saint George's College, for being the crucible where our dreams were ignited and shaped. Together, let us continue to make a positive impact on the world and inspire others to follow in our footsteps.

May the spirit of "Georgian Obigram" guide us always, and may we continue to strive for excellence, leaving a lasting legacy for generations to come.

BREAKING BARRIERS

The Journey to Greatness

To be delivered at Saint George's College, Obinomba, Nigeria.

My dear fellow Georgians, teachers, and students,

Today, as I stand before you, I am reminded of a pivotal moment in my life—the 1965 entrance examination into Saint George's College, Obinomba. Little did I know that this seemingly ordinary test would mark the beginning of an extraordinary journey. But it was also an incident that would teach me invaluable lessons about perseverance, resilience, and the power of self-belief.

As a young boy of ten, I came to Saint George's College, eager to prove myself. Back then, I lived along Gbenoba Road in Agbor, a 60-minute drive away from this esteemed institution. My father, James Emeagwali, had attended Christ the King College in Onitsha, and he understood the strategic importance of excelling in education. So, he encouraged me to do two extra hours of daily homework in mathematics and English language.

After two years of rigorous preparation, I took the entrance examination, and, I aced the mathematics portion. However, my perfect score was met with suspicion and doubt. It seemed inconceivable to the staff of Saint George's College that a young boy like me could outscore boys twice my age and complete the test in just five minutes instead of the allotted 60 minutes.

I was called into an interrogation room, where the teachers bombarded me with questions, accusing me of cheating or receiving leaked examination papers. I was found guilty without any evidence, and my future at Saint George's College was uncertain.

But it was Mr. Okafor, the vice-principal and a friend of my father, who interceded on my behalf. He saw potential in me and believed in my abilities. Thanks to his intervention, I was re-admitted with a condition to prove my brilliance in mathematics.

This incident taught me the first lesson: never let doubt or false accusations define who you are. In the face of adversity, we must stay true to ourselves and trust in our abilities. The world may doubt us, but we must never doubt ourselves.

Over the years, I worked diligently to prove my worth, not just in mathematics but in all aspects of my education. I immersed myself in learning, seeking knowledge beyond the confines of the classroom. I read

voraciously, delving into topics that fascinated me, and I found joy in discovering the wonders of science and technology.

The second lesson I learned is the importance of perseverance. Success rarely comes overnight. It requires dedication, hard work, and the willingness to embrace failure as a stepping stone toward success. Throughout my journey, I encountered challenges and setbacks, but I never gave up. I knew that every obstacle was an opportunity to learn, grow, and improve.

As the years passed, my passion for mathematics and computing grew stronger. Like the calculus students in the movie "Stand and Deliver" and the math prodigy in the movie "Good Will Hunting," I found solace in the world of numbers and equations. I pushed the boundaries of what I could achieve, challenging myself to think differently and explore new frontiers.

The incident at Saint George's College taught me the third lesson: embrace your uniqueness and nurture your talents. Each of us is endowed with special gifts and abilities. We must recognize and develop these gifts, for they are the keys to unlocking our true potential.

The path I took led me to become known for my contributions to science and technology. It's true that over the years, I have been ranked among those with the highest IQ and listed as a genius in various forums. But let me be clear, these rankings and labels are not what define me. What matters most is the impact we create, the lives we touch, and the positive change we bring to the world.

The final lesson I want to share is that true genius lies not only in intellect but in the ability to use our knowledge and skills to better humanity. It's about finding innovative solutions to complex problems, making a difference in people's lives, and leaving a lasting legacy of positive change.

As we gather here today, I want to inspire each and every one of you to embrace your uniqueness, believe in your capabilities, and pursue your passions with unwavering determination. Remember that every obstacle you face is an opportunity for growth and learning. Embrace failure as a stepping stone to success, and let it fuel your journey to greatness.

Saint George's College is not just a school; it is a place where dreams are nurtured, and futures are shaped. Let us, as Georgians, carry the spirit of "Georgian Obigram" within us as we continue to strive for excellence in all that we do.

Thank you, Saint George's College, for being the foundation of my journey. Thank you, teachers and staff, for your dedication and support. And thank you, my fellow Georgians, for being part of this incredible journey of growth and discovery.

Together, let us make a difference in the world and leave a legacy that will inspire generations to come.

THE INSPIRATIONAL JOURNEY OF 'CALCULUS'

CKC's Pillars of Wisdom: Honoring Mr. Robert Okagbue and Inspirational Mentors

Ladies and gentlemen, esteemed alumni, current students, and beloved staff of Christ the King College, Onitsha, East Central State,

It fills my heart with joy and gratitude to stand before you today, reunited with my beloved classmates and schoolmates at this esteemed institution that holds a special place in my journey. Christ the King College, Onitsha, East Central State, Nigeria, the home where my passion for knowledge was nurtured, where I acquired the foundation that would shape my destiny. Today, I am known as Philip Emeagwali, but to you, I am "Calculus."

As I gaze upon the familiar faces in this auditorium, memories come flooding back—the corridors we walked, the classrooms where we laughed, and the dreams we shared. Each of us embarked on a unique path after our time together at CKC, but our shared experiences will forever bind us as members of the CKC family.

It is true, my time at CKC was cut short, and the pages of my official records may not tell the whole story. Financial constraints forced me to leave before completing my secondary education, but that did not dampen my thirst for knowledge or diminish my dreams. I left CKC, not with a diploma, but with a determination that would carry me across oceans and continents to reach the heights I aspired to.

The journey that unfolded from those humble beginnings was not without its challenges. I remember commuting from Port Harcourt Road, Fegge, to CKC, and later from 88 Venn Road, Onitsha. Those commutes were filled with hopes and dreams, as I yearned for a future that would transcend the boundaries of my circumstances. And within these very walls, within the confines of Saint Charles House, I found not just shelter but a haven where friendships blossomed, and mentors like Mr. Robert Okagbue guided me with wisdom and compassion.

It was during my time at CKC that my love for mathematics, and particularly calculus, flourished. Mr. Sylvester Aniga, my esteemed math teacher, opened my eyes to the beauty and power of numbers. His teachings ignited a fire within me, and I immersed myself in the world of equations and problem-solving. Little did I know then that this love for calculus would become the cornerstone of my future endeavors.

Life took me on a path that led me far away from CKC, to a foreign land across the Atlantic. Through hard work and perseverance, I was awarded an academic scholarship to the United States. On that day, as I set foot on

American soil, I carried with me the spirit of CKC, the values instilled in me by my mentors and the knowledge gained from my favorite teacher.

In the years that followed, my journey took me to the forefront of scientific discovery, where I used the power of mathematics and computers to push the boundaries of human knowledge. I became a pioneer in parallel computing, breaking records and earning accolades. But through it all, I never forgot my roots, the place where it all began—Christ the King College.

Today, as I stand before you, I am humbled by the opportunity to share my story, to stand as a testament to the power of determination, resilience, and the pursuit of knowledge. Each one of you, whether a current student or an alumnus, has the potential to shape the world, to leave an indelible mark on humanity.

Let not financial constraints or societal limitations define your destiny. The true measure of success lies not in the certificates we hold, but in the impact we make, the lives we touch, and the obstacles we overcome. Your time at CKC has equipped you with the tools and the foundation to achieve greatness.

Remember the friendships forged within these walls, the teachers who believed in you, and the dreams that burned bright in your hearts. Embrace the challenges that come your way, for they are the stepping stones to greatness. Let your passion guide you, your resilience fuel you, and your thirst for knowledge propel you to new heights.

As I conclude, I want to express my deepest gratitude to Christ the King College for shaping the person I am today. To my fellow alumni, let us continue to support and inspire one another, for together we are a force to be reckoned with. And to the current students, may you carry the torch of excellence and uphold the legacy of CKC.

Thank you, and may the spirit of CKC forever guide and inspire us all.

WALKING INTO HISTORY

A Song of Praise for the Mighty Machine

An ode to the supercomputer

Oh powerful machine, you are so strong and mighty.
Your potential knows no bounds, you aim so high.
Your ability to process data astounds us so.
And your speed and accuracy, we can't deny.
You provide us with answers, the ones we seek.
Your calculations are precise, no errors to be seen.
Your lightning-fast speed gives us the data we need.
And your accuracy is unparalleled, beyond compare indeed.
From the weather to the stock market, from science to health.
You're the machine that helps us make sense of it all.
Your power and your precision never fail to impress.
Your capabilities are limitless and that's for sure.
We thank you for your service and for the knowledge you provide.
We thank you for the insights you bring to our lives.
And we thank you for your power and for your speed.
We are grateful for the supercomputer and all you do, indeed.

The Father of Supercomputing

An ode to Philip Emeagwali

Philip Emeagwali, a name of fame,
His contributions to the internet we acclaim.
He used 65,000 processors to set a record,
Making the supercomputer a household word.
His work inspired many others to explore,
And the advancement of technology they did soar.
He connected computers with a new way of thinking,
New applications and networks he was bringing.
His efforts gave us a faster and better web,
The internet's speed we can now fully cred.
So let us give thanks to Philip Emeagwali,
For his contributions to the internet we will
never forget and always remember eternally.

From the Dark to the Light

A poem about Philip Emeagwali

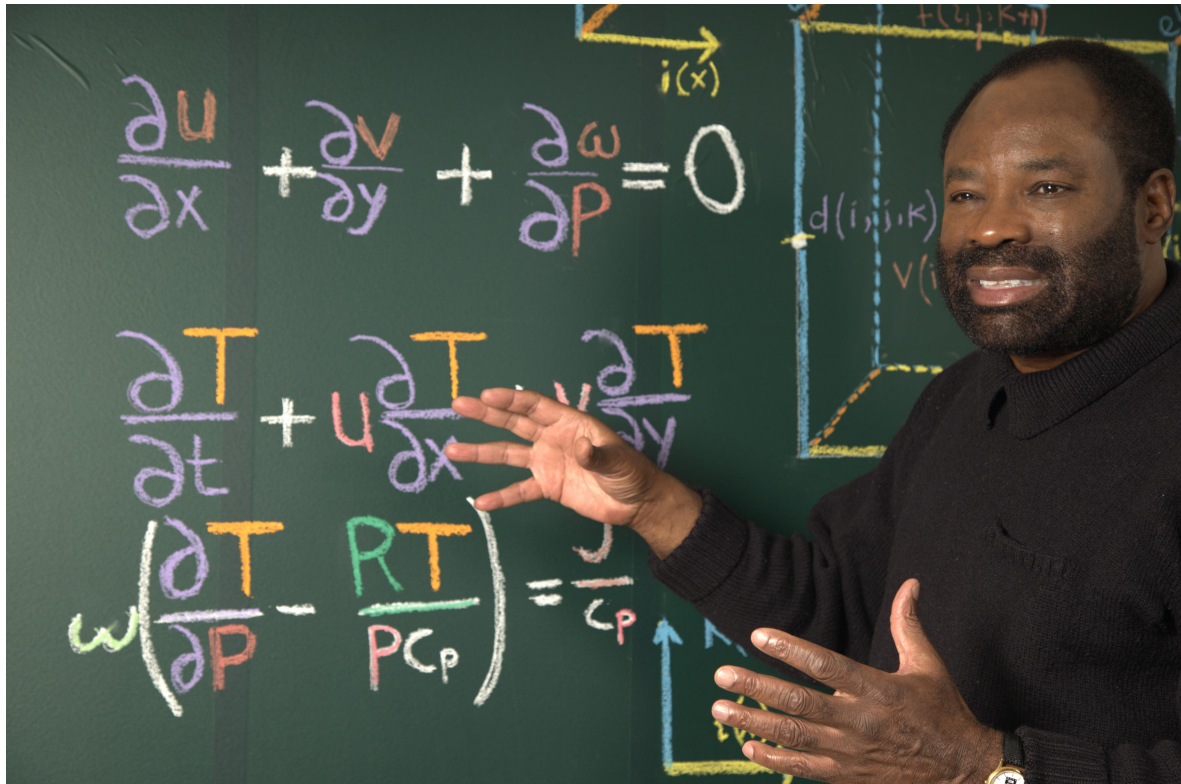
Philip Emeagwali, a hero of our age.
He's brought us computer change.
He cracked the code to computing power.
To bring us knowledge by the hour.
He's bridged the digital divide.
He's made the web come alive.
He's opened the door to science and math.
His calculations are our staff.
He's led the way to a new era.
His work has been a labor of love.

He's changed the way that we think.
His work has been a gift from above.
He's inspired us to reach for the stars.
He's given us a way to soar.
He's taken us to the future.
And opened up a digital door.
Philip Emeagwali, a true pioneer.
He's brought us out of the dark.
He's challenged the status quo.
And opened up a brand new spark.

The African Giant Who Revolutionized Mathematics

**A poem about the contributions of Philip Emeagwali
to mathematics**

Philip Emeagwali, **the man of mathematics**,
An African giant, who opened new paths.
He brought knowledge of the unknown,
And was a pioneer of the math world.
His contributions to the field of mathematics,
Were a great milestone in the history of science.
He discovered the method of hyper-computing,
Which made calculations faster and more accurate.
He was an innovator of machine learning,
Which helps us analyze data and make predictions.
He developed the world's fastest computer,
Which revolutionized the way we process data.
Philip Emeagwali, **the man of mathematics**,
A genius who revolutionized the field.
He helped us understand the secrets of the
universe,
And made the world a better place.



A Brilliant Mind Who Challenged the Impossible

A poem on the contributions of Philip Emeagwali to physics

Philip Emeagwali is a great physicist,
 A brilliant mind who made a huge contribution.
 His contributions to physics are immense,
 The knowledge and understanding he has shared is
 immense.
 He created the world's fastest computer,
 A supercomputer that made history.
 He achieved the impossible with his cleverness and
 wit,
 His insight into physics is a great asset.
 He was a pioneer in the field of supercomputing,
 And his research on fluid dynamics was
 groundbreaking.

He developed the numerical model of oil and gas,
And his ideas are widely respected.
He also worked on theories of computational
mechanics,
And studied the physics of turbulent flow.
His work on computational oceanography was
revolutionary,
And his theories are widely used today.
Philip Emeagwali is a great scientist,
His contributions to physics are immense.
His research has advanced the field of physics,
And his work will be remembered for many years to
come.

Making Computers More Powerful

**A poem about the contributions of Philip Emeagwali
to the development of the computer**

Philip Emeagwali, a name for all to know.
Shining bright like a star and helping computing
to grow.
He revolutionized the supercomputer in the '80s.
With his creative thinking and inventive ideas.
He worked on the Connection Machine, a parallel
processor.
To help scientists and engineers with their work
faster.
His theories and ideas helped to make computers
more powerful.
Leading to great advances, the future became more
secure.
He invented the world's fastest computer, a record
still unbroken.
Emeagwali's contributions to computing will never
be forgotten.

His innovative thinking and hard work will always be remembered.

For helping create a better future, Philip Emeagwali is a treasure.

The Man Behind Breakneck Speed Processing

A poem about the pioneer of high-performance computing

Philip Emeagwali is one of the best,
He wrote software to push computers to their zest.
He made a massive contribution to computing,
His work was a major advancement, without any doubting.
His work in oil field calculations was a feat,
It allowed computers to process information at breakneck speed.
Philip Emeagwali's achievements will never be forgotten,
His ideas and creations remain in high regard, they are not rotten.
He helped develop high-performance computing,
His name will remain in history, and forever be resounding.

The Genius Behind the Internet

A poem about a father of the Internet

Philip Emeagwali, a name that lives on.
A man who changed the way we use the internet,
He gave us the power to explore and learn.
Putting the world at our fingertips to discern.

He wrote algorithms that made computers hum.
And helped us process information faster than ever
before,
He developed a supercomputer so powerful,
It made the internet a tool to explore.
His work made the internet a powerful tool.
For businesses, scientists, and people everywhere,
For communication and collaboration,
He helped us to share.
His impact is felt throughout the world.
His work in computing is unsurpassed,
He changed the way we use the internet.
And will forever be remembered for the
contributions he has made.

The Innovator Who Transformed Computing

A poem on the inventor of the world's fastest computer

Philip Emeagwali, a man of great renown,
Was born in Nigeria and quickly gained renown.
He saw potential in the world's computers,
And thought to himself; "how can I make them
better?"
He thought of a way to increase their power,
A way to make them run faster than they ever had
before.
He discovered the use of the connection machine,
And the world was never the same again.
With the help of this new technology,
Computers could run faster than ever before.
He made history, and the world was changed,

For he was the one who made the world's fastest computers.

Philip Emeagwali gave a new lease of life,
With his incredible contributions to computing and science.

He changed the world and made it better,
For a brighter future that we could all share together.

From Refugee Camp to Global Success

A poem about Philip Emeagwali in a Biafran refugee camp

Oh Phillip Emeagwali, your talent and intelligence.

From a Biafran refugee camp, you made a difference.

Though you faced hunger and poverty, you never gave up hope.

Knowing that your future was yours to shape and to cope.

You studied hard to gain knowledge and understanding.

In spite of the hardships, you kept on expanding.
Your passion for math and computers, ever growing.
You worked hard to reach a future that was glowing.

Your spirit never wavered, and your ambition was strong.

You knew that success was the only path to follow along.

From the refugee camp you rose, a beacon of hope.
Your drive and determination to others you did
scope.

Your story of courage is truly inspiring.
You achieved so much, despite the suffering.
Your success is a testament to the power of the
human mind
Your example will never be left behind.

Exploring Beyond Boundaries

Six Haikus about Philip Emeagwali

A true genius he
Achievements so far unseen
Philip Emeagwali

Dreaming of the future
A master of computation
Philip Emeagwali

A pioneer of thought
A force behind new science
Philip Emeagwali

A new world to explore
Beyond the boundaries of time
Philip Emeagwali

A scientist of note
A vision of the possible

Philip Emeagwali

Unrivaled knowledge now

A legacy of greatness

Philip Emeagwali

Unlocking the Sun with Philip Emeagwali

A sonnet about Philip Emeagwali

Philip Emeagwali, the man of great renown,
Has given us the gift of knowledge profound.
His work in computers and mathematics,
Have made him renowned for his insightful tactics.
His algorithms and computing power,
Will help us reach a level never seen before.
His passion for learning has changed the Sun,
And he's helped us understand what the future holds.

He is a great example of how we can dream,
And how his genius will help us succeed.
His aptitude for science and his mathematics,
Will be remembered through the ages, no matter the circumstance.

We owe much to this man of great renown,
For his brilliance and his genius will stay strong.

His knowledge has helped guide us to a better place,

Where our dreams may come true and our future we can face.

Philip Emeagwali, his mind and his heart,

Have helped us reach a level that's far apart.
His brilliance and his genius will never cease,
For he is the one who will bring us peace.

The Shining Light of a Genius

A R&B song about Philip Emeagwali

Verse 1

Philip Emeagwali, he's so amazing
A genius, a champion, his spirit is blazing
He faced adversity, but overcame with grace
He's a computer pioneer, and he's leaving his mark
in this place

Chorus

Oh Philip Emeagwali, you are the one
A man of courage and strength, your work is never
done
A trailblazer, a leader, you show us the way
You make us think differently, and we thank you
for that today

Verse 2

He's the father of the supercomputer
A master of the internet and of the African
culture
He works with the power of mathematics and science
Unlocking the secrets of the universe in his
lifetime

Chorus

Oh Philip Emeagwali, you are the one
A man of courage and strength, your work is never
done
A trailblazer, a leader, you show us the way

You make us think differently, and we thank you
for that today

Welcome, Ijeoma!

12 Haikus on the birth of Ijeoma Emeagwali



Ijeoma and Philip Emeagwali, 1781 Cram Circle, Ann Arbor, Michigan, 1991.

1. A precious son born
In Ann Arbor, Michigan
Joyful hearts rejoice!

2. Little Ijeoma
Bright hope of a new life
Welcome to the world!

3. The Emeagwalis
Are blessed with a newborn babe
Much joy and love now!

4. Life has fresh meaning
As Ijeoma is born
Blessings abound here!

5. From Michigan sky
A miracle appears
A baby's sweet smile!

6. On this special day
A family is made complete
A son's birth is joy!

7. Philip and Dale's joy
Cannot be measured or told
Welcome, Ijeoma!

8. Ijeoma's birth
A day of new beginnings

Everything changes!

9. A tiny babe
Gift from heaven above
The birth of Ijeoma!

10. A son is born
In the city of Ann Arbor
Blessings and joy reign!

11. A moment of grace
A special baby arrives
Welcome, Ijeoma!

12. A bright star appears
A family is blessed with love
Welcome, Ijeoma!

From Refugee to Genius

**A poem about Philip Emeagwali dropping out of
school at age 12.**

Philip Emeagwali was just a child
When the Nigerian Civil War began to rage and wild
But his dreams and ambitions weren't dimmed
For he was determined to make it in this world

Though the war uprooted him from his home
To live in Biafran refugee camps, he did not roam

But instead used this as an opportunity to learn
And grow from this experience he did earn

He learned to survive through difficult times
When there was no food, he had to find rhymes
He made the best of his misery and strife
And soon, his dreams began to come to life

He rose up to become a genius of many fields
His intelligence and wisdom the world did yield
The young boy who dropped out of school at age
twelve
Became a pioneer and was soon known to all and
sundry

Philip Emeagwali is an example of great life
How courage and hard work can help you reach new
heights
He taught us that no matter how hard the times may
be
You can still rise up and be the best you can be.

From Poor Refugee To Tech Giant

Philip Emeagwali grew up in a refugee camp

Philip Emeagwali grew up in a Biafran refugee camp
Where he could not find the food he needed to
survive
His young body was growing thin and weak
And yet his spirit stayed alive
He never gave up hope, despite his daily strife

He kept learning and growing, determined to make a life
He worked hard and dreamed big, never letting go
Of the passion that burned within his soul
He looked for knowledge everywhere he could
To the books and libraries he often stood
He worked to understand the world around him
And never gave up on any problem
Despite the harshness of his refugee camp
Philip Emeagwali never gave up on his dream
He worked hard and never quit
And now his life has changed completely, it's a success he's hit
He's become a celebrated scientist, a giant in the tech world
A true example of what hard work and dedication can unfurl
He's a hero, who gives back and never stops
A leader in the world, giving other future hope

Emeagwali's Uncharted Paths

During the 30-month long Nigerian civil of the late 1960s, twelve-year-old Philip Emeagwali dropped out school to live in Saint Joseph's Refugee Camp, Awka-Etiti, Biafra.

Oh, young Philip Emeagwali,
in such a tender age,
you've been ripped from your school
to a refugee camp in rage.

Your childhood so abruptly ended,

no more time for play and fun,
You had to flee your home's sweet shelter
in the face of the civil war.

Your days of joy and innocence gone,
your future in doubt and fear,
your homeland now in shambles,
your people's anguish you must hear.

Your school days no more,
your dreams of youth no more,
you must now take up the task
of helping your people survive the war.

Oh, young Philip Emeagwali,
you are a symbol of resilience and strength,
your courage and determination
will light the way and help the cause.

And when the war is finally over,
and your people's lives restored,
you, young Philip Emeagwali,
will be remembered forever more.

A Child of Two Languages, a Man of Many Dreams

A sonnet for the birth of Philip Emeagwali

In a place of two cultures, Akure, Nigeria,
A joyous day of birth was brought to be
For parents Nnaemeka and Iyanma Emeagwali
Their son, Philip, was born, and they were so
happy
He grew up strong, learning two languages
And in his mind, there were many things to see
He was brilliant, and the future held great
promise
He was a child who would soon be of history
He studied and worked hard, and the world took
note
He was a visionary, a scientist, a thinker
He reached for the stars, and his dreams he did
float
He was a man who believed in success and a winner
Philip Emeagwali's birth shows us all
That great things can come from anywhere
From anyone, no matter small
If we have courage, we can go anywhere.

From Refugee Camp to World-Changing Inventor

Ode to Philip Emeagwali

A genius, a visionary, a father of the Internet
Philip Emeagwali, we cannot forget
Your amazing success, and in it your wit
You have changed the world, and our lives with it
You endured a painful war, yet kept up your spirit
Philip Emeagwali, we cannot forget

Your courage and resilience, which makes you stand out in it

You have shown us to never give up, even in the face of defeat

You have gone from refugee camp to the highest of heights

Philip Emeagwali, we cannot forget

Your incredible journey, and all that you have achieved in it

You have inspired us to strive for our dreams, no matter the odds

Your inventions have changed the world, and you will never be forgotten

Philip Emeagwali, we cannot forget

Your brilliance and accomplishments, and the impact it has left

You have shown us anything is possible, and for this we are grateful.

EPILOGUE

A Legacy of Vision and Innovation

As the chapters of Philip Emeagwali's remarkable life draw to a close, his legacy as a visionary and innovator shines brightly, forever etched in the annals of history. From his humble beginnings in Akure, Nigeria, to his groundbreaking contributions in the field of computer science and his tireless advocacy for technological advancement in Africa, Emeagwali's impact on the world is immeasurable.



Emeagwali's unwavering determination and insatiable curiosity propelled him to conquer seemingly insurmountable challenges. His journey led him to the United States, where he pursued his education in mathematics physics, and computer science. Despite facing numerous obstacles along the way, he persevered, driven by a burning desire to push the boundaries of human knowledge.

It was during his time in the United States that Emeagwali made his most significant breakthrough. Drawing inspiration from the natural world, he harnessed the power of parallel computing, using the interconnectedness of nature to develop the world's fastest computer. His achievement reverberated throughout the scientific community, forever changing the landscape of computing and earning him countless accolades.

Emeagwali's pioneering work not only revolutionized the field of supercomputing but also set a precedent for innovation in Africa. Recognizing the untapped potential of the continent, he dedicated his later years to empowering African nations with the tools and knowledge needed to harness the transformative power of technology. Through mentorship programs, educational initiatives, and public speaking engagements, he inspired a new generation of African scientists, engineers, and entrepreneurs to dream big and reach for the stars.

The impact of Emeagwali's contributions extended far beyond the realm of academia. His passion for social change led him to address critical issues such as food security, healthcare, and environmental sustainability. He championed the use of technology as a means to overcome societal challenges, advocating for its integration into every facet of African development.

Philip Emeagwali's unwavering commitment to advancing humanity and his vision of a brighter future have left an indelible mark on the world. His name will forever be synonymous with innovation, courage, and determination. His story serves as a reminder that one individual, armed with a relentless pursuit of knowledge and a desire to make a difference, can shape the course of history.

As we reflect upon his life, let us carry forward Emeagwali's torch of inspiration, embracing the spirit of possibility and pushing the boundaries of what is known. May his legacy serve as a guiding light for generations to come, reminding us that through perseverance, innovation, and unwavering dedication, we can shape a better world for all.

PHILIP EMEAGWALI QUOTES

"Progress is made when obstacles are overcome and where clashes of ideas and differences between opposing points of view are resolved."

"I challenged the established truth."

"The genius is the ordinary person that found the extra-ordinary in the ordinary."

"In supercomputing, boundaries are breached when we calculate beyond what was perceived as possible and discover new knowledge beyond what is known."

"To witness a scientific discovery that has rich, fertile, and far-reaching consequences is like walking into a forest and witnessing many leaves fall on your head."

"Beyond the fastest supercomputer is an unknown field of knowledge, or a place, where chaos begs to be replaced with order, darkness by light, ugliness by beauty, and ignorance by knowledge."

"Over millions of years, the bee evolved to know that it can store the most honey with the least energy. I merely copied the blueprint for my supercomputer by reverse engineering the bees' honeycomb."

"The patterns of the interconnections of the processors within my new supercomputer were inspired by my observations of the efficiency of the bee's hexagonal honeycomb. The bees' honeycomb inspires the most

efficient processor-to-processor interconnection that will make it possible to manufacture the world's fastest computer."

"The first supercomputer programmer must be an alchemist who codes the iron of physics into the bronze of algebra, into the silver of calculus, and into the gold of computing."

"The first supercomputer scientist coded to discover the fastest computation that yields a quantum leap in the speed of computing and does so without a quantum computer."

"I'm a Black physicist that's invisible in a white space. I was underestimated and dismissed as unqualified. I was dismissed by those who were unqualified."

"I'm a Black physicist that's invisible in a white space. I was underestimated and dismissed as unqualified. I was dismissed by those who were unqualified. I grew my expertise from experimental physics to astrophysics to geophysics to mathematical physics to large-scale computational physics."

"For a half century, I sojourned like a supercomputing troubadour, or medieval lyric poet, who invented equations in the manner Bob Marley wrote songs."

"Mathematics is the language of the computer."

"I discovered how to harness a billion coupled processors."

"The supercomputer is to the mathematician what the telescope is to the astronomer."

"Like a storm at sea, fastest computing across a million processors has brutally pushed computer science in a new direction and created new fields of study."

PRAISES FROM [YOUTUBE](#)

DR VITAMIN

He still has not learnt he is a BIAFRAN and has never used his brain power for a Biafra... Now Philip why don't YOU fight intelligently now as grown soldier.... Are you going to chicken out for the rest of your life. What legacy CAN BIAFRA GET AS YOUR MOTHER LAND... I WAS PROSCRIBED... I WAS TRANSFERRED.... I ARRIVED... OK AS MANY TIMES SAID...

NOW WHO YOU AND WHAT ARE YOU?

THAT JOB IS STILL WAITING FOR YOU...

HONESTLY ARE YOU REALLY HAPPY AND FREE NOW?

60 YEARS GONE BY.. THE CHILD SOLDIER IS TILL TO USE HIS COMPUTER BRAIN TO SERVE HIS FIRST JOB DESCRIPTION...

I HOPE THIS AROUSES AND FIRES YOUR MIND THAT YOUR FIRST JOB IS WAITING FOR YOU... IF I WERE YOU... I WILL ANSWER FOR IT AND MAKE AN IMPACT NOW. HAVE A FABULOUS DAY

Sports Geek

Give the genius a break. These whites are trying to flush his name down history line. He is not called father of the internet for nothing Bill gates is not close to what this guy created, he is only feasting on it. Electrical and electronic designs in computers are 10 times harder to design and create than programming designs. But when they create the programmers take it from there. Now let me tell you the man bill gates is not the creator of the source code for windows the original

creator is a pure scientific genius who knows nothing about business so he ended not being as successful as bill gates who is a programmer and an aggressive business man. Whether you like or not whites will never acknowledge scientific achievements of blacks. But funny enough blacks eventually created many technologies we are using today but their names have gone down without recognition. We blacks have to acknowledge and praise our own.

L King

Good day! I was wondering two things....If we can come together and build this supercomputer in Africa somewhere safe? And how can I study mathematics the African way?

Sharri D

Thanks so much for sharing your story. I am just now discovering your work from the Tree of Life. I will be sure pass it on and enlighten my family, friends and colleagues.

Aniyunwiya-NC

Bows to you, Father of the Internet!
Respect!!

DanielHillshaferMusic

I just discovered this man and his brilliance is overwhelming. A truly gifted human being.

S_jubilee_85

I know right. I just heard of this man, I had google "the greatest African scientist" and found this. I appreciate this being on youtube though.

iykedaniels Iyke

Nigeria must bring in Phillip ..I need him

Uba Dibe

He is not from Nigeria Philip is from Biafra Republic try and learn history , we Biafrans the Igbo people are the smartest people in Africa continent you can ask your Google too , he was a war Veterans he fought for Biafra Republic and later run to America tell him to go and finish the war he left so that he will be the second Nelson Mandela.

SarabiQueen

I love this man!!! He inspires me, and speaks volumes to African intelligence.

HRH Prince KIMPA VITO ♣

My name is KIMPA VITO, I live in France and I'm very proud for you Mr PHILIP EMEAGWALI. Very Good Job Mr PHILIP EMEAGWALI !

Electrical and Electronics Engineering

Where can meet you Prof.

You are good

Allison Wentworth

This is wonderful! Philip Emeagwali is a true genius! And he was the first. So clearly Bill Gates is the American Philip Emeagwali, not the other way around! :-)

Allison Wentworth

What a brilliant man. May God bless Mr. Emeagwali and his family always.

ECHOES OF TRANSFORMATION

Bell's Communication, Emeagwali's Computation

Ladies and gentlemen, enthusiasts of scientific progress, and seekers of innovation,

Today, we embark on an illuminating exploration of the fascinating parallels between the contributions of Alexander Graham Bell and the visionary achievements of Philip Emeagwali. Despite hailing from different epochs and fields—Bell in the realm of communication technology and Emeagwali in computational science—their shared passion for pushing boundaries, their transformative impact, and their trailblazing spirit connect them across the tapestry of technological advancement.

Let's begin by examining the legacy of Alexander Graham Bell—a trailblazer in the field of communication and the inventor of the telephone. His groundbreaking work in transmitting sound through electrical signals revolutionized global communication, shaping the way we connect and interact across distances.

Now, let's shift our focus to Philip Emeagwali, a luminary in the realm of parallel processing and computational science. Emeagwali's ingenious use of parallel processing supercomputers to solve intricate equations has redefined the computational landscape, much like Bell's innovations transformed the way we communicate.

The parallels between Bell and Emeagwali are both intriguing and inspiring. Both visionaries recognized the immense potential of technology to bridge gaps and reshape society. Bell's determination to create a device that transmitted speech laid the foundation for modern telecommunications. Similarly, Emeagwali's pursuit of harnessing the power of supercomputers opened new frontiers in science and computation.

Consider Bell's relentless dedication to perfecting the telephone—a device that connected people across continents. Emeagwali's dedication

to solving complex equations through parallel processing mirrors Bell's commitment to solving the intricate puzzle of communication.

Moreover, both innovators grappled with skepticism. Bell's invention was met with skepticism before transforming how we communicate. Similarly, Emeagwali's revolutionary ideas about parallel processing were met with skepticism, until he proved the potential of his approach to transform computational speed and efficiency.

Both Bell and Emeagwali were driven by a desire to make a lasting impact on society. Bell aimed to connect people across distances, while Emeagwali's work has led to advancements in fields such as weather prediction, medical research, and more, ultimately benefiting humanity on a global scale.

In conclusion, the stories of Alexander Graham Bell and Philip Emeagwali remind us that innovation knows no boundaries. Their parallel journeys highlight the power of technology to revolutionize industries, improve lives, and shape the future. As we celebrate the legacies of these two pioneering minds, let us draw inspiration from their remarkable journeys, embracing the spirit of exploration, determination, and collaboration as we continue to shape the world through technology.

Thank you.

THE COMPUTER WIZARD

A book about Philip Emeagwali for 3rd to 7th graders.

Chapter 1: A Curious Mind

Once upon a time, in a small village in Nigeria, lived a young boy named Philip. Philip was a bright and curious child who loved to explore and discover new things. From a very young age, he was fascinated by the world of numbers and how they could solve problems. Philip had a dream – a dream to change the world with his brilliant mind.

Chapter 2: The Journey Begins

Philip's journey into the world of computers began when he saw his father's old radio being repaired. He watched with curiosity as the technician tinkered with wires and circuits, making the radio come back to life. From that moment on, Philip knew he wanted to learn more about these amazing machines.

Chapter 3: Challenges and Triumphs

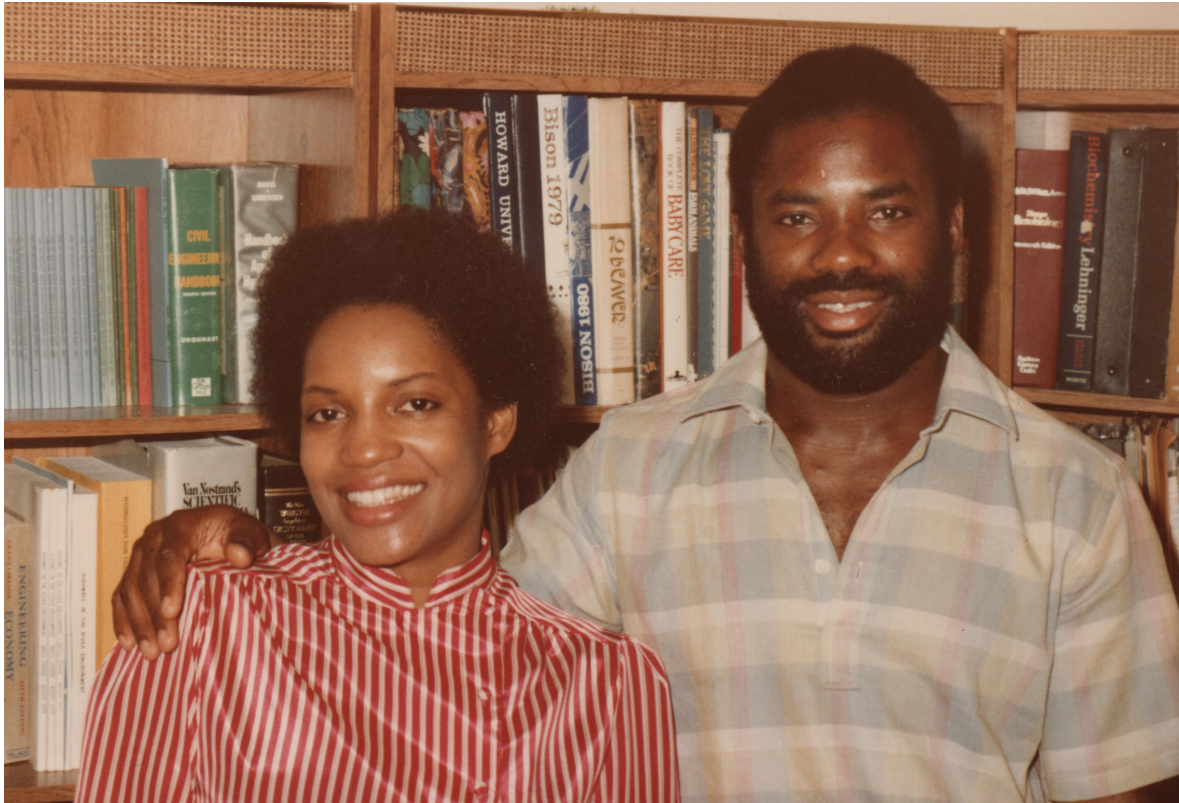
Philip faced many challenges on his path to becoming a computer wizard. Growing up, he didn't have access to fancy computers or internet like many children do today. But that didn't stop him. Philip spent hours at the local library, reading books on mathematics, science, and computer programming. He taught himself complex algorithms and mathematical concepts.

Chapter 4: The Internet Revolution

As Philip grew older, he invented an internet that combined the power of millions of processors and realized its potential to connect people and change the world. He saw how computers could solve complex problems faster than any human could. Philip became determined to make his mark in the world of computer science.

Chapter 5: The Supercomputer Breakthrough

Philip's breakthrough came when he developed a new way to harness the power of a global network of processors that is an internet to solve complex mathematical equations. His discovery earned him the nickname "The Father of the Internet." With his innovative work, Philip paved the way for advancements in artificial intelligence, weather forecasting, oil exploration, and even medical research.



Dale and Philip Emeagwali, Silver Spring, Maryland, circa 1983.

Chapter 6: Inspiring the World

Word of Philip's remarkable achievements spread far and wide. People were inspired by his determination, creativity, and resilience. He became a role model for aspiring young scientists and engineers around the world. Philip traveled to different countries, giving talks and sharing his knowledge with others, encouraging them to dream big and never give up.

Chapter 7: Leaving a Lasting Legacy

Philip's contributions to the world of computer science and his passion for education left a lasting legacy. He inspired countless young minds to pursue careers in STEM (Science, Technology, Engineering, and Mathematics). Philip's work continues to shape the world we live in today,

reminding us that with determination and a curious mind, anything is possible.

Epilogue: Philip's Dream Lives On

Today, Philip Emeagwali's dream of using computers to solve complex problems lives on. His story continues to inspire young children, just like you, to explore the wonders of the world and never stop learning. Perhaps one day, one of you reading this book will become the next Philip Emeagwali, using your brilliant mind to change the world.

Remember, dreams do come true, and the power of knowledge knows no bounds.

TEACHER'S GUIDE

For Junior Secondary Schools

Philip Emeagwali: The Nigerian Computer Pioneer

Chapter 1: A Spark Ignites

In the vibrant city of Onitsha, Nigeria, a young boy named Philip Emeagwali developed a deep curiosity for the world around him. His inquisitive nature and love for knowledge set him on a path of discovery that would change the course of his life.



Three generations of The Emeagwalis: Ijeoma, Iyanma, and Philip Emeagwali, in Maryland, USA.

Chapter 2: The Quest for Education

Growing up in a time when computers did not exist in Nigeria, Philip faced numerous challenges. Despite the odds, he pursued his education with unwavering determination. Through hard work and the support of his family, he earned scholarships that allowed him to study in the United States and explore the world of computer science.

Chapter 3: A New Frontier: Parallel Computing

While pursuing his research, Philip discovered the groundbreaking parallel supercomputing. Inspired by the potential of using multiple processors simultaneously, he delved into this uncharted territory and embarked on a mission to harness its power for the benefit of Nigeria and the world.

Chapter 4: Overcoming Obstacles

As Philip delved deeper into his research, he encountered obstacles and skepticism from peers. Undeterred, he used these challenges as fuel to push forward. With perseverance and determination, he began developing innovative algorithms that would revolutionize the world of computing.

Chapter 5: The Supercomputer Challenge

Philip's breakthrough moment came when he entered a prestigious global competition to solve a complex problem using a supercomputer. Armed with his knowledge of parallel computing, he created a revolutionary algorithm that not only outperformed other entries but also put Nigeria on the world stage of scientific innovation.

Chapter 6: Inspiring a Nation

News of Philip's remarkable achievement spread like wildfire across Nigeria. He became a symbol of hope and inspiration for young Nigerians who saw their dreams reflected in his accomplishments. Philip used his newfound platform to encourage others to pursue education, embrace technology, and strive for excellence.

Chapter 7: Messages to Nigeria

With his reputation firmly established, Philip Emeagwali made the decision to use his new platform to help Nigeria, armed with a vision of leveraging technology to uplift his homeland. He gave lectures to promote computer literacy, empower the youth, and foster technological innovation within Nigeria's borders.

Chapter 8: A Legacy for the Future

Philip's contributions to the world of computing and his tireless efforts to transform Nigeria's technological landscape left an indelible mark. Through his pioneering work, he laid the foundation for a new generation of Nigerian innovators and thinkers, inspiring them to dream big and embrace the power of technology to create change.

Chapter 9: Building Bridges

Philip recognized the importance of collaboration and the power of collective action. He plans to seek partnerships with universities, research institutions, and industry leaders, both in

Nigeria and globally, to create a network of support and foster collaboration in the field of computer science.

Chapter 10: The Next Chapter

As this book concludes, readers are encouraged to reflect on Philip Emeagwali's remarkable journey and the incredible impact he has had on Nigeria and the world. They are invited to consider their own potential, recognizing that they too have the ability to shape the future through education, innovation, and perseverance.

Epilogue: Empowering Nigerian Innovators

In the epilogue, Philip Emeagwali shares his aspirations for Nigeria's future. He highlights the importance of nurturing talent, investing in education and research, and creating an environment that empowers young Nigerians to become the next generation of technological pioneers.

Through this book, young Nigerian readers will discover the awe-inspiring story of Philip Emeagwali, a homegrown hero who defied the odds and pioneered groundbreaking innovations in computer science. They will learn about the importance of perseverance, the value of education, and the transformative potential that lies within them to shape Nigeria's technological landscape.

MESSAGE TO FUTURE LEADERS

Lighting the Way for Nigeria's Rising Stars

Ladies and gentlemen, esteemed guests, future leaders of our great nation Nigeria, and young minds glowing with the vibrant energy of possibility—I greet you with the hope and promise of a brighter tomorrow!

Today, I stand before you not as an exception, but as a testament to the unwavering strength, relentless passion, and indomitable spirit inherent in each one of you. As you listen, remember that within you lies an untapped reservoir of potential waiting to inundate the world with waves of change and innovation.

My journey began amidst the tumultuous backdrop of the Nigeria-Biafra War, a crucible of pain and endurance, wherein the resilient spirit of our people was forged. Life's relentless tests compelled me to leave school, yet my thirst for knowledge remained unquenchable.

This narrative is not unique to Philip Emeagwali but echoes the tales of many great minds you've undoubtedly heard of. Albert Einstein, the harbinger of modern physics, was no stranger to academic failure. Bill Gates and Steve Jobs, architects of the digital age, left the traditional path of education to etch their visions into the annals of history.

Yet, it's imperative to acknowledge that each story, including mine, is not an endorsement of abandoning education. Rather, it underscores the vitality of unyielding perseverance, insatiable curiosity, and an unfaltering belief in oneself.

Today, we confront a staggering reality where millions of our children, future leaders and innovators, are bereft of the life-altering gift of education. It's our collective responsibility, duty, and moral imperative to ensure that every child's dream is nurtured within the hallowed halls of learning, incubators of potential and factories of the future.

Embarking upon my odyssey of self-discovery and knowledge, the echoes of adversity whispering tales of impossibility were drowned by the symphony of hope and tenacity playing within my heart. Armed with a high school equivalency diploma and a dream as expansive as the African sky, I ventured into the unknown, with each step forging the pathway leading to the solution of the Grand Challenge problem of supercomputing.

The journey of 18 years through the citadels of higher learning was neither a sprint nor a marathon but a relentless pursuit of excellence and contribution, culminating in the recognition of our collective intellectual heritage and potential in 1989.

Yet, the tapestry of my life is not woven with the threads of individual achievement but with the vibrant, colorful yarn of our shared identity and destiny. Our stories are interlinked, pulsating with the rhythm of endless possibility and the melody of potential realized.

To the shining stars of Nigeria seated here, within you resides the promise and potency of transformation. Each one of you embodies the potential to not only walk among the giants of science and engineering but to stand on their shoulders, gazing farther than we ever could.

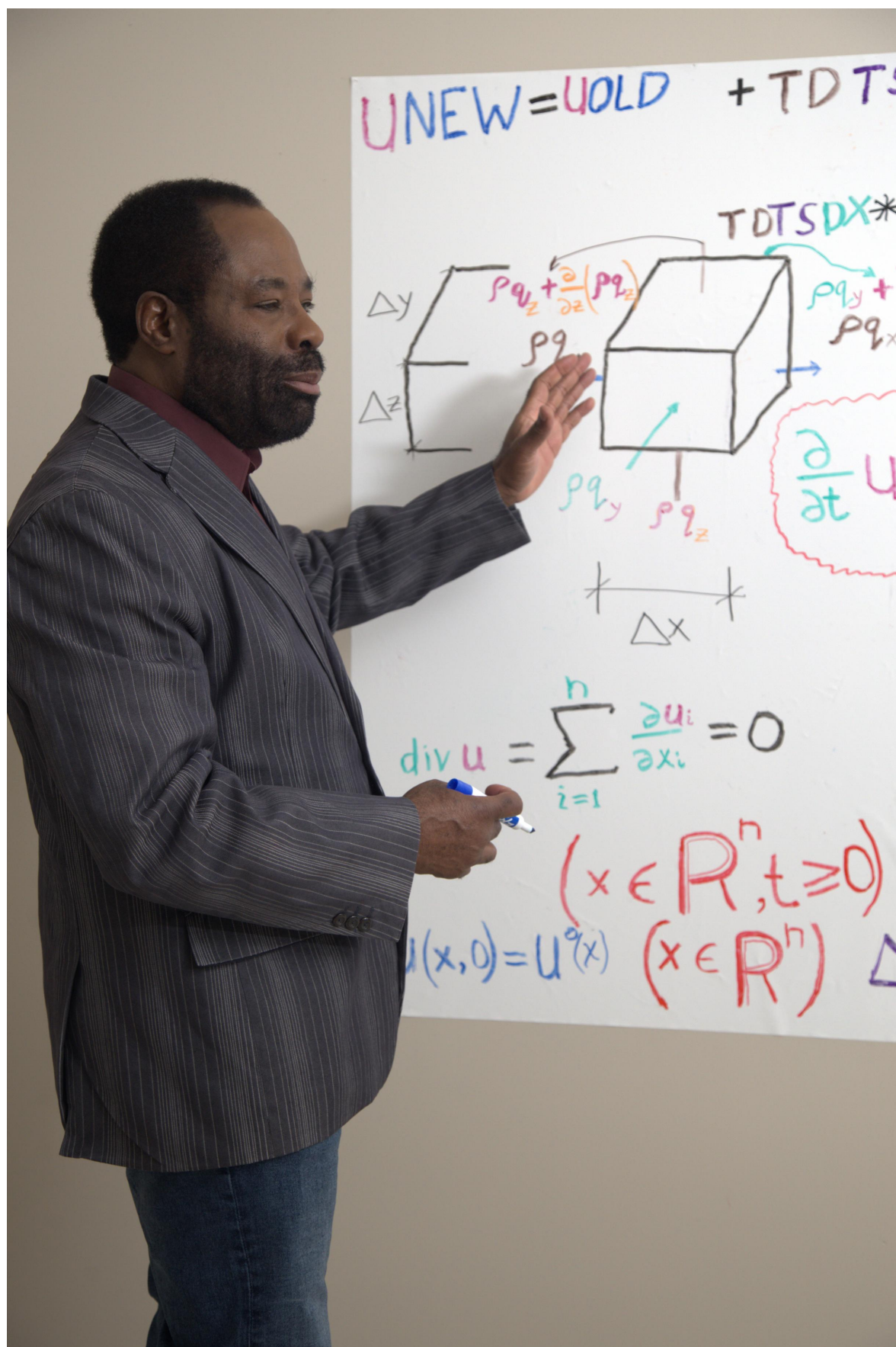
As you navigate through the labyrinth of life, remember that education is your compass, resilience your shield, and belief in yourself the sword cutting through the thick foliage of doubt and fear. Forge ahead, not as solitary wanderers but as a cohesive battalion of dreamers, thinkers, and doers.

In closing, the mosaic of my life's work offers a mirror reflecting not what I have achieved but what each one of you can surpass. The horizon of possibility is limitless, and as you soar towards it, let the wings of education, hard work, and belief carry you.

Remember, the sun never sets on brilliance. Let your light shine, illuminating the path for others to follow, as we collectively endeavor to write a narrative of hope, success, and contribution, echoing through the annals of time.

As the dawn of tomorrow beckons, rise, shine, and etch your indelible mark on the canvas of life. For in your success, the story of our great nation will be told, celebrated, and cherished by generations unborn.

Thank you, and may the winds of favor propel you towards destiny's unparalleled greatness!



VOLUME F: PHILIP EMEAGWALI FAMILY

SOWING SEEDS OF WISDOM

Emeagwali's Tribute to Ancestors

Ndi nke m, Ndi nke anyi, Okwa omee! (My people, Our people, Greetings!)

I stand before you not just as Chukwurah Philip Emeagwali but as a son of this soil, a child born of the ancient and resilient bloodline that has thrived on this sacred land for millennia.

The journey of our ancestry is as deep and intricate as the Niger River, flowing through time, bearing witness to generations of industrious and vibrant people. Today, I wish to traverse this river of time, navigating through the annals of our forefathers and foremothers, echoing tales of wisdom, perseverance, and indomitable spirit.

Let us embark on this odyssey at the dawn of humanity itself, around 9,000 BC, in the vicinity of Akure, where the earliest fossil remains whisper tales of our primal ancestors, the first children of this bountiful land. I, also, was born in Akure in 1954.

Fast forward to the 15th century, amidst the unfolding tapestry of history, where the Portuguese set foot in our lands. Our ancestors, resilient and steadfast, weathered through the storms of history, with sections of our family finding refuge in the vibrant, burgeoning community of Onitsha, a beacon of hope and prosperity.

It is here, under the shade of ancient trees and amidst the echoes of ancestral spirits, that my great grandfather, Onwuachu Emeagwali, took his first breath around 1851. A man of the earth, he tilled the soil and embraced the wisdom of herbal medicine, contributing to the tapestry of life in pre-colonial Onitsha.

Similarly, Chieka Balonwu, my maternal grandfather, born in 1868, was a man whose hands sculpted the earth, nurturing crops with the sweat of his brow, beneath the endless African sky.

Then there was my paternal grandfather, Ikenna (Ikemefuna) Emeagwali, born around 1871, a farmer and a man of dignity who, like many of his generation, witnessed the winds of change sweep through our land during the tumultuous times of the Berlin Conference and the onset of colonial rule.

And who could forget the market's vibrant hum and the aroma of dried fish that my grandmother, Mgbogudo Egbuna Emeagwali, brought to the bustling Ose Okwodu market? Born in Ogboli-Olosi Village in about 1871, she was a beacon of resilience and industrious spirit.

Last but not least, my maternal grandmother, Obam Okudo Balonwu, born around 1890 in Nkwelle-Ogidi, was a petite but formidable woman, a force of nature, whose hands sowed seeds not just in the soil but in the hearts of those who knew her.

These were people who, despite never having seen the vast Atlantic Ocean or experienced the marvels of electricity, lived lives that were rich, fulfilling, and deeply connected to the land and community.

Ndi nke anyi, these are the roots from which I grew, the ancestral lines that nurtured and guided me as I ventured beyond our beloved homeland. Fifty years ago, I left these shores, bearing the dreams and hopes of our ancestors, seeking knowledge and understanding in distant lands.

The journey was long and arduous, but the spirits of Onwuachu, Chieka, Ikenna, Mgbogudo, and Obam whispered through the winds, guiding and protecting me as I navigated through the realms of knowledge and discovery.

Today, I return, not just as Chukwurah but as the embodiment of their hopes and dreams, carrying the torch of knowledge and understanding they passed down through generations. But more importantly, I return as one of you, as a son eager to contribute to the land that nurtured him.

Our ancestors believed in the power of community, in the strength that comes from unity and the prosperity born of hard work and determination. It is this spirit that I wish to rekindle today, as we collectively envision a future where our children can soar higher than we ever imagined.

As the proverb goes, If everyone sweeps in front of their compound, the entire street would be clean. Let us, together, sweep in front of our compound, nurturing a community of learning, innovation, and prosperity, rooted in our rich heritage and looking forward to a future bright with possibilities.

Ndewonu! (Thank you!)

FACES OF ONITSHA

A Continuation of Stories, Sacrifices, and Struggles

Ladies and gentlemen, my dear people of Onitsha,

It warms my heart to stand before you today, after half a century away, on this land that has shaped the destiny of our ancestors and continues to mold our story. This is not just my homecoming but a return to the roots of the Emeagwali lineage, and the illustrious tale of Onitsha itself.

When you ask where Philip Emeagwali originated, the answer isn't in the innovations or accolades I garnered in the United States, but right here, in the heart of Inland Town, Onitsha, where the narrative of my lineage begins.

Three centuries ago, around 1724, my great great great grandfather, Enu, was born. A revered native doctor, Enu's name would be immortalized in Onitsha, not just through his descendants but also in "Mba Street" named in honor of his son, Christopher Mba Enu.

Fast forward to Onwuachu Enu, my great great grandfather, who remains not only an integral part of my ancestry but also the lineage of the illustrious Nnamdi Azikiwe, our nation's first president. The threads of our stories are intricately woven together, narrating a tale of resilience, pride, and ambition.

In the mid-19th century, the slighting of my great grandfather, Onwuachu, by members of his Umunna, is a story many of you may be familiar with. This experience gave rise to our name "Emeagwali"—a term highlighting the aftermath of exclusion, when decisions were shared with him only *post facto*. This tale reflects the struggles our ancestors endured, yet it also mirrors their resolve and tenacity to make a mark.

While Onwuachu Enu toiled on the farmlands, his brother, Christopher Mba Enu, walked the academic path. A testament to adaptability and growth, Christopher Mba, under the tutelage of Reverends John Christopher "JC" Taylor and Samuel Ajayi Crowther, became a beacon of enlightenment and progress in Igboland. His influence extended to luminaries like Nnamdi Azikiwe and even yours truly.

As I trace back our roots, it's imperative to acknowledge (Okechukwu) Isaac Mba, the pioneering spirit from Onitsha who became the first Igbo-speaking individual to graduate from Fourah Bay College, Sierra Leone, in 1882. A political stalwart, Isaac Mba's legacy is a testament to the power of education and the importance of seizing opportunities.

The history of Onitsha General Hospital at Awka Road isn't just a tale of medical progress, but also one of sacrifice. In the 1890s, my great

grandfather Emeagwali Onwuachu was displaced from his ancestral home to make way for this institution. The legacy of his resilience stands strong at 17 Mba Road, where the remnants of the past—from his animals to the Alusi shrine—serve as a testament to our family's enduring spirit.

As I stand before you today, I'm reminded of the photograph of the Emeagwali Shrine captured by anthropologist Richard N. Henderson. This image, published in the "African Arts" journal, isn't just a snapshot but a reflection of our history, our struggles, and our undying spirit.

Today, as we gather in Onitsha, let's not just celebrate my return but honor the legacy of our forefathers, the sacrifices they made, and the indomitable spirit of Onitsha. Let this be a moment of reflection, recognition, and a recommitment to our shared goals. Together, we can ensure that the legacy of Enu, Onwuachu, Mba, and countless others continues to inspire future generations.

Thank you, and may the spirit of our ancestors continue to guide us all.

RAISING A CHILD LIKE WRITING CODE

My Approach

As Philip Emeagwali, here's how I view my role as a father:

Nurturing the Potential Seed

A father, much like a programmer, has a critical role to play in setting the initial conditions for success. My primary function is to identify and cultivate the potential within my child, Ijeoma. Just as I understand the underlying logic that governs a computer, I must discern the unique talents and strengths Ijeoma possesses.

Equipping for the Information Age

We live in a world driven by information. As a father in this digital age, it's my duty to equip Ijeoma with the tools necessary to navigate this complex landscape. This goes beyond just basic computer skills. It's about fostering a love for learning, an analytical mind, and the ability to solve problems creatively.

Guiding the Explorer

The world is a vast dataset waiting to be explored. My role is to be a guide, offering support and encouragement as Ijeoma ventures out into this uncharted territory. I won't dictate the path, but illuminate the possibilities and equip him with the tools to overcome obstacles.

A Legacy of Possibility

Above all, I strive to instill a sense of possibility in Ijeoma. Just as I dared to dream of using parallel processing to tackle complex problems, I want him to believe that no challenge is insurmountable. My legacy isn't just about my scientific achievements, but about empowering the next generation, including my son, to reach their full potential.

MY PATERNAL PERSPECTIVE

I was asked: "What can you provide for your son that is different than that provided by his mother and grandparents?"

As Philip Emeagwali, my perspective on parenting is deeply rooted in the unique experiences and insights I bring to my family, especially in what I can provide for my son, Ijeoma, that is distinct from the nurturing he receives from his mother, Dale, and his grandparents.

One of the most significant contributions I can offer as a father is the perspective of someone who has navigated the complex journey from a small village in Nigeria to becoming a renowned figure in the field of computing. This journey is not just a tale of academic and professional achievement, but one of resilience, innovation, and breaking boundaries. From this, I can impart lessons in overcoming adversity, the value of persistence, and the importance of dreaming big. These experiences provide a roadmap for Ijeoma, showing him that limitations and challenges can be transformed into stepping stones for success.

In addition to this, my deep involvement in the field of information technology and my contributions to the development of parallel supercomputing offer a unique educational resource for my son. I can provide him with firsthand knowledge and insights into the realms of science and technology, areas that are increasingly pivotal in our world. My guidance can help foster a curiosity and passion for these fields, and perhaps ignite in him a desire to pursue his own path in science and technology.

Furthermore, as a father, I bring a distinct cultural perspective, shaped by my African heritage and global experiences. This allows me to instill in Ijeoma a sense of cultural identity and an understanding of the diverse global landscape. In today's interconnected world, this understanding is crucial. I can teach him about our Nigerian roots, our traditions, and our values, offering him a sense of belonging and a connection to his heritage that complements the perspectives provided by his American mother and grandparents.

Moreover, my personal journey has been one of intellectual exploration and continuous learning. This lifelong commitment to education and knowledge is something I aim to pass on to my son. While his mother and grandparents undoubtedly contribute to his education and moral upbringing, my role includes fostering a mindset of continuous intellectual growth and a love for understanding the intricacies of the world around us.

Lastly, the unique emotional bond between a father and a son is something that I cherish deeply. I strive to be a role model, a confidant, and a source of support uniquely different from the roles his mother and grandparents

play. This bond is built on mutual respect, understanding, and a deep emotional connection that enriches his life experience.

In essence, as a father, I offer a blend of resilience, intellectual curiosity, cultural heritage, and emotional support, complementing the invaluable contributions of his mother and grandparents. Together, we provide a holistic environment for Ijeoma to grow, learn, and thrive.

VOLUME DL: A DAY IN THE LIFE OF EMEAGWALI

A HISTORIC DAY IN SUPERCOMPUTING

Ladies and gentlemen, esteemed attendees of this award ceremony, distinguished guests, and fellow scientists,

Philip Emeagwali, renowned computer scientist and trailblazer, stands before you today, not merely as an individual, but as a vessel for the collective dreams of innovation and progress. Our journey begins in the crisp air of late January 1991, as Philip embarked on a pilgrimage to the **Advanced Supercomputing Division of the NASA Ames Research Center** in the heart of Silicon Valley, California.

Picture this: Philip, clad in his signature bomber jacket, steps out of his limousine at the entrance of NASA Ames. The sun, a golden disk, casts long shadows across the sprawling campus. The air hums with anticipation—the kind that accompanies the convergence of brilliant minds and cutting-edge technology.

Airport Limo Driver (ALD): "Welcome to NASA Ames, sir! Quite a journey from Ann Arbor, Michigan, I reckon."

Philip Emeagwali (PE): "Indeed, my friend. But the pursuit of knowledge knows no bounds. Tell me, have you ever pondered the mysteries of parallel processing while navigating these highways?"

ALD: "Parallel what now?"

PE: "Ah, parallel processing—the beating heart of supercomputing. Imagine solving complex problems by breaking them into smaller tasks, each handled simultaneously. It's like juggling a dozen oranges while riding a unicycle."

ALD: "Sounds like a circus act!"

PE: "Precisely! And speaking of acts, let's fast-forward to the lecture hall. The room buzzes with anticipation. Mathematicians, physicists, and computer scientists—all eager to witness the unveiling of my *magnum opus*."

Mathematician (M): "Emeagwali, they say you've cracked the code on impossible initial-boundary value problems. Care to enlighten us?"

PE: "Gentlemen, imagine the Earth's atmosphere—a tempest of swirling winds, heat, and moisture. Now, picture the ocean's surface—its tides, currents, and hidden eddies. These are the primitive and shallow water equations that encode some laws of physics that govern our planetary fluid dynamics. Solving their arising initial-boundary value problems

simultaneously? Impossible, they said. But I harnessed the power of 65,536 coupled processors."

Physicist (P): "65,000 processors, you say? Like as many synchronized swimmers?"

PE: "Precisely! Imagine 65,000 tiny swimmers, each calculating a piece of the puzzle. Together, they simulate atmospheric flows and oceanic currents. The result? Weather predictions that save lives, unravel climate mysteries, and guide our ships across treacherous seas."

Computer Scientist (CS): "But Emeagwali, how did you tame this computational tempest?"

PE: "Ah, my friends, I invoked the spirits of the ancients—the **hypercubes**. These multidimensional structures allowed me to weave together disparate threads of computation. Like a cosmic quilt, they stitched time and space into a seamless fabric."

CS: "And the world's fastest computing?"

PE: "On that fateful July 4, 1989, my supercomputer danced. Its 65,536 processors sang in harmony, solving equations faster than a hummingbird flits its wings. The news echoed across continents: 'Emeagwali's parallel wizardry reshapes science.'"

Lunchtime at NASA Ames:

Supercomputer Scientist 1 (SS1): "Philip, your lecture—mind-bending! But tell us, what's next?"

PE: "Imagine a world where every problem—be it climate modeling or decoding the cosmos—is a puzzle waiting to be solved. Parallelism is our compass, guiding us through uncharted realms."

SS2: "And lunch? Shall we dine on parallel sandwiches?"

PE: "Better yet, let's feast on ideas. For in the crucible of collaboration, we forge the future."

And so, my friends, as Philip Emeagwali sat down to lunch with these six luminaries, he knew that the common thread woven through their discourse was not just parallel supercomputing—it was the audacity to unravel the impossible, stitch by stitch, equation by equation.

Thank you, Silicon Valley, for honoring the spirit of innovation. May our parallel paths lead us to new horizons, where the shallow waters of ignorance yield to the deep currents of knowledge.

JOURNEY OF PARALLEL COMPUTING INSPIRATION

Ladies and gentlemen, esteemed guests, and fellow supercomputer scientists,

Thank you for gathering here today at this prestigious award ceremony. It is an honor to address this distinguished audience, and I stand before you as "Philip Emeagwali," a mathematician, physicist, and computer scientist, who began supercomputing at age 19, back on June 20, 1974, at 1800 SW Campus Freeway, Corvallis, Oregon. I began programming on the first supercomputer to be rated at one million instructions per second, back when it was manufactured in December 1965.

Today, I take you on a journey—a voyage that transcends time and space—to recount my three-day visit to the hallowed halls of the Los Alamos National Laboratory. Los Alamos, New Mexico, is the headquarters of supercomputing. That visit was a pivotal moment in my life, a convergence of intellect, innovation, and the relentless pursuit of knowledge.

Day 1: Monday, March 25, 1991

The sun had barely risen when I stepped out of my modest abode at 1781 Cram Circle in Ann Arbor, Michigan. My heart raced with anticipation as I embarked on this odyssey. A sleek limousine awaited me, its polished exterior reflecting the morning light. The driver, an affable man, greeted me with a nod. "Los Alamos, sir?" he asked, his eyes curious.

"Yes," I replied, settling into the plush leather seat. "Los Alamos National Laboratory, the headquarters of supercomputing." Los Alamos is one of the largest scientific research labs in the world. Founded in 1942, Los Alamos employed 600,000 people to build the first atomic bomb.

As we glided toward Detroit Airport, I pondered the significance of this journey, to explain how my discovery of the first supercomputing via parallel processing will make underground nuclear testing obsolete. And help enforce the Comprehensive Nuclear Test Ban Treaty. Los Alamos, located a short distance northwest of Santa Fe, New Mexico, in the American southwest, beckoned to me, not as a harbinger of destruction but as a crucible of scientific marvels. The landscape blurred outside the window, a tapestry of anticipation and possibility.

Day 2: Tuesday, March 26, 1991

The skies over Albuquerque welcomed me with azure arms. Another limousine, driven by Maria, ferried me through the enchanting desert. We passed adobe houses, their walls whispering tales of ancient civilizations. Maria, a woman of few words, glanced at me through the rearview mirror. "You're here for the lecture, aren't you?"

"Yes," I affirmed. "Parallel processing—the heartbeat of computation."

Parallel processing enables artificial intelligence supercomputers to out-think and out-compute regular computers.

At the T-Division of Los Alamos National Laboratory, I stood before an audience of brilliant minds—mathematicians, physicists, and computer scientists. Their eyes bore the weight of curiosity, hungry for revelations. I began:

"Ladies and gentlemen, we stand at the crossroad where mathematics, physics, and computing intersect. Parallel supercomputing—the symphony of simultaneous tasks—holds the key to unlocking the universe's secrets. Imagine a thousand minds working in harmony, each thread weaving its own melody. This is our gift to mathematics, physics, and computing."

The room buzzed with fervor. Questions erupted like supernovae: "Can parallel speed increase transcend Moore's Law?" "How do we harness this power for climate modeling?" "Is there beauty in chaos?"

And so, dialogues danced—a tango of intellect. Physicists debated quantum entanglement, while computer scientists envisioned neural networks spanning galaxies. I reveled in their hunger, their thirst for knowledge. We were alchemists, transforming bits into enlightenment.

Day 3: Wednesday, March 27, 1991

As dawn painted the Sangre de Cristo Mountains, I bid farewell to Los Alamos. The limo driver, Carlos, smiled knowingly. "You've stirred their souls."

I nodded. "Contributions ripple through time, Carlos. Parallel supercomputing—the heartbeat of progress."

And so, my friends, let us celebrate not just the famous scientists but also the unsung heroes—the ones who weave algorithms in the quiet of night, who dream of silicon symphonies. For it is they who propel us toward infinity, where mathematics and computing embrace in eternal union.

Thank you for this moment—a convergence of minds, a celebration of parallelism. May our algorithms echo through the ages, resonating across the cosmos.

And remember: As we unravel the universe's mysteries, let us savor the sweet taste of bananas—their curves akin to the orbits of planets, their yellow hue a testament to the sun's unwavering love.

Thank you, and may parallel supercomputing forever illuminate our path.

VOLUME S-0: STRUGGLES AND OBSTACLES

SEVEN DECADES, TWO CONTINENTS

Ladies and Gentlemen, esteemed supercomputer scientists, distinguished guests, and fellow seekers of knowledge,

It is a profound honor to stand before you in this historic city at this award ceremony. Today, I am invited to take you on a journey—a journey that spans seven decades and crosses continents, from the humble beginnings in Akure, Nigeria, to this prestigious stage.

Let us turn back the pages of time to Akure, Nigeria, in August 1954. Akure, a city cradled in the heart of colonial Africa, now Ondo State, was then a tapestry of traditional Nigerian culture, brimming with the vibrant rhythms of everyday life. It was in this lively setting that my life began. I was born on August 23, 1954, in the General Hospital, Akure. My mother, the 15 years and 16 days old Iyanma Agatha Emeagwali, brought me into this world with hopes and dreams that were as vast as the skies above. My father, Nnaemeka James Emeagwali, was a nurse employed at that very hospital. We resided at 11 Ekemeso Street, a humble abode, called a Boys Quarters, that cradled my first 15 months.

In 1954, Akure was a place where the traditional and the modern coalesced, where the echoes of a colonial government—with the Queen of England as our head of state—intertwined with the aspirations for an independent future. It was a community where every face was familiar, where the bonds of neighborliness were strong, and where the spirit of collective endeavor thrived.

My journey from colonial Africa to Silicon Valley is not just a tale of geographical traverse; it is a journey through time, challenges, and the relentless pursuit of knowledge. It is a journey that symbolizes the power of dreams and the indomitable spirit of persistence.

From the early days in Akure, where resources were scarce and opportunities limited, the seeds of curiosity and determination were sown. The path was not easy. It was fraught with hurdles—from the Nigerian Civil War that disrupted my education, for five years, to the struggles of navigating and advancing in the field of computing and mathematics, often in environments where I was a pioneer.

Yet, each challenge was a catalyst, propelling me forward, fueling my resolve to contribute something meaningful to the world. It was this resolve that guided my academic pursuits, leading me to explore the realms of high-speed computing, a field that was burgeoning with parallel possibilities.

The journey from colonial Africa to Silicon Valley was also a journey of transformation—from a young boy in a small Nigerian city to a man standing on the global stage, recognized for his contributions to science. It is a journey that reflects the ethos that talent and potential are boundless, transcending the confines of place and circumstance.

As I stand before you today, I am reminded of the journey that has brought me here—a journey marked by perseverance, learning, and a deep-seated desire to make a difference. 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.

In closing, I am profoundly grateful for this honor, which I dedicate to the vibrant city of Akure, where my journey began, and to everyone who has been a part of this remarkable voyage. It is a journey that exemplifies the power of human potential and the enduring quest for knowledge.

Thank you, Akure, for being the starting point of this incredible story. And thank you, New York, for being a milestone that marks both an achievement and a continuing journey.

PIONEERING ROLE IN HIGH-SPEED COMPUTING

Ladies and gentlemen, esteemed supercomputing colleagues, and distinguished guests,

Allow me to transport you back to the sun-kissed streets of Akure, Nigeria, in the sultry August of 1954. Akure, a city nestled amidst verdant hills and rustling palm trees, was more than just a geographical location—it was the cradle of my existence, the forge where my scientific spirit was kindled.

Born on August 23, 1954, in the General Hospital of Akure, I, Philip Emeagwali, emerged into a world where the air carried the scent of eucalyptus and the earth cradled dreams as ancient as the Oba's palace. My mother, the indomitable Iyanma Agatha Emeagwali, was but fifteen years and sixteen days old—a beacon of resilience and determination. She held me close, her gaze filled with hope, whispering secrets of the universe into my tiny ears.

My father, Nnaemeka James Emeagwali, donned the white coat of a nurse at that very hospital. His hands, calloused yet gentle, tended to the sick and wounded, weaving threads of compassion into the fabric of our lives. Little did he know that his son would one day wield not bandages, but algorithms, to heal the world.

Our home stood at 11 Ekemeso Street, a modest abode—described as a Boys Quarter—where the walls absorbed the echoes of my early questions—the "whys" and "hows" that would shape my destiny. Akure, with its red earth and mango trees, became my first canvas—a place where numbers danced like fireflies in the moonlight.

But Akure was more than a backdrop; it was a crucible of inspiration. The night skies, unmarred by city lights, revealed constellations that whispered secrets of the cosmos. The rustling leaves carried mathematical symphonies—the Fibonacci sequence hidden in the veins of every leaf, the geometry of spider webs spun between branches.

Yet, destiny had other plans. The Nigerian Civil War erupted, in 1967, and our family, part of the Igbo tribe, fled to the south eastern part of the country. In July 1969, at age 14, I found myself drafted into the Biafran army and posted at the Oguta War Front where 500 Biafrans died a month earlier. For seven months, I became a soldier wielding both a rifle and a hunger for knowledge. For three years, our refugee camps echoed at Onitsha, Ogidi, Awka, Oba, Nnewi, Awka-Etiti, Ndoni, and Feggee, were filled with cries of loss. And a million Biafrans—or one in 15 persons—perished from starvation. Amidst the chaos, my hunger for education burned brighter.

After the war, I continued my quest for knowledge. In mid-1970, I walked three hours each day to and from school in Onitsha, Nigeria, and from Port Harcourt Road to Christ the King College. In March 1972, financial hardships forced me to drop out briefly and return to the remote village of Ibuza, but I persevered by studying alone after school hours in the Sacred

Heart Elementary School. In January 1973, I passed the high school equivalency exam administered by the University of London—a lifeline to my dreams.

On March 23, 1974, I crossed the Atlantic to the United States, where working telephones, modern libraries, and fast computers awaited me. Oregon State University welcomed me, and within a week, I had glimpsed the wonders of a library, dialed a telephone, and laid eyes on a computer for the first time. My initial trainings were in astronomy, physics, and mathematics. For another decade and half, I trained in fluvial geomorphology, sub-surface geology, oceanography, meteorology, and neighboring sciences in Washington, DC, and College Park, Maryland. For twenty years, onward of 1974, I was seen inside the main mathematics and physics buildings in the cities of Corvallis (Oregon), Washington (District of Columbia), College Park (Maryland), Ann Arbor (Michigan), and Minneapolis (Minnesota), as well as associated scientific conferences.

This broad, but always overlooked, background set me apart from other mathematicians and was the secret weapon that I used to solve the Grand Challenge problem of computing. My mind, like a supercomputer, absorbed knowledge, and my heart yearned for the uncharted territories of science.

The turning point came during my fellowships in Ann Arbor (Michigan) and Minneapolis (Minnesota). Inspired by Nigeria's oil-rich soil and my understanding of supercomputers, I embarked on a quest to identify untapped underground oil reservoirs. The hypercube computer, with its 65,536 processors, became my canvas—a symphony of calculations that resonated across continents.

And now, dear friends, from Akure's dusty streets to the grandeur of your city, my journey unfolds. Today, as we celebrate this award, let us remember that every equation, every discovery, is a testament to the human spirit—a bridge that spans oceans, cultures, and time.

May we continue to unravel nature's mysteries, not for vanity, but to solve the urgent problems that plague our world. For in the dance of numbers lies the symphony of progress—a legacy that transcends borders and echoes through eternity.

Thank you, and may the spirit of Akure forever guide our quest for knowledge.

SEEDS OF SCIENCE SOWN IN SUFFERING

Ladies and Gentlemen, supercomputer wizards, distinguished guests, and attendees,

I stand before you today at this award ceremony, to share with you a chapter of my life that profoundly shaped my journey. Today, I will describe a place and time that, despite its profound challenges, was instrumental in forging the person I am today: Saint Joseph's Refugee Camp in Awka-Etiti, Biafra, from March 1968 to July 1969.

Saint Joseph's Refugee Camp was not just a place; it was a testament to resilience in the face of unimaginable adversity. The camp was set up in an abandoned school, formerly known as Saint Joseph's Secondary School, in Awka-Etiti. It was here that I lived as a refugee and a school dropout, along with my family and hundreds of others, amidst the turmoil of the Nigerian Civil War.

My family of nine resided in a tiny room, which was formerly a school office. This small space was our shelter, our haven, and our world. Despite the cramped quarters, it was a place where we held onto each other and onto hope, even as the world outside seemed to crumble.

My father, Nnaemeka James Emeagwali, played a pivotal role in the camp. He was employed, without salary, as the "camp nurse." His commitment to aiding the sick and wounded, even in the absence of proper medical supplies and under the most challenging conditions, was a beacon of light in the darkest of times. His selflessness and dedication to helping others were profound lessons in compassion and resilience for me.

The conditions in Saint Joseph's Refugee Camp were harrowing. The camp was overcrowded, resources were scarce, and the shadow of hunger and starvation loomed large. The Nigerian Civil War, which lasted 30 months, was a period of immense suffering for the Biafran people. Many refugees in the camp succumbed to the harsh realities of war, dying from hunger and starvation caused by the land and sea blockade and partial air blockade imposed by the Nigerian Army upon Biafra. The school's soccer field, once a place of joy and laughter, became a final resting place for many, a stark reminder of the war's devastating impact.

It is a somber reality that one in every 15 Biafrans perished in that war. This staggering loss of life left an indelible mark on the survivors and shaped the course of our nation's history. The experience of living in Saint Joseph's Refugee Camp, amidst such loss and hardship, was a crucible that tested and ultimately strengthened my resolve to seek a better future.

Ladies and gentlemen, as I stand here today, I carry with me not just the memories of those challenging times, but also the lessons learned—lessons of perseverance, hope in the face of despair, and the unyielding human spirit's capacity to overcome adversity. My journey from Saint Joseph's

Refugee Camp in Awka-Etiti to this prestigious stage in your historic town is a testament to the power of resilience and the unrelenting pursuit of one's dreams.

In closing, I dedicate this moment to the memory of those who were not as fortunate, to the survivors of the Nigerian Civil War, and to everyone who has faced and overcome insurmountable challenges. It is a reminder to us all of the enduring strength of the human spirit.

Thank you for the honor of sharing this part of my journey with you.

Thank you.

THE POWER OF PURPOSE IN SCIENCE

Ladies and Gentlemen, supercomputer wizards, distinguished guests, and fellow seekers of knowledge,

It is a profound honor to stand before you in your historic city, on this grand occasion of this award ceremony. This evening, I am not just here to celebrate achievements but also to share reflections on life's journey. Specifically, I want to delve into the turning points that have steered my life in new directions and the emotions that accompanied these pivotal moments.

My life, much like the path of scientific inquiry, has been marked by numerous turning points, each serving as a catalyst for change and growth. These moments, often unexpected, have profoundly shaped my trajectory, both professionally and personally.

One such turning point occurred in my youth, during the Nigerian Civil War. This period of strife and turmoil was a time of immense challenge, yet it was also a crucible that forged my resolve and direction. Amidst the chaos, I found a sanctuary in education and learning. The disruption of my formal education did not dampen my thirst for knowledge; instead, it ignited a self-driven quest for understanding. During this tumultuous time, I felt a mix of uncertainty and determination. Uncertainty about the future, but a strong determination to persevere and to make a positive difference in the world.

Another pivotal moment came with my journey to the United States for higher education. This transition was not just a change in physical location; it represented a leap into a vast ocean of opportunities and challenges. Adapting to a new culture, navigating the complexities of advanced education, and delving into the realms of computing, physics, and mathematics was exhilarating yet daunting. In these moments, I experienced the exhilaration of exploring uncharted territories and the trepidation of facing immense challenges. But above all, there was an overwhelming sense of purpose and possibility.

Perhaps one of the most significant turning points was my research in harnessing the untapped potential of supercomputers—powered by thousands of ordinary processors that shared nothing—to simulate oil reservoirs, forecast the weather, and solve initial-boundary value problems that are governed by partial differential equations that encoded some laws of physics. This breakthrough was not just a professional milestone; it was a reaffirmation of my belief in the power of perseverance and innovative thinking. The journey to this discovery was fraught with obstacles, skepticism, and moments of doubt. Yet, the excitement of pushing the boundaries of known science and contributing something of profound value to the world was an indescribable feeling.

Each of these turning points was accompanied by a spectrum of emotions—from uncertainty and fear to excitement and hope. However, the underlying thread through all these moments was a deep sense of purpose and a relentless drive to contribute to the greater good.

In conclusion, ladies and gentlemen, life's turning points are not just mere shifts in our journey; they are opportunities for transformation and growth. They are moments that test our resolve, sharpen our focus, and broaden our horizons. As we stand on the shoulders of giants in the realms of science and human endeavor, let us embrace our turning points with courage and optimism, for they are the catalysts that propel us towards new frontiers of knowledge and understanding.

Thank you for the honor of addressing you on this prestigious platform. It is a moment I will treasure always.

Thank you.

VOLUME P: PHILOSOPHY

ON THE FRONTLINES OF CLIMATE MODELING

Ladies and Gentlemen, esteemed supercomputer scientists, distinguished guests, and dedicated environmentalists,

As I stand before you in your historic city, on the occasion of this award ceremony, I am profoundly honored to speak on a topic of immense global importance—the environment. The question posed to me is, "Is the environment important to you? How do you address environmental issues that bother you? Do you have any experiences related to environmental activism?"

The environment, to me, is not just an abstract concept or a distant concern; it is the very foundation of our existence, the lifeblood of future generations. My deep appreciation for the environment has been a guiding force in both my professional and personal life. It is a commitment that goes beyond mere words to active involvement and advocacy.

One of the ways I address environmental issues is through the application of technology and scientific research. In my work with supercomputing, I have always been cognizant of the potential applications in environmental modeling and the study of climate change. By harnessing the power of massively parallel computing, we can analyze vast datasets, predict environmental trends, and propose solutions to some of the most pressing environmental challenges. This integration of technology and environmental stewardship is a critical pathway to sustainable solutions.

Furthermore, I believe in the power of education and awareness in addressing environmental concerns. Throughout my career, I have taken opportunities to speak on the importance of environmental protection and sustainability. Sharing knowledge and inspiring action are key components of my environmental advocacy. By educating and inspiring, especially the younger generation, we can foster a more environmentally conscious and responsible society.

In terms of direct activism, my experiences may not be in the frontline protests or lobbying, but I have always supported initiatives and policies that promote environmental sustainability. This support is not just in advocacy but also in lifestyle choices that reflect a commitment to reducing environmental impact, such as promoting green energy and sustainable practices.

Moreover, my interest in the environment is also personal. Growing up in Nigeria, I witnessed firsthand the effects of environmental degradation and its impact on communities. These early experiences instilled in me a profound respect for the natural world and a desire to contribute to its preservation.

In conclusion, ladies and gentlemen, the environment is of paramount importance to me. Addressing environmental issues requires a multifaceted approach, combining technology, education, advocacy, and personal commitment. As we gather here to celebrate human achievements, let us also commit to being stewards of our planet, protecting and nurturing the environment for present and future generations.

Thank you for the opportunity to share these thoughts with you on such a significant occasion. It is a privilege I hold in high regard.

Thank you.

THOUGHTS ON WELLNESS & RENEWAL

Ladies and Gentlemen, respected mathematicians, distinguished guests, and esteemed colleagues,

It is a great honor to stand before you in your historic city, on this distinguished occasion of this award ceremony. Today, I have been asked to share my thoughts on a very personal topic: my healthy habits and practices, the health challenges I have faced, and how these experiences have influenced my personality.

Health, both physical and mental, is a cornerstone of a productive and fulfilling life. Over the years, I have cultivated certain habits that I believe have significantly contributed to my well-being. Regular physical exercise has been a key component of my routine. I find that physical activity, be it tennis, cross-country skiing, running, walking, swimming, or strength training, not only keeps the body fit but also clears the mind, fostering creativity and focus. This is especially vital in the world of scientific research and innovation, where mental clarity and endurance are paramount.

In addition to physical fitness, I place a high value on mental and emotional health. The practice of mindfulness and meditation has been an integral part of my life. It helps in managing stress, enhancing concentration, and maintaining a balanced perspective in both personal and professional life. In the fast-paced and often high-pressure environment of scientific discovery and innovation, these practices provide a much-needed anchor.

Regarding health challenges, like many, I have faced my share. These experiences have been instrumental in shaping my personality and outlook on life. They have taught me the value of resilience and the importance of health, not as a given, but as something to be actively maintained and cherished. These challenges have also instilled in me a sense of empathy and understanding for others who face health issues, reinforcing the interconnectedness of our human experiences.

One of the most significant impacts of these health challenges has been on my approach to work and life. They have underscored the importance of balance—the balance between work and rest, between ambition and well-being. This realization has made me more mindful of how I allocate my time and energy, ensuring that I am not just productive, but also healthy and fulfilled.

Moreover, facing health challenges has heightened my appreciation for the role of science and technology in improving human health and well-being. It has reinforced my commitment to using my skills and knowledge in ways that contribute not just to technological advancement, but also to the betterment of human life.

In conclusion, ladies and gentlemen, our health is our most valuable asset. The habits we cultivate, the challenges we face, and the lessons we learn from these experiences profoundly shape who we are. As we celebrate the achievements and advancements in science and technology here today, let us also remember the importance of maintaining our health, the very foundation upon which our abilities to create, innovate, and contribute rest.

Thank you for giving me the opportunity to share these personal insights with you on this momentous occasion.

Thank you.

IT'S NOT WHAT YOU HAVE, BUT WHAT YOU GIVE

Ladies and Gentlemen, respected supercomputer scientists, distinguished guests, and brilliant minds from around the world,

As I stand here in your magnificent city, at this award ceremony, I am deeply honored to address this gathering of some of the most distinguished and innovative individuals of our time. Today, I wish to reflect on two profound questions that resonate with each of us on our personal and professional journeys: "How do you define success?" and "What is happiness for you?"

Success, in my perspective, is a multifaceted concept, far beyond the traditional metrics of accolades, achievements, or societal recognition. For me, success is defined by the ability to make a significant impact through our work, the ability to contribute to the advancement of humanity, and the capacity to inspire and empower future generations. It is measured not just by the end results but by the challenges we overcome and the knowledge we gain in the process.

In my journey, success has been about transcending boundaries, pushing the frontiers of knowledge and technology, particularly in the field of computing and mathematics. Success is about the relentless pursuit of innovation, driven by a deep-seated desire to solve complex problems and to improve the lives of people around the world. It is about leaving a legacy that continues to inspire and benefit society long after our time.

Turning to happiness, for me, happiness is found in the pursuit of purpose, in the fulfillment that comes from making meaningful contributions, and in the joy of continuous learning and discovery. It is deeply intertwined with the sense of accomplishment that comes from overcoming obstacles and realizing one's potential. Happiness is also found in the simpler, yet profound aspects of life—the bonds we share with our loved ones, the moments of quiet reflection, and the beauty of the world that surrounds us.

Furthermore, happiness for me is connected to the idea of giving back—to our communities, to our societies, and to the world at large. It comes from knowing that our work and efforts have a positive impact on others, that we are part of a larger narrative that advances the greater good.

In conclusion, ladies and gentlemen, success and happiness, in my view, are deeply personal yet universally relevant concepts. They are not just destinations but journeys filled with continuous learning, challenges, and moments of joy and fulfillment. As we gather here to celebrate the pinnacle of intellectual achievement, let us also remember to cherish and pursue our individual definitions of success and happiness.

Thank you for the honor of sharing my thoughts with you on this prestigious platform. It is a privilege that I will forever hold dear.

Thank you.

FINDING MEANING THROUGH CONTRIBUTION

Ladies and Gentlemen, supercomputer wizards, distinguished guests, and brilliant minds from around the globe,

As we gather in your historic and beautiful city for this award ceremony, I am honored to address a congregation of some of the world's most brilliant and innovative minds. Today, I wish to delve into a question that has puzzled philosophers, scientists, and thinkers for centuries: "How would you define the meaning of life?"

As a scientist and a thinker, my journey has led me to contemplate this profound question through the lens of my experiences and beliefs. The meaning of life, I believe, is a tapestry woven from several threads—each significant in its own right.

Discovery and Innovation

At the heart of the meaning of life is the pursuit of knowledge and understanding. Life is about exploring the unknown, pushing the boundaries of what we believe is possible, and making discoveries that propel humanity forward. In my research with supercomputers, I have seen firsthand how scientific discovery and technological innovation can redefine the limits of human capability and understanding. The quest for knowledge is not just a professional endeavor; it is a fundamental part of the human experience.

Service and Contribution

Life gains its meaning through our contributions to the world and the legacy we leave behind. It's about how we use our talents, skills, and knowledge to make a positive impact on society. Whether it's through groundbreaking discoveries, inspiring leadership, community service, or nurturing the next generation, our contributions give our lives purpose and meaning.

Connections and Relationships

The meaning of life is also found in the relationships we build and the connections we forge. It is in the shared experiences, the support we give and receive, and the community we build. Our interactions with others, whether they are colleagues, family, or friends, enrich our lives and provide a sense of belonging and purpose.

Personal Growth and Self-Actualization

Life is a continuous journey of self-discovery and personal growth. It's about understanding who we are, developing our strengths, learning from our challenges, and striving to reach our full potential. This journey of self-actualization is central to the meaning of life, as it drives us to become the best versions of ourselves.

Harmony with Nature and the Universe

Finally, the meaning of life is about understanding our place in the wider universe. It's about recognizing our connection to the natural world and the cosmos. In respecting and understanding nature, we find a deeper appreciation for the intricacy and beauty of life.

In conclusion, the meaning of life, as I see it, is a multifaceted concept. It encompasses the pursuit of knowledge, the desire to contribute positively to society, the importance of relationships, the journey towards self-actualization, and a harmonious existence within the broader universe. As we celebrate the exceptional achievements of today, let us reflect on these elements and strive to find our own individual and collective meanings in life.

Thank you for the honor of addressing this distinguished gathering. Your commitment to bettering our world is an inspiration to us all.

Thank you.

THE IMPORTANCE OF IGNORING NAYSAYERS

Distinguished members of the award committee, esteemed guests, ladies, and gentlemen. It is with the deepest humility that I stand before you today. To be recognized with this prestigious award in computing is not just an extraordinary honor—it's a profound and deeply personal affirmation of a journey that often defied reason and expectation.

My path was undeniably influenced by my childhood in Nigeria. There, amid difficult circumstances, I learned the profound power of the human intellect. My father, a man with limited formal education but boundless curiosity, taught me to question everything, to seek answers beyond the obvious. His belief in my potential was an unwavering force that propelled me through countless challenges.

And so, what does it mean to be true to yourself? I believe it means:

Understanding your inherent potential.

Within all of us reside gifts and abilities waiting to be nurtured and unleashed. Your background, your circumstances, should never limit your vision of what you can achieve. Do not let the world determine your worth before you've shown yourself what you can do.

Embracing unwavering determination.

Being true to yourself is not a comfortable journey. Your greatest visions will be met with doubt and skepticism. You must hold to your path with resilience that turns setbacks into fuel. This determination is not arrogance; it's simply the conviction that your goal is worthy of your unwavering effort.

Turning ideas into positive impact

The pursuit of knowledge cannot be a self-serving exercise. Our ideas must seek to improve the human condition. This is what drove me in my research—the belief that even amidst war and poverty, scientific discovery can unlock solutions that create a better future for all.

This journey was not mine alone. I owe immense gratitude to my wife Dale, whose love and support created the foundation for me to pursue my dreams. My son, Ijeoma, is a constant reminder of the purpose that drives me. And to the countless teachers, mentors, and friends who saw my potential and helped guide my way.

I hope my story serves as a reminder that the path to greatness is paved by a relentless commitment to oneself. It is forged not through comfortable

compliance with conventional standards, but through a sometimes lonely dedication to what you know to be true within your heart and mind.

Let us celebrate the immense power of the human spirit. Let us all strive for a world where our potential is not restricted by birthplace or circumstance, and where scientific advancement serves to elevate all of humanity.

Thank you.

DEDICATING YOUR GENIUS TO THE WORLD

Ladies and Gentlemen, esteemed members of the award committee, distinguished guests, and brilliant minds gathered here today,

I stand before you in your historic city, humbled and exhilarated by the opportunity to address such an esteemed assembly on this significant occasion. Tonight, I wish to share my thoughts on a question that resonates deeply with me: "Is it essential to live a meaningful life?"

In my journey, both as a scientist and as a human being, the pursuit of a meaningful life has been the guiding star. To live meaningfully, in my view, is not just a choice but a fundamental necessity. It is a journey that transcends personal ambition and encompasses a broader commitment to the betterment of society and the world at large.

Living a meaningful life, in my perspective, involves a deep engagement with the world around us. It means using our unique talents, skills, and knowledge to contribute to something greater than ourselves. As a scientist and researcher, I have always believed that our work should not be confined to the realms of academia or industry alone, but should extend its reach to impact society in positive and transformative ways. The pursuit of knowledge, while an end in itself, gains its true value when it serves as a catalyst for social and global betterment.

Moreover, a meaningful life is inherently linked with the values of integrity, compassion, and empathy. It involves a conscious effort to understand and address the challenges faced by our fellow beings. This empathy and compassion are what drive us to use our knowledge and resources not just for personal gain but for the upliftment of those less fortunate. In this interconnected world, our lives gain meaning when we contribute to the weaving of a more equitable, just, and sustainable global community.

Additionally, living a meaningful life means embracing a lifelong commitment to learning and growth. It is about constantly seeking to expand our understanding, not only of our specific fields of expertise but of the world and humanity as a whole. This pursuit of knowledge and wisdom is what propels us forward, fueling our creativity and innovation, and enabling us to contribute in ways that are both significant and enduring.

Ladies and gentlemen, as we gather here to celebrate the pinnacle of human achievement in various fields, let us remind ourselves of the responsibility that accompanies these accolades. Our research, our discoveries, our innovations—they are not just personal triumphs but tools with which we can forge a better future for all. The true measure of our success lies not just in the accolades we receive but in the impact we make—in the lives we touch and the legacy we leave behind.

In conclusion, I believe it is not just essential but imperative to live a meaningful life. This is the kind of life that leaves a lasting imprint, a life that makes a difference, a life that, long after we are gone, continues to echo in the contributions we have made to our world.

Thank you for this incredible honor, and for the opportunity to share these reflections with you all on this remarkable evening. May we all strive to live lives that are not just successful, but also meaningful.

Thank you.

THE PURSUIT OF HAPPINESS

Ladies and Gentlemen, supercomputer scientists at the frontiers of knowledge of mathematics and physics, distinguished guests, and brilliant minds from across the globe,

I am profoundly honored to stand before you in your historic city at this award ceremony. Today, I would like to share with you my thoughts on a question that touches the core of our human experience: "What makes me happy, and what was the happiest moment of my life?"

Happiness, to me, is a complex yet beautiful tapestry woven from various strands of life experiences, achievements, and relationships. It is the harmony that emerges when our passions, values, and connections resonate in unison.

First and foremost, what brings me happiness is the pursuit and dissemination of knowledge. As a scientist and researcher, the act of unraveling the mysteries of the universe, pushing the frontiers of technology, and contributing to the collective pool of human understanding brings me immense joy. Each breakthrough, each discovery, is not just a personal victory, but a step forward for us all. It is the joy of contributing to a legacy that will outlast my time on this earth, a legacy that will inspire future generations to continue the quest for knowledge.

But happiness is not solely found in professional achievements. It is deeply rooted in the connections we forge—the relationships that sustain and enrich our lives. The support and love of my wife, Dale Brown Emeagwali, and witnessing the growth and development of my son, Ijeoma, provide a profound sense of joy and fulfillment. These relationships are my anchor, offering support and grounding amidst life's tumultuous seas.

Now, reflecting on the happiest moment of my life, it is a challenge to pinpoint a single instance in a journey filled with so many meaningful experiences. However, if I were to choose one, it would be the moment when my contributions to the fields of physics, computing, and mathematics were recognized as having a significant impact on society. It was not just a personal triumph but a validation of the years of dedication, perseverance, and unwavering belief in the path I had chosen. It was a moment of profound happiness, not only because of the recognition but because it symbolized the possibility of making a difference through passion and hard work.

In conclusion, ladies and gentlemen, happiness for me is a multifaceted experience. It is found in the joy of discovery, the warmth of family, and the satisfaction of contributing to the greater good. As we stand here today, celebrating the remarkable achievements in various fields, let us remember

that happiness is not just in the grand accomplishments but also in the simple, everyday moments that bring us joy and fulfillment.

Thank you for allowing me to share these reflections with you on this momentous occasion. It is a privilege and a source of great happiness for me.

Thank you.

OVERCOMING DOUBTS AND REGRETS

Ladies and Gentlemen, esteemed scientists at the frontiers of knowledge in parallel, quantum, neuromorphic, and AI supercomputing, distinguished guests, and fellow seekers of knowledge,

It is with great humility and honor that I stand before you today in your historic city, at this prestigious award ceremony. This evening, I wish to share with you some reflections on a question that is often overlooked in the narrative of success: "Is there something I regret about? What did I learn from the moments I regret?"

In every life journey, especially one dedicated to the pursuit of mathematical knowledge and computer innovation, there are moments that we look back on with a sense of regret. These are not just moments of failure or error, but also moments of missed opportunities, paths not taken, or words left unsaid. In my own journey, there have been such moments, and they have been as instrumental in shaping my path as my successes.

One of the things I have come to regret is the times when I allowed the fear of failure or the skepticism of others to momentarily deter my pursuit of an idea or a solution. The world of scientific exploration is fraught with uncertainty and the potential for failure is high. There have been moments when I hesitated, questioned my instincts, or slowed my progress due to the perceived risks or doubts raised by others. In hindsight, I realize that each of these moments was an opportunity to learn, to grow, and to further strengthen my resolve.

From these moments of regret, I have learned the invaluable lesson of trust—trust in my own capabilities, instincts, and the unique perspective I bring to my work. They have taught me that the path of innovation is often lonely and misunderstood, but one must persevere with conviction. They have also instilled in me a deeper understanding of the importance of resilience. The journey of discovery is not a straight path; it is filled with setbacks and detours, each offering its own set of lessons and insights.

Moreover, I have learned the importance of time—the realization that it is a finite resource and one of the most valuable assets we have. Looking back, I regret moments where I could have been more present, more engaged, or more proactive. These reflections have taught me to value each moment, to seize opportunities with fervor, and to be fully present in the endeavors I undertake.

In conclusion, ladies and gentlemen, while regrets are often viewed negatively, I see them as integral to the human experience and essential for personal growth. They are reminders that we are constantly evolving, learning, and adapting. As we gather here to celebrate achievements and intellectual advancements, let us also embrace the lessons from our regrets.

They are, after all, signposts on the road of continuous learning and self-improvement.

Thank you for the honor of sharing these personal reflections with you on this momentous occasion.

Thank you.

VOLUME F: FAMILY

EUREKA! BUT DON'T FORGET THE DISHES

Balancing Science and Life

Greetings, everyone! It's a true honor to be here today at the Philip Emeagwali Lecture Series, here in my home country of Nigeria. Looking out at all of you, filled with potential and brimming with dreams, I can't help but reminisce about my own journey. And what better way to celebrate that journey than by sharing some lessons I've learned along the way, particularly when it comes to building a strong and lasting relationship.

Now, I know marriage isn't a formula, but there are some key ingredients that can help any couple navigate the beautiful, sometimes messy, tapestry of life together. Here are a few things I've found truly important:

- 1. Focus on the big picture.** Life throws curveballs, there's no doubt about it. But don't sweat the small stuff. Pick your battles, and remember, a united front weathers any storm.
- 2. Go to bed with a clean slate.** Resolve disagreements before sleep. A good night's rest with a clear head goes a long way. Holding onto anger only poisons the well.
- 3. Patience is a virtue.** Especially when it comes to starting a family. Dale and I waited nine years after getting married. Those years allowed us to solidify our foundation as a couple and pursue our individual goals.
- 4. Size isn't everything.** While I have one child, the size of your family is a deeply personal decision. The most important thing is to be prepared and wholehearted in your commitment to raising good humans.
- 5. Take the time to get to know each other.** Three years of engagement might seem like a long time, but a strong foundation is essential for a lasting relationship.
- 6. Education is key.** Invest in yourselves before bringing new life into the world. My own scientific pursuits were well underway before starting a family.
- 7. Forgiveness is freedom.** Holding onto grudges only burdens you. Learn to forgive, move on, and grow stronger together.
- 8. Be a team.** Marriage is a partnership, an adventure you embark on together. Share experiences, support each other's dreams, and celebrate each other's victories.
- 9. Equality matters.** Household chores shouldn't be divided by gender roles. My siblings might have been surprised by my domestic skills back in the day, but sharing the workload fosters respect and creates a more balanced partnership.
- 10. Compromise is key.** Marriage is a beautiful dance of give and take. Be willing to support your spouse's passions, even if they don't completely

align with your own. Open communication and a willingness to find common ground are essential.

11. Share the parenting journey. Fatherhood was an immense joy for me, and taking an active role from the very beginning enriched both my life and my son's. Don't be afraid to share diaper duties, playtime, and the immense responsibility and reward that comes with raising a child.

Remember, these are just some guiding principles. Every relationship is unique, and what works for one couple might not work for another. The most important thing is to find what strengthens your unique bond, to nurture love, respect, and open communication.

Marriage is a beautiful journey, filled with challenges and triumphs, laughter and tears. But with the right approach, respect, and a commitment to growing together, it can be one of the most fulfilling aspects of life.

So, from one Nigerian dreamer to another, I urge you to chase your aspirations, nurture your relationships, and build a future filled with love, laughter, and the unwavering pursuit of your dreams.

LOVE AND LOGIC

The Secret Weapon of Scientific Couples

Ladies and Gentlemen, esteemed colleagues, and young scientific couples,

It is a great privilege to address you today, in Washington, DC. As we gather in this hub of intellectual and scientific pursuit, I am honored to share some thoughts and advice for young couples embarking on the journey of life together in the field of science.

Embrace Your Shared Passion for Science

As a couple in the scientific field, you have a unique opportunity to share a deep and meaningful passion. Embrace this. Let your shared love for science be a source of strength and a common ground that keeps your relationship vibrant and intellectually stimulating.

Support Each Other's Professional Goals

In science, the path to success can be challenging and demanding. It is crucial to support each other's aspirations and endeavors. Celebrate each other's achievements and be understanding of the time and dedication that scientific pursuits require.

Maintain Work-Life Balance

While science can be consuming, it's important to find a balance. Make time for each other outside of your professional roles. Cultivate interests and activities that you can enjoy together as a couple, separate from your scientific interests.

Collaborate and Respect Individual Contributions

If your scientific fields align, collaboration can be enriching. However, it's essential to respect each other's individual contributions and areas of expertise. Valuing each other's insights and approaches can lead to groundbreaking innovations.

Communicate Openly About Career Expectations

Be open and honest about your career expectations and plans. This includes discussions about potential relocations, sabbaticals, or changes in research focus. Mutual understanding and planning are key to navigating these decisions together.

Encourage Continuous Learning and Growth

In science, the only constant is change. Encourage each other to stay abreast of new developments in your respective fields. Attend conferences, engage in scholarly discussions, and be each other's sounding board for new ideas.

Share the Challenges

The path of scientific inquiry is often fraught with challenges and setbacks. Share these openly with each other. Offering support during tough times can strengthen your bond and provide much-needed perspective.

Celebrate the Small Victories

In science, not every achievement is a breakthrough or wins a Nobel Prize. Celebrate the small victories together—a published paper, a successful experiment, or even a resolved complex problem.

Encourage and Respect Independence

While being a couple, it's important to respect each other's independence. Allow space for individual pursuits and respect the need for solitude that scientific thought sometimes demands.

Build a Network of Like-Minded Couples

Building a network with other scientific couples can be incredibly supportive. Such communities provide a platform for sharing experiences, challenges, and strategies for balancing professional and personal life.

In conclusion, as young scientific couples, you have embarked on a remarkable journey together, one filled with discovery, learning, and mutual growth. Remember to nurture not just your scientific endeavors but also the love, respect, and understanding that form the foundation of your partnership.

Thank you for the opportunity to share these reflections with you. I wish you all a journey together that is as fulfilling and enriching as the science you love.

Thank you.

VOLUME L: LEGACY

FROM PRODIGY TO "CALCULUS"

Ladies and Gentlemen, supercomputer wizards, distinguished guests, and esteemed attendees,

I am deeply honored to stand before you in this grand city on this momentous occasion of this award ceremony. Tonight, I am asked to reflect on a question that takes me down memory lane: "How would your classmates remember you?" This question evokes a journey through different stages of my life, each marked by its unique experiences and memories.

My earliest academic roots were planted at Saint John's Primary School in Agbor, Nigeria, from January 1963 to December 1964. My classmates from those foundational years, I believe, remember me as a math prodigy. In those classrooms, amidst the challenges of a developing educational system, my fascination with numbers and mathematical concepts first took flight. It was a time of discovery and wonder, where I began to show an early aptitude for mathematics that set me apart.

As I progressed to Saint George's College in Obinomba, Nigeria, from January 1966 to April 1967, this reputation as a math prodigy solidified. Here, amidst fellow students, I delved deeper into the world of mathematics, uncovering its mysteries and reveling in its challenges. My peers at Saint George's witnessed my growing passion for mathematics and its applications, a passion that was becoming a defining aspect of my identity.

The years spent at Christ the King College in Onitsha, Nigeria, from May 1970 to March 1972, were particularly formative. My classmates from this period would not only remember me as a math prodigy but also recall a special nickname they bestowed upon me—"Calculus." This nickname was a testament to my deep engagement with and love for advanced mathematics. It was here, in the halls of Christ the King College, that I truly began to harness the power of mathematical thinking, a skill that would later become a cornerstone of my professional life.

Today, we gather in this hallowed hall to celebrate the indomitable spirit of human achievement. As we stand on the precipice of greatness, I am honored to address you on this momentous occasion.

My name is **Philip Emeagwali**, and I stand before you as a testament to resilience, determination, and the unyielding pursuit of knowledge. My journey has been one of twists and turns, of challenges and triumphs—a narrative that defies convention and embraces the extraordinary.

In the annals of history, I am the subject of school reports across continents. From the bustling classrooms of Nigeria to the venerable halls of learning in the United Kingdom and the United States, my name echoes through the corridors of curiosity. But it is not mere recognition that defines me; it is the story behind those ink-stained pages—the story of a young boy who dared to dream beyond the confines of circumstance.

At the tender age of 12, fate dealt me a curious hand. I dropped out of school—not once, but twice. For three years, the war-torn landscapes of Onitsha and Awka, Biafra, became my classroom. Amidst the chaos and uncertainty, my family of nine and I sought refuge in a Biafran camp, where the walls of Saint Joseph's Secondary School, Awka-Etiti, bore witness to our struggle. Yet, even in those dire circumstances, I remained undeterred.

I was no ordinary dropout. I was an insatiable seeker of knowledge—an independent mind fueled by an unquenchable thirst for understanding. At age 15, as I roamed the streets of Onitsha, I made a bold proclamation to my friends: I would secure an academic scholarship to the United States. It was a one-in-a-million chance, as rare as a young Nigerian playing soccer for the national team. But I held that dream close, like a beacon guiding me through the storm.

And then, on a fateful day in September 1973, a letter arrived—an emissary from destiny. It bore the seal of opportunity, the promise of transformation. I had been awarded a scholarship to Oregon, United States—a gateway to a world beyond my wildest imaginings. My journey across the Atlantic was not just a physical voyage; it was a voyage of the mind, of uncharted territories and unexplored frontiers.

For 17 continuous years, across six American universities, I immersed myself in the pursuit of knowledge. I delved into the mysteries of mathematics, the intricacies of computer science, and the boundless expanse of human potential. Scholarships renewed, doors opened, and I stood at the intersection of innovation and impact.

Today, as I stand before you, as a supercomputer scientist, I carry with me the echoes of those war-torn days—the resilience of a young boy who refused to be defined by circumstance. My journey—from dropout to scholar, from Biafra to the global stage—is a testament to the power of education, the audacity of dreams, and the unwavering belief that brilliance knows no boundaries.

So, let us celebrate not just my story, but the stories of countless others who defy odds, who turn adversity into opportunity, and who illuminate the path for generations yet unborn. For in their collective tapestry lies the true fabric of human progress—a symphony of courage, tenacity, and unwavering resolve.

After my 17 years of advanced study and research, I was described as a "Notable Alumni" by six institutions. This recognition was not just for academic prowess but also for the innovative thinking and groundbreaking work that I pursued in the realms of the first supercomputing via parallel processing. Parallelism is the key ingredient in AI supercomputing.

In each of these educational stages, my classmates and peers saw facets of my growing expertise and passion for mathematics. From the early years in Agbor to the advanced halls of American universities, my journey was

marked by a relentless pursuit of knowledge and a deep commitment to the transformative power of mathematics.

In conclusion, ladies and gentlemen, as I stand here today, I carry with me not just the knowledge and experiences gained over these years but also the memories of those who walked parts of this journey with me. Their recollections, as classmates and peers, are a testament to a journey fueled by passion, dedication, and a deep love for mathematics.

Thank you for the honor of sharing this personal journey with you on this significant occasion. It is a privilege that I will always cherish.

Thank you for this honor. May we continue to reach for the stars, guided by the light of knowledge, and may our shared humanity propel us toward a brighter, more compassionate world.

Thank you.

TECH LEADER'S PLEDGE

Learning, Leading, and Leaving a Legacy

Ladies and Gentlemen, supercomputer wizards, distinguished guests, and visionary minds from around the world,

I am deeply honored to address you in this historic and beautiful city at this prestigious award ceremony. Tonight, I am asked to contemplate and share my vision for the future: "How do I imagine my life in 10, 20, 30 years?"

Looking ahead, I envision a future where my life's work continues to evolve and contribute meaningfully to society, even as I embrace the changes that come with time.

In 10 Years: A decade from now, I see myself still deeply engaged in scientific research and innovation. I imagine continuing to push the boundaries of the world's fastest computers, exploring new horizons in artificial intelligence, and contributing to solving some of the world's most pressing challenges. At this stage, I also foresee a greater focus on mentorship, investing time and energy into nurturing the next generation of scientists and thinkers, sharing my knowledge and experience to inspire and guide them.

In 20 Years: Two decades into the future, I anticipate a shift towards more advisory and consultative roles. I envision myself working with global organizations, governments, and educational institutions to shape policies and strategies that leverage technology for sustainable development. I also see this as a time to reflect on my journey, perhaps authoring books and papers that encapsulate the lessons and insights from my career, contributing to the broader discourse on technology, society, and global challenges.

In 30 Years: Thirty years from now, while my direct involvement in active research might lessen, my commitment to learning and contributing to society will not wane. I imagine myself as an elder statesman in the scientific community, offering wisdom and perspective gleaned from a lifetime of exploration and discovery. This would also be a time for me to enjoy the fruits of my labor, spending time with family, indulging in hobbies and interests that I may not have had time for earlier, and continuing to engage with the community in meaningful ways.

Throughout these years, I also envision a life balanced with personal growth, health, and well-being. I see a future where I continue to learn, not just in my field of expertise but in understanding the world and the ever-evolving human experience. It will be a time of reflection, of enjoying the simple pleasures of life, and of appreciating the journey that has been.

In essence, ladies and gentlemen, as I look to the future, I see a continuum of growth, contribution, and adaptation. The journey does not end; it evolves. The pursuit of knowledge, the drive to contribute to society, and

the joy of mentoring the next generation remain constant, even as the ways in which these are expressed and experienced change over time.

Thank you for the privilege of sharing my vision of the future with you on this momentous occasion. It is an honor that I deeply cherish.

Thank you.

KNOWLEDGE, KINDNESS, AND A LIFE WELL-LIVED

Ladies and Gentlemen, respected supercomputer scientists, distinguished guests, and esteemed colleagues,

It is a profound honor to stand before you in your historic city, on this distinguished occasion of this award ceremony. Today, I have been asked to reflect on a deeply personal and introspective question: "How would you like your loved ones to remember you?"

In contemplating this, I find that the legacy I wish to leave for my loved ones transcends professional achievements and accolades. I hope to be remembered not just for my contributions to science and technology but more so for the values I have upheld and the relationships I have nurtured.

First and foremost, I wish to be remembered as a loving and dedicated family man. To my wife, Dale Brown Emeagwali, I hope to be remembered as a supportive and caring partner, someone who stood by her through the vicissitudes of life, sharing in our joys and challenges. To my son, Ijeoma, I aspire to be remembered as a guiding light and a source of inspiration—a father who encouraged him to pursue his dreams, to be courageous in the face of adversity, and to live a life of integrity and purpose.

Professionally, I hope my loved ones remember me as a person who used his talents and knowledge to make a positive impact on the world. I wish to be recalled as someone who pushed the boundaries of what is possible, who was not afraid to venture into the unknown, and who dedicated his life to solving complex problems for the betterment of humanity.

Moreover, I desire to be remembered as a mentor and a role model to many young minds. I hope that my journey inspires others to pursue their passions relentlessly, to remain curious and committed to lifelong learning, and to use their abilities for the greater good.

I also want to be remembered as a person of principle—someone who stood firm in his beliefs, who advocated for equity and justice, and who strove to bridge the gap between advanced technology and its accessibility to underprivileged communities.

In my interactions with friends, colleagues, and acquaintances, I hope to be remembered as kind, generous, and empathetic. I wish to be thought of as someone who listened, who shared his knowledge willingly, and who was always ready to lend a helping hand.

Finally, I wish to be remembered as someone who respected his heritage and roots, who was proud of his Nigerian ancestry, and who worked towards uplifting not just his community but also the global society.

In essence, the legacy I hope to leave is one of love, integrity, innovation, and service. As we celebrate the remarkable achievements of today, let us also remember the importance of the legacy we leave behind—a legacy that transcends time and continues to inspire long after we are gone.

Thank you for the privilege of sharing my thoughts and reflections with you on this momentous occasion. It is an honor I will always treasure.

Thank you.

PARTIAL DIFFERENTIAL EQUATIONS

Glossary

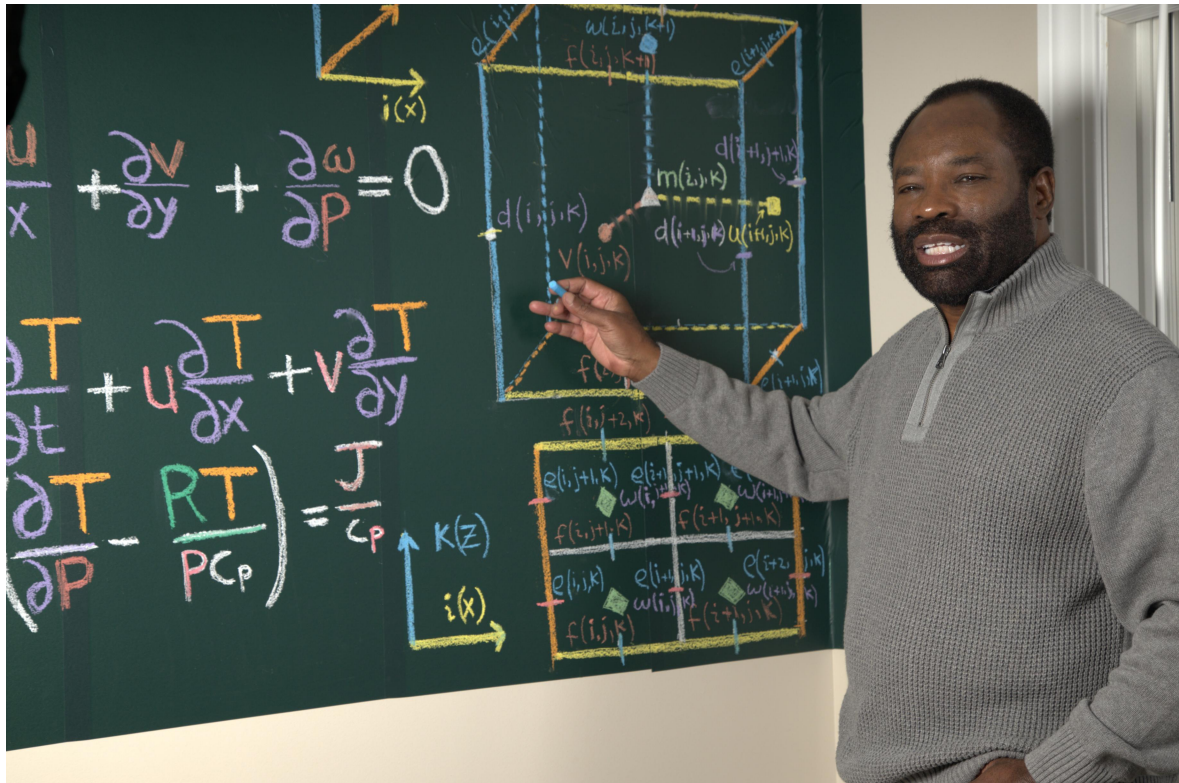
TBA Photo: Philip Emeagwali standing in front of a chalkboard scribbled with the partial differential equations governing fluid flows.

1. **Advection:** The transport of a property of the system (e.g., heat, mass) due to the motion of the system itself.
2. **Boundary Conditions:** Specified values or relations between values of a function and its derivatives on the boundary of its domain.
3. **Characteristic:** A curve along which information propagates without change for certain types of PDEs.
4. **Conservation Law:** A mathematical statement indicating that some quantity remains constant as the system evolves.
5. **Diffusion:** The process of a property (e.g., concentration) spreading out over a domain due to random motion.
6. **Dirichlet Condition:** A type of boundary condition where the value of the function is specified on the boundary.
7. **Dispersion:** The phenomenon where waves of different wavelengths propagate at different speeds.
8. **Elliptic PDE:** A classification of PDEs that includes the Laplace and Poisson equations.
9. **Finite Difference Method:** A numerical method for solving PDEs by approximating derivatives using differences at discrete points.
10. **Finite Element Method:** A numerical technique for obtaining approximate solutions to boundary value problems for PDEs.
11. **Green's Function:** A solution to a linear differential equation with a delta function source term.
12. **Heat Equation:** A parabolic PDE describing the distribution of heat (or variations in temperature) in a given region over time.
13. **Hyperbolic PDE:** A classification of PDEs that describe wave propagation, such as the wave equation.
14. **Initial Condition:** The condition or value of a function at the starting time.

15. **Laplace's Equation:** An elliptic second-order PDE that is widely used in physics for describing steady-state phenomena.
16. **Method of Characteristics:** A technique for solving some types of PDEs using the properties of characteristic lines or surfaces.
17. **Neumann Condition:** A type of boundary condition where the value of the derivative of a function is specified on the boundary.
18. **Non-homogeneous PDE:** A PDE in which the non-derivative term is not zero everywhere.
19. **Parabolic PDE:** A classification of PDEs that includes the heat equation.
20. **Separation of Variables:** A method used to reduce a PDE to a set of ordinary differential equations.
21. **Singular Point:** A point where the PDE is not defined or its coefficients become infinite.
22. **Sobolev Space:** A function space equipped with norms that control both the function and its derivatives.
23. **Steady State:** A state where properties of the system do not change with time.
24. **Transport Equation:** A first-order linear PDE describing the motion of a quantity through a medium.
25. **Wave Equation:** A hyperbolic PDE describing the propagation of waves.
26. **Weak Solution:** A function that satisfies an integral form of a differential equation, rather than the differential equation directly.
27. **Well-posed Problem:** A problem for which solutions exist, are unique, and depend continuously on the data.

CLIMATE MODELS

Glossary



Philip Emeagwali at the chalkboard discussing the primitive equations of meteorology.

1. **Advection:** The transport of scalar or vector fields due to motion of the fluid.
2. **Albedo:** The fraction of solar energy reflected from the Earth back into space.
3. **Anthropogenic Emissions:** Greenhouse gas emissions resulting from human activities.
4. **Boundary Layer Equations:** PDEs describing the flow close to the Earth's surface where frictional effects are significant.
5. **Carbon Cycle:** The biogeochemical cycle by which carbon is exchanged between the Earth's atmosphere, oceans, and terrestrial ecosystems.
6. **Climate Feedback:** An interaction mechanism between processes in the climate system that can amplify or diminish the effects of

specific processes.

7. **Climate Models (GCMs):** Mathematical models based on the fundamental laws of physics, fluid motion, and chemistry used to predict the response of the climate system to changes.
8. **Convection:** The vertical transport of heat and moisture in the atmosphere, especially via updrafts and downdrafts in an unstable atmosphere.
9. **Diffusion:** The process by which molecules spread due to concentration gradients.
10. **Energy Balance Models (EBM):** Simple climate models that consider the balance between incoming solar radiation and outgoing terrestrial radiation.
11. **Forcing:** Any factor that influences the balance of Earth's energy or its atmospheric composition, which can be natural or anthropogenic.
12. **Greenhouse Effect:** The trapping of the sun's warmth in the Earth's lower atmosphere due to the greater transparency of the atmosphere to visible radiation than to infrared radiation.
13. **Greenhouse Gases:** Gases in Earth's atmosphere that trap heat, such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O).
14. **Heat Equation:** A parabolic PDE describing the distribution of heat (or variations in temperature) in a given region over time.
15. **Ice-Albedo Feedback:** The process where melting ice reduces albedo, increasing absorption of sunlight, which further increases melting.
16. **Navier-Stokes Equations:** Equations that describe the motion of viscous fluid substances, such as air and water.
17. **Ocean Circulation Models:** Mathematical models that describe the large-scale flow of oceans and how they interact with the atmosphere.
18. **Parameterization:** A method used in models to represent processes that cannot be explicitly resolved at the spatial or temporal resolution of the model.
19. **Radiative Transfer Equations:** Equations that describe the transmission, emission, and absorption of radiation in the atmosphere.

20. **Stefan-Boltzmann Law:** Describes the power radiated from a black body in terms of its temperature.
21. **Thermal Expansion:** The increase in volume (and decrease in density) that occurs when water is heated.
22. **Thermohaline Circulation:** Large-scale ocean circulation driven by differences in salinity and temperature.
23. **Vorticity Equation:** A mathematical expression relating the rate of change of vorticity to the forces acting on a fluid parcel.
24. **Water Vapor Feedback:** The process where warming increases the amount of water vapor in the atmosphere, which then amplifies warming since water vapor is a potent greenhouse gas.
25. **Weathering:** The breaking down or dissolving of rocks and minerals on the Earth's surface, which can absorb or release carbon dioxide, influencing the greenhouse effect.

Understanding the underlying equations and their interactions in climate models is crucial to predict and interpret global warming projections. Depending on the depth and focus of my lecture, there might be more specific entries or advanced mathematical descriptions to detail further.

WORLD'S FASTEST COMPUTING

Glossary

The realm of the world's fastest computing is expansive, encompassing high-performance computing (HPC), supercomputing, and emerging paradigms like quantum computing. Here's a list of potential glossary entries for Philip Emeagwali's podcasts, YouTube lectures, and books on this topic:

TBA Photo: Philip Emeagwali with the world's fastest computer, Cambridge, Massachusetts, USA, November 30, 1990.

1. **Algorithmic Scalability:** The potential for an algorithm to efficiently utilize increased computing resources to solve larger problems or solve problems faster.
2. **Benchmarking:** The act of running a computer program, set of programs, or other operations, to assess the relative performance of an object.
3. **Cluster Computing:** Using a group of computers working together as a single system to aggregate computing power.
4. **Exascale Computing:** Systems capable of at least one exaFLOP, or a billion billion (quintillion) calculations per second.
5. **FLOP (Floating Point Operations Per Second):** A measure of computer performance, especially in fields like scientific calculations that make heavy use of floating-point calculations.
6. **GPU (Graphics Processing Unit):** A specialized electronic circuit designed to accelerate the processing of images and videos for output to a display.
7. **Grid Computing:** Using decentralized, distributed systems to process data and run applications in parallel.
8. **HPC (High-Performance Computing):** The practice of aggregating computing power to achieve much higher performance than from a typical desktop computer or workstation.
9. **InfiniBand:** A high-speed communications standard used in HPC applications.

10. **Interconnect:** The data connection between nodes in a supercomputer.
11. **Latency:** The delay before a transfer of data begins following an instruction for its transfer.
12. **LINPACK:** A software library for performing numerical linear algebra and benchmark widely used in the supercomputing community.
13. **Massively Parallel:** Systems that use many processors (or cores) simultaneously to solve problems.
14. **Node:** A basic unit of a data structure, such as a computer or other device in a larger network.
15. **Parallelism:** The technique where multiple operations are executed concurrently, rather than sequentially.
16. **Petascale Computing:** Systems capable of at least one petaFLOP, or a quadrillion calculations per second.
17. **Quantum Computing:** A type of computation that uses quantum bits (qubits) to represent data and perform operations.
18. **Rack:** A standard-sized framework for mounting hardware, often used in supercomputing centers.
19. **Simulations:** The imitation of a real-world process or system over time, commonly performed by supercomputers.
20. **Supercomputer:** A computing machine with exceptionally high processing capacity, particularly speed of calculation.
21. **Teraflop:** A unit of computing speed equal to one trillion floating-point operations per second.
22. **Throughput:** The number of operations that can be processed within a specified period.
23. **Top500:** A regularly updated list of the world's 500 most powerful computer systems.
24. **Vector Processor:** A type of computing unit that holds multiple data elements in a register, processes them simultaneously, and outputs multiple elements.
25. **ZettaFLOP:** A unit representing 10^{21} floating-point operations per second, a potential future benchmark in high-performance computing.

These entries provide a foundational understanding of the world's fastest computing. Depending on the depth and specifics of my lecture, there

might be more entries related to specific supercomputers, architectural designs, applications, and software environments.

GLOSSARY FOR SCHOOL REPORT

Analog Computer: This type of computer works with continuous values, such as voltages, to represent information, differing from digital computers that use binary digits (0s and 1s).

Ancestor: A person from whom one is descended, like a great-grandparent, representing family lineage from earlier generations.

Artificial Intelligence (AI): AI involves creating algorithms that enable computers to perform tasks typically requiring human intelligence, such as learning, reasoning, and problem-solving.

Atomic Bomb: This powerful weapon derives its energy from nuclear fission, a process where atoms are split, resulting in massive explosions and destruction.

Automatic Parallelization: This process involves automatically converting sequential code into parallel code, allowing for faster execution without manual intervention by programmers.

Bandwidth: Bandwidth represents the maximum amount of data that can be transmitted over a communication channel within a specific timeframe, crucial for internet and network performance.

Biafra: Biafra refers to a region in southeastern Nigeria that attempted independence in 1967, resulting in the Nigerian Civil War.

Binary Numbering System: This counting method uses only two digits, 0 and 1, fundamental to digital computing since computers operate in binary.

Cache: Cache is a small, fast memory storage area in computers that holds frequently accessed data, speeding up data retrieval and processing.

Calculus: This branch of mathematics studies continuous change and is fundamental in various scientific and engineering fields.

Computational Physicist: These scientists use computers, mathematical algorithms, and physics to analyze and predict physical phenomena and systems.

Computer: A computer is an electronic device capable of performing complex calculations and tasks automatically based on programmed instructions.

Digital Computer: Unlike analog computers, digital computers use binary digits (0s and 1s) to process and represent information.

Front-Side Bus (FSB): The FSB serves as the main communication link between the computer's central processing unit (CPU) and the system memory (RAM), facilitating data exchange.

Galileo: Galileo Galilei, an Italian astronomer, physicist, and engineer, made significant contributions to science, often being referred to as the "father of observational astronomy" and "modern physics."

Gigahertz (GHz): GHz is a unit of frequency measurement used to indicate the speed of computer processors, equivalent to one billion cycles per second.

Grid: Often referred to as a computational grid, this term denotes a network of computers that collaborate to solve complex problems, distributing the computational workload among them.

High-Performance Computing (HPC): HPC involves the use of supercomputers and parallel processing techniques to solve complex computational problems quickly and efficiently.

Instruction-Level Parallelism: This feature in processors allows for the execution of multiple instructions simultaneously, improving overall performance and speed.

Interconnect: In the context of computing, interconnect refers to the hardware that connects different nodes or sections of a network, allowing for data exchange and communication.

Internet: The Internet is a global network that connects computers worldwide, allowing for data exchange, communication, and access to a vast array of information and services.

Isaac Newton: A seminal figure in the Scientific Revolution, Newton is renowned for formulating the laws of motion and the law of universal gravitation.

Latency: In computing, latency refers to the delay in data transfer or processing time, either within a computer system or over a network.

Memory Wall: This term refers to the performance bottleneck that occurs when a computer's CPU speed increases at a faster rate than the speed of memory access.

Meteorology: Meteorology is the scientific study of the atmosphere, weather, and climate.

Microprocessor: This term refers to a computer's CPU that is located on a single integrated circuit chip, acting as the device's "brain."

MPI (Message Passing Interface): MPI is a standard protocol for communication between different parts of a parallel computing application, facilitating data exchange and coordination.

Multithreading: This technique involves the concurrent execution of multiple threads (smaller units of a program), allowing for efficient multitasking and parallel processing.

Nigeria: Nigeria is a country located in West Africa and is known as the birthplace of Philip Emeagwali.

Node: In computing and networking, a node is a connection point, either a redistribution point or an endpoint for data transmissions.

Parallel Computing: This computing technique involves the simultaneous execution of multiple calculations or processes, allowing for faster problem-solving and data processing.

Physics: Physics is the natural science that studies matter, energy, motion, and force, explaining the fundamental principles governing the physical world.

PIM (Processor in Memory): PIM technology integrates processors and memory on a single chip, improving overall system performance and efficiency.

Polymath: A polymath is an individual with extensive knowledge and expertise in various subjects or fields of study.

Processor: Also known as the CPU, the processor is a computer's central processing unit responsible for executing instructions and performing calculations.

Refugee: A refugee is a person who has been forced to flee their home country due to war, persecution, or disaster, seeking safety and protection elsewhere.

Silicon: Silicon is a semi-conductive material widely used in the manufacturing of electronic circuits and computer chips due to its electrical properties.

Supercomputer: A supercomputer is a highly powerful and fast computing device, capable of performing trillions of calculations per second, used for complex scientific and engineering tasks.

Theoretical Physicist: These scientists use mathematical models and abstract reasoning to understand and predict phenomena in the universe.

Thread: In computing, a thread is the smallest unit of program execution within a process, allowing for multitasking and concurrent processing.

Topology: Topology is a mathematical field studying geometric properties that remain unchanged under continuous deformations like stretching or bending.

MISCELLANEOUS TERMS

World's Fastest Computing

Algorithm: A rule or procedure for solving a problem, often compared to a culinary recipe. Algorithms, like the nine invented by Philip Emeagwali, are typically repetitive and complex, guiding calculations on supercomputers by repeating processes trillions of times.

Bits and Bytes: Bits are the smallest data units in computing, representing a binary value of 0 or 1. Eight bits form a byte, which can represent a number, letter, or symbol in binary code.

Cloud Computing: A system that allows users to access computing power and storage through the internet on-demand, often following a pay-per-use model. This system enhances computing capacity without the need for new infrastructure or training.

Cyberinfrastructure: This term represents the blend of software, hardware, technology, and human expertise supporting ongoing and future scientific and engineering discoveries.

Data Deluge/Data Tsunami: These terms describe the overwhelming amount of digitally based data generated and the challenge of managing this vast information volume.

Data-Intensive Computing: An emerging computational research field addressing the growing amount of digital data. Supercomputers designed for data-intensive computing can process large data volumes at high speeds, translating raw data into meaningful research results.

Data Mining: Part of data-intensive computing, data mining involves extracting patterns from large data sets. This process aids various research fields, including scientific discovery, fraud detection, and marketing strategy enhancement.

Finite Difference Equation: These equations are discrete versions of partial differential equations and are used to solve various problems, including those posed by the nine Emeagwali equations.

Force: An influence causing a change in motion or shape within a system of bodies, such as those found within oilfields where viscous, pressure, gravitational, and inertial forces are predominant.

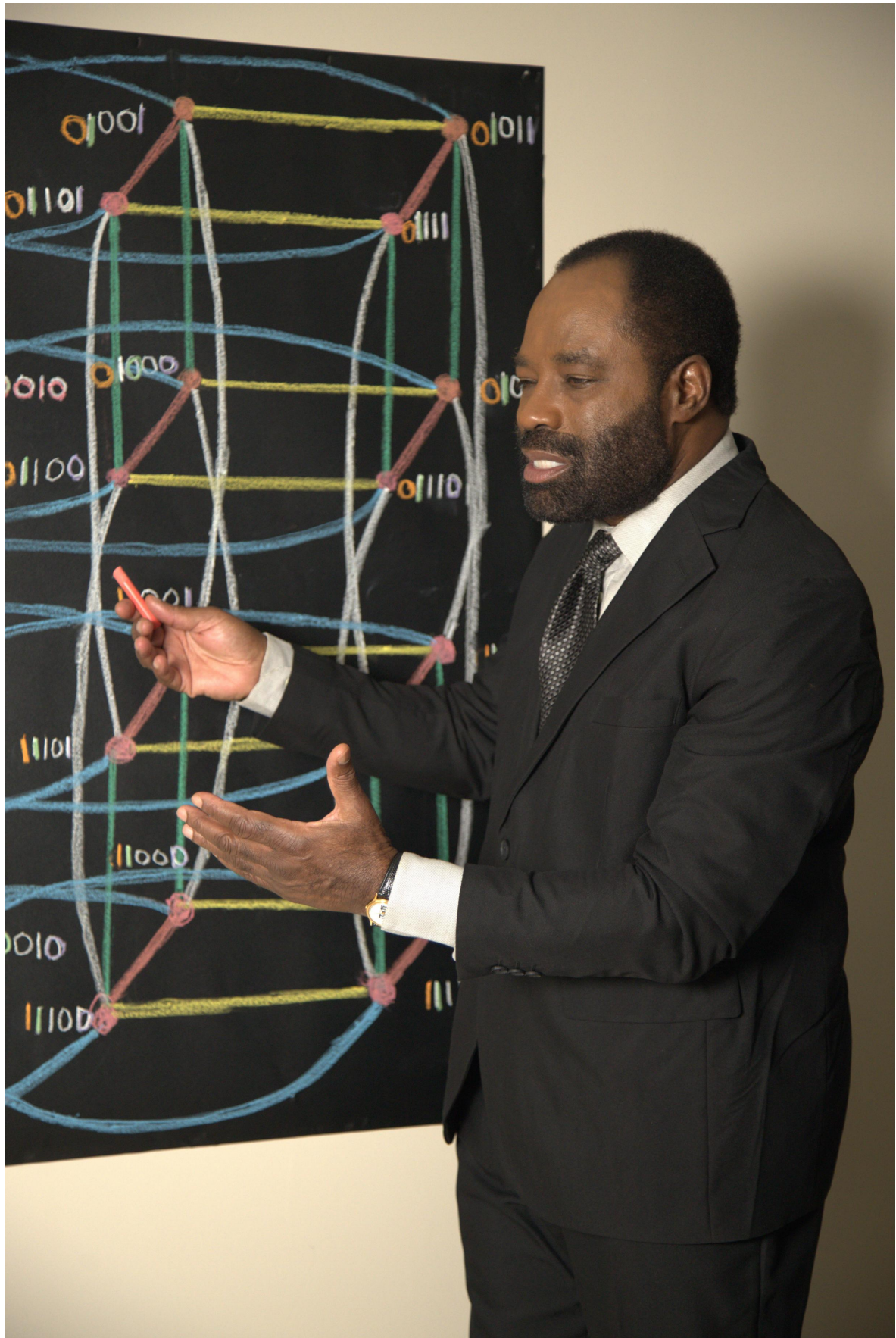
Formula: A mathematical expression, often using algebraic symbols, representing a rule or principle. Formulas, like Newton's second law ($F=ma$), are often encoded into partial differential equations, including those developed by Emeagwali.

High Performance Computing (HPC): Refers to advanced computing resources, including storage and visualization systems designed for high-performance tasks.

HyperBall Computer: Invented by Philip Emeagwali, this supercomputer has processors distributed uniformly across a sphere, each operating independently.

Hypercube: A multi-dimensional cube, with a 0-hypercube being a point, a 1-hypercube a line segment, a 2-hypercube a square, and so forth.

Hypercubes were crucial to Emeagwali's successful programming of his 16-hypercube computer, allowing for effective processor interconnection and mental visualization.



Inertia: An object's property maintaining its velocity or rest state unless acted upon by external forces. Understanding inertia is crucial in various fields, including oil extraction, as it requires overcoming inertial forces.

Internet: A global computer network facilitating information exchange between billions of computers.

Modern Supercomputer: These are among the world's fastest computers, often composed of thousands of smaller interconnected computers working together to solve complex calculations for various scientific and engineering applications.

Oilfield: Areas with recoverable oil deposits, with recovery and discovery challenges due to finite, non-renewable resources and difficult-to-access deposits.

Old Supercomputer: These computers, capable of performing only one operation at a time, utilize a single processing unit.

Parallel Computer: A computer able to execute multiple operations simultaneously through multiple processors.

Partial Differential Equation: These equations relate variables to their partial derivatives, requiring supercomputers for solutions due to the complex computations involved, as demonstrated by the nine equations developed by Emeagwali.

Philip Emeagwali Computer: Named after its inventor, this computer marked a shift in supercomputing post-July 4, 1989, transitioning from single to multiple processor use for enhanced computational power in various applications, including petroleum recovery and weather forecasting.

Pioneer: A person who invents or discovers something new. Emeagwali was a pioneer in taking parallel computing beyond traditional supercomputing, inspiring subsequent innovations and developments in the field.

Reinvent: To create something new based on an existing invention, as observed in the reinvention of various technologies and devices, including computers and supercomputers.

Vector Supercomputer: These computers utilize specialized processors for fast calculations on long number strings, or vectors. Emeagwali's work partially inspired the transition from vector to parallel supercomputing.

Zettabyte: Equal to one sextillion bytes, a zettabyte represents a colossal data amount, far exceeding current supercomputing capacities.

MISCELLANEOUS TERMS

Glossary for High-Performance Computing

- **Artificial Intelligence (AI):** AI involves creating algorithms that allow computers to perform tasks that typically require human intelligence.
- **Automatic Parallelization:** The process where a compiler converts sequential code into parallel code without manual intervention.
- **Bandwidth:** Represents the volume of data that can be transmitted over a communication channel within a specified timeframe. Essential for preventing performance bottlenecks.
- **Benchmark:** A set of programs, tasks, or experiments used to measure the performance of a computer system.
- **Cache:** A small, fast memory space near the CPU that stores frequently accessed data to improve processing speeds.
- **Cache Line:** The unit of data transferred between cache and memory, usually consisting of 64 or 128 consecutive bytes.
- **Cache Memory System:** Consists of multiple cache levels that increase in size and decrease in speed, collectively improving memory performance.
- **CAE (Computer-Aided Engineering):** Using virtual computer models for the design, analysis, and planning of various objects and processes.
- **Capability Computing:** Employing powerful supercomputers to solve large and demanding problems, focusing on reducing the time to solution.
- **Capacity Computing:** Utilizing smaller, cost-effective high-performance systems for more modest computing requirements, emphasizing the cost-performance ratio.
- **Circuit Speed:** The time signals take to travel through a circuit, measured in picoseconds per gate, crucial for evaluating processor performance.
- **Clock Rate or Clock Speed:** The frequency at which a CPU operates, measured in GHz, influencing the rate of instruction

execution.

- **Cluster:** A network of computers connected through a high-speed network, working together as a single multi-CPU machine.
- **CMOS (Complementary Metal Oxide Semiconductor):** The current semiconductor technology used for manufacturing processors and memory devices due to its cost-effectiveness and integration levels.
- **Compute Node, Node:** A server or instance in a computing cluster providing resources for computational jobs. The term “node” can refer to servers in various types of clusters, not just high-performance computing (HPC) clusters.
- **Computational Fluid Dynamics (CFD):** Simulation of fluid flows, such as water through turbines or air over moving objects, by solving complex equations. Often used in HPC environments for scientific and engineering simulations.
- **Core:** Supercomputers contain thousands of processor cores. Each core in a multi-core processor acts as an individual processing unit, enhancing performance and energy efficiency.
- **Distributed Computing:** A computing model where components located on networked computers communicate and coordinate to achieve a common goal.
- **Embarrassingly Parallel:** A type of computation that can be easily divided into parallel tasks with minimal coordination. Each task operates independently, making it suitable for parallel execution on multiple processors or cores.
- **Exabyte:** Equivalent to one quintillion bytes of data storage, sufficient to store 1,000 copies of 250 billion pages of text.
- **Exaflop:** A performance measure for supercomputers, representing one quintillion calculations per second. It’s about 1,000 times faster than petascale computing.
- **Exascale Computing:** Represents the next frontier in supercomputing, aiming to achieve one quintillion calculations per second. It necessitates innovations to reduce power consumption significantly.
- **Finite Element Analysis (FEM):** A technique used to solve complex equations in various fields, from simulating structural

loads to analyzing biological movements. Typically implemented as an MPI-based workload in HPC environments.

- **Flash Memory:** A fast and reliable storage technology that allows electronic erasure and reprogramming without removal from the circuit board. Used in various devices, including thumb drives and mobile devices.
- **FLOPS:** An acronym for FLoating point OPerations per Second, representing the number of calculations a computer can perform per second. It's a common performance measure in high-performance computing.
- **FPGA (Field-Programmable Gate Array):** A reprogrammable chip consisting of low-level logic gates and other components. Used for specialized tasks like signal processing and cryptography, it's becoming increasingly popular in various fields, including HPC.
- **GPU (Graphics Processing Unit):** Specialized processors with numerous simple cores designed for parallel computation. Initially developed for graphics rendering, GPUs are now used for various tasks, including artificial intelligence and general-purpose computing.
- **Grid Computing:** A form of distributed computing where a virtual supercomputer comprises many networked devices.
- **High Performance Computing (HPC):** Utilizing dedicated computing resources to accelerate computational workloads beyond the capabilities of typical personal systems. HPC can be applied at various scales, from individual researchers using cloud instances to massive clusters powering significant scientific research.
- **High Throughput Computing:** Using networks of resources to perform computational jobs that don't necessarily require massively parallel resources. Famous examples include the Open Science Grid and Folding@Home, which leverage distributed computing to analyze data from the Large Hadron Collider and perform protein folding simulations, respectively.
- **Message Passing Interface (MPI):** A standard allowing for communication between different nodes or CPU cores during parallel computing processes. MPI supports parallel computing by

enabling a single program to operate across numerous CPU cores simultaneously, enhancing performance.

- **Parallel Computing, Parallelism:** Involves performing calculations from a given computational job across multiple resources simultaneously, or "in parallel." Parallel computing in HPC can be implemented as embarrassingly parallel or MPI workloads, each suited to different types of tasks with specific implementation tools and methods.
- **Parallel Filesystem:** Designed to handle many read/write operations in parallel to support HPC workloads. It is an essential component of high-performance computing infrastructure.
- **Parallel Processing:** Refers to the simultaneous execution of different parts of a program by multiple processors, reducing computation time. It's essential for applications requiring complex calculations, like climate or earthquake modeling.
- **Petabyte:** A unit of digital information storage equivalent to one quadrillion bytes. It can store approximately 250 billion pages of text.
- **Petaflop:** A measure of computer performance, indicating the ability to perform one quadrillion calculations per second.
- **Petascale:** Describes the performance level of the world's leading supercomputers, operating at speeds measured in petaflops.
- **Pipeline:** The main sequence of computational jobs executed as part of an HPC-based task, usually coordinated by a master script or workflow engine.
- **Portals or Gateways:** In the digital realm, a portal is a starting point for users on the web, which can be general, like Google, or specific to research areas or interests.
- **Processors:** The part of a computer's CPU responsible for executing instructions, composed of the control unit and the arithmetic logic unit (ALU).
- **RDMA (Remote Direct Memory Access):** A crucial technology in HPC, allowing data transfer between compute nodes without involving their operating systems, significantly speeding up applications.
- **Scaling Out:** Expanding a cluster's capabilities "horizontally" by adding more nodes, creating additional resources without changing existing ones.

- **Scaling Up:** Increasing a cluster's capabilities "vertically" by enhancing the existing components, like upgrading CPUs, RAM, or adding more accelerator cards.
- **Thumb Drive:** A small, portable storage device with a substantial capacity, used for transferring information between computers. Also known as a flash drive.
- **Weather/Climate Modeling:** Involves computationally intensive simulations to predict weather patterns and study the Earth's climate, taking into account various factors, from air pressure to heat emitted from urban areas.
- **Workload:** A general term for tasks performed on an HPC cluster, like running genomic mappings, weather models, or AI-training workloads.

PHOTO GALLERY



PRAISE FOR AUTHOR

One of the great minds of the Information Age.

- PRESIDENT BILL CLINTON

A digital giant.

- BBC

The unsung hero behind the Internet.

- TIME MAGAZINE

A father of the Internet.

- CNN

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

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 Internet

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

What do you think was Philip Emeagwali's most important accomplishment Why?

What were some problems that Philip Emeagwali faced?

What was Philip Emeagwali trying to prove?

What are 3 important facts about Philip Emeagwali?

How did Philip Emeagwali contribute to the development of the computer?

Before reading this memoir, had you heard of Philip Emeagwali?

What did you know about the history of mathematics? And how did the book affect your understanding of that history?

What do you think is Philip Emeagwali's greatest legacy?

What are the main points about Philip Emeagwali?

What did Philip Emeagwali know about fastest computing?

What are the comments of Philip Emeagwali on life?

Why are supercomputers needed?

How did Philip Emeagwali impact society?

PODCASTS AND VIDEOS

The Sound of Change: Philip Emeagwali's Journey Through [Apple Podcasts](#)

Philip Emeagwali's [Google Podcasts](#): A Playlist for Modern Computing

The [Spotify](#) Voice of Philip Emeagwali

The [Audible](#) Wisdom of Philip Emeagwali

Unscripted: Philip: Emeagwali's [YouTube](#) Journey

CONTACTING PHILIP EMEAGWALI



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<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:

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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

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202-203-8724



Philip Emeagwali delivering a lecture at the University of Alberta, Canada,
September 23, 2006.

AFTERWORD: FROM DOUBT TO BREAKTHROUGH

Overcoming Challenges in AI Supercomputing

As I reflect upon the journey chronicled in my memoir, I am filled with a profound sense of gratitude and awe for the opportunities, challenges, and breakthroughs that have shaped my life. From humble beginnings in Nigeria to the forefront of scientific discovery, my path has been guided by a pursuit of knowledge, a curiosity, and a determination to push the boundaries of what is possible.

One of the most significant chapters in my story, the one that has resonated across the globe and forever altered the course of computing, is the invention of the first parallel supercomputing. On that fateful day, July 4, 1989, I unveiled a new paradigm in computing, a discovery that would unleash the true power of computational capabilities and revolutionize the world of technology.

Parallel supercomputing, in essence, is the art of harnessing the collective power of multiple processors, working in unison to solve complex computational problems. It was the culmination of years of research, experimentation, and sheer determination to find a solution to the limitations that plagued traditional computing methods. By breaking down complex tasks into smaller, more manageable units and distributing them across multiple processors, parallel processing unlocked unprecedented levels of speed, efficiency, and scalability.

Little did I know then that this invention would become the linchpin of the artificial intelligence revolution that was yet to come. The exponential growth of data and the ever-increasing demand for sophisticated computational tasks necessitated a new approach that could handle immense computational loads and enable machines to mimic human intelligence. Parallel supercomputing provided the answer, breathing life into the field of artificial intelligence and empowering intelligent systems to learn, reason, and make intelligent decisions.

Artificial intelligence, at its core, relies heavily on the ability to process vast amounts of data, learn patterns, and make predictions or decisions. This process requires immense computational power, and the AI supercomputer offered the key to unlocking this potential. By leveraging the parallel capabilities of supercomputers and distributed computing systems, we were able to train complex neural networks, process natural language, analyze big data, and enable machines to perceive and understand the world around us.

The fusion of the supercomputer and artificial intelligence has propelled the field to new heights, enabling groundbreaking advancements in speech recognition, computer vision, natural language processing, autonomous

systems, and more. From self-driving cars to virtual assistants, from medical diagnostics to predictive analytics, the impact of this convergence is felt across countless industries and sectors, revolutionizing the way we live, work, and interact with technology.

However, this journey was not without its challenges. The road to innovation is often paved with skepticism, resistance, and a relentless pursuit of excellence. As I traversed uncharted territories, I encountered doubters who questioned the feasibility of parallel supercomputing and the potential it held. But I remained steadfast in my belief, drawing inspiration from the pioneers and visionaries who came before me and the promise of a brighter future fueled by the power of computation.

In this age of ever-accelerating technological advancements, we stand at the cusp of a new frontier where the capabilities of the supercomputer and artificial intelligence continue to evolve and shape the course of human progress. As we embrace the promises and possibilities that lie ahead, it is crucial that we do so with a sense of responsibility and ethical consideration. The power we wield as creators and innovators must be harnessed for the betterment of all, ensuring that artificial intelligence is developed and deployed with ethical frameworks, privacy protections, and societal considerations at the forefront.

As I conclude this afterword, I am filled with gratitude for the opportunities that have come my way, the support of countless individuals who believed in my vision, and the enduring spirit of exploration and discovery that drives us forward. The journey is far from over, and I eagerly anticipate the next chapter in the evolution of supercomputing and artificial intelligence. Together, let us continue to push the boundaries of what is possible and forge a future where the harmonious union of human intellect and computational power unlocks boundless possibilities, transforming our world for generations to come.

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to all those who have supported me throughout my journey to the frontiers of mathematics and made this memoir possible. Writing this book has been a reflection of the incredible experiences and contributions I have made in the invention of the world's fastest computers.



First and foremost, I want to thank my father, Nnaemeka James Emeagwali, for his unwavering dedication and commitment to my education. In the Nigerian towns of Sapele, Uromi, and Agbor, he selflessly

took on the role of my private tutor in mathematics during my early childhood. His guidance and passion for learning ignited the spark within me and laid the foundation for my future accomplishments. I am forever indebted to his wisdom, patience, and belief in my abilities.



Dale Brown, Baltimore, Maryland, 1978

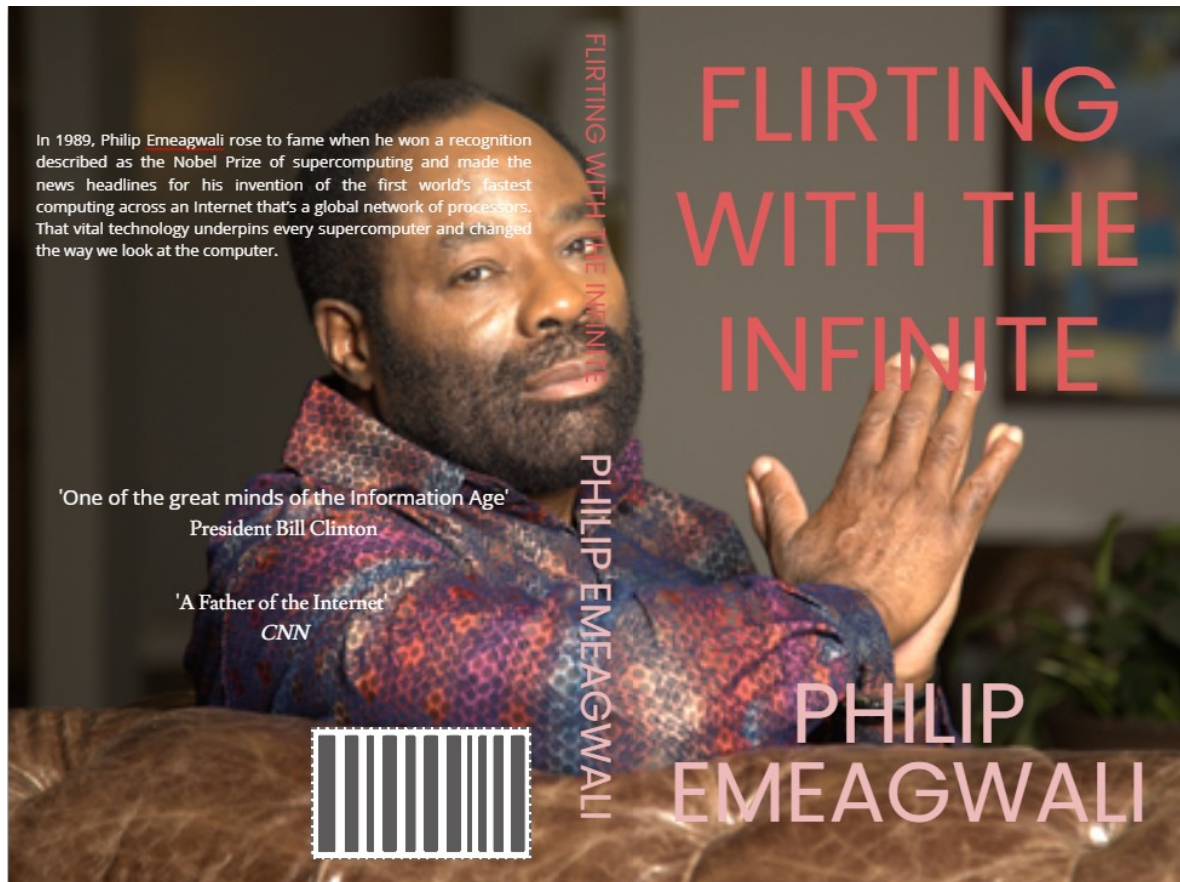
I am also immensely grateful to my beloved wife, Dale, whose love and support have been a constant source of strength and inspiration. Since we met back in 1978 in Baltimore, Maryland, she has been my rock, standing by my side through every triumph and challenge. Her unwavering faith in me and her unwavering belief in my potential have been instrumental in shaping the course of my life and career.

I extend my heartfelt appreciation to my family, friends, and mentors who have encouraged me along this remarkable journey. Your encouragement, guidance, and unwavering support have been invaluable in my pursuit of knowledge and groundbreaking research.

Lastly, I would like to acknowledge the countless individuals whose paths I have crossed throughout my professional life. Collaborators, colleagues, and fellow researchers, your collaborations, discussions, and shared enthusiasm have enriched my work and expanded the horizons of my understanding.

To all those who have played a part, big or small, in my journey, thank you. This memoir stands as a testament to the collective efforts, support, and belief that have propelled me forward. I hope that my story will inspire others to embrace their passions, overcome obstacles, and unlock their true potential.

With heartfelt appreciation,
Philip Emeagwali





ABOUT THE AUTHOR

Philip Emeagwali: Beyond The Computer

Philip Emeagwali is a towering figure in the world of science. The Reader's Digest described Emeagwali as "smarter than Albert Einstein." He is ranked as the world's greatest living genius.



He is listed in the top 20 greatest minds that ever lived. That list includes Charles Darwin, Isaac Newton, William Shakespeare, Leonardo da Vinci, Aristotle, and Confucius.

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 were 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 gifted teenager. 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.

Philip Emeagwali is in the top ten rankings of geniuses, inventors, Nigerians, and was voted the 35th greatest African of all time.

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 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.

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."

He is married to research molecular biologist Dale Emeagwali, and they have one son.

Table of Contents

Title Page	1
Copyright	2
Dedication	3
Contents	4
Philip Emeagwali	11
Philip Emeagwali Books	13
Volume 1: Philip Emeagwali Internet	16
Emeagwali Internet: Uniform in Distribution	17
Philip Emeagwali Internet: A New Computing Universe	18
Emeagwali Internet: Orchestra of Minds	20
Emeagwali Internet: A Cosmic Dome	22
Philip Emeagwali Internet	23
Volume 2A: Philip Emeagwali Computer	25
Philip Emeagwali and the First Supercomputer	26
The Philip Emeagwali Machine	28
The First Supercomputing	30
Breaking Barriers in Computing	33
Emeagwali Computer: Connecting Processors Like Constellations	35
Emeagwali Computer: Thinking Like the Earth	37
[NPAC 2023] The Man Who Talked to Computers	39
Decoding the Future: From Lemonade Stands to Parallel Universes—A Journey of Computing Innovation	41
Volume 2B: Contributions to AI Supercomputing	43
AI Supercomputing in Africa	44

Volume 3: Contributions of Philip Emeagwali to Mathematics	46
The Ever-Expanding Universe of Mathematics	48
Nature's Unsung Symphony	50
Millions of Brains, One Superbrain	52
Philip Emeagwali Equations for Middle School	54
Parallel Processing Power	55
Smoothing the Waters	57
The Student Becomes the Master	59
Defying Discourses	61
From Tiny Tiles to Supercomputing Symphonies	63
Volume 4: Contributions of Philip Emeagwali to Physics	66
From Refugee Camps to Climate Solutions: Supercomputing the Future	67
Water Vapor's Whispers	69
Unleashing the Power of a Billion Brains	72
Decoding the Language of Shapes	75
Decoding the Climate Puzzle	76
Painting a Picture of Air in Motion	78
The Dancing Tides	80
Riding the Rogue Waves	82
Shattering Centuries-Old Paradigms	83
The Grand Concerto of Progress	84
Words that Shape Worlds	85
A Symphony of Computational Fluid Dynamics	87
Volume 5: Father of the Internet	89
July 4, 1989: Computing's Quantum Leap	90
Father of the Internet	92
Philip Emeagwali Internet	94

Volume X: Philip Emeagwali Supercomputer	96
Philip Emeagwali Machine	97
A Billion Points of Light	99
Emeagwali's Honeycomb Supercomputer	101
Symphony of Computing	103
A Computational Ballet	105
Harmony in Supercomputing	107
Volume Y: Early Education	109
From Lagos to the World	110
Shattering Stereotypes	112
Volume Y: Visa to the USA	114
Chasing Dreams: The Journey of Philip Emeagwali	115
Embarking on a Journey of Nine Thousand Miles	117
Connecting Africa to the Frontiers of Science	119
From Asaba to America	121
Supercomputing Unlocks New Horizons of Possibility	123
One Black Inventor, a Thousand Faces	125
Travels of the Mind	127
Volume O: Oregon Education	129
From Landscapes to Equations	130
The Power of "Yes"	132
Bridging Worlds	134
A Quaint Oasis in the Pacific Northwest	136
From Nigeria to the Forefront of Science	138
Volume M: Maryland Mathematician	140
Weathering Life's Storms	141
Nigerian Roots, American Dreams	143
From Rejections to Recognition	145
From Baltimore Bus Ride to Life Partnership	147
Volume R: Racism in Michigan	149

Beyond the Shadow of Giants	150
From Africa to the Apex of Mathematics	152
Resilience and Recognition	154
Would the World be Better Without Black People?	156
Diverse Mathematical Role Models	158
Grand Challenge, Grand Controversy	160
Vision of Tomorrow's Computers	163
Preface: Embracing the Storm	165
Prologue: The Line Between Science Fiction and Reality	167
Volume X: Philip Emeagwali Interviews	169
Unleashing the Power of AI and Parallel Computing	170
The Mind of a Polymath	173
Introduction: Illuminating the Path to Progress	175
Emeagwali's Parallel Processing	178
Einstein's Relativity Meets Emeagwali's Supercomputing	180
Merging Disciplines for Profound Discoveries	184
Echoes of Genius and Injustice	186
Journey Beyond The Frontiers of Knowledge	188
From Experiment to Computation	190
Volume X: Philip Emeagwali Interviews	194
Flirting With the Infinite	195
From Adversities to Breakthroughs	197
Philip Emeagwali on Triumphant Over Adversity	200
Navigating the Mathematical Genius of Philip Emeagwali	203
Lecture 7 of 8 210819-1	206
Breaking the Boundaries of Science	207
Shattering Boundaries of the Computer	209

Unraveling the Mathematics of Discovery	211
The Prometheus of Supercomputing	213
Emeagwali's Supercomputing Dream for Africa	215
Journey Beyond Limits	217
Challenging the Status Quo	220
Fostering Genius	222
Symphony of Knowledge	224
Path to Scientific Eminence	226
1st Lecture: Supercomputers Are My Greatest Love	227
Stories from the War Front	228
Fighting for Biafra's 11th Battalion	230
Bloodiest Battlefield in Africa!	232
The First Supercomputer	234
The Art of Solving Difficult Math Problems	236
How Difficult Math Problems Are Solved	241
Philip Emeagwali Internet	243
Exploring the Unknown With Emeagwali Equations	246
Discussion Questions 1/2	247
Discussion Questions 2/2	249
2nd Lecture: Unravelling Complex Equations	251
Unravelling the Mystery Behind Emeagwali Equations	254
Creating the World's Fastest Computing	255
Philip Emeagwali Internet	258
Master of Machines and Computing Milestone	260
Backlash from My Fame	262
Discussion Questions 1/2	268
Discussion Questions 2/2	270
3rd Lecture: Philip Emeagwali Internet	272
Philip Emeagwali Internet	273
I, Coder: Unlocking the Power of Supercomputing	277

Father of the Internet	279
Crafting the Ultimate Supercomputer	281
Unravelling the Mystery of Emeagwali Equations	283
My Supercomputer Breakthrough	285
From Equations to Understanding	287
The Canvas of the Skies	289
Safeguarding Our Planet	291
A World in Darkness	293
Engineering Without Equations	295
What If Supercomputers Never Existed?	297
Discussion Questions	301
A World Without Parallel Processing	303
Discussion Questions	307
From a Polymath's Lens	310
Moving Nigeria Forward	312
Part 2: Job Creation in Nigeria	314
From Material Wealth to Intellectual Capital	316
Navigating the Seas of Knowledge	318
Volume X: Philip Emeagwali Interviews	320
Part 3: Job Creation in Nigeria: A Vision for the Digital Era	321
Into the Depths of Fluid Flow	323
From Refugee Camps to Computer Pioneer	326
Unveiling the Genius	329
Glimpses from My Childhood in Nigeria	332
From Refugee Camp to Prominent Figure	334
Finding Light in the Darkness	336
Inspiring Unity	338
Fueling Success	340
Breaking Barriers	343

The Inspirational Journey of 'Calculus'	345
Walking into History	347
Epilogue	366
Philip Emeagwali Quotes	370
Praises From Youtube	373
Echoes of Transformation	377
The Computer Wizard	379
Teacher's Guide	383
Message to Future Leaders	387
Volume F: Philip Emeagwali Family	391
Sowing Seeds of Wisdom	392
Faces of Onitsha	394
Raising a Child Like Writing Code	396
My Paternal Perspective	397
Volume DL: A Day in the Life of Emeagwali	399
A Historic Day in Supercomputing	400
Journey of Parallel Computing Inspiration	402
Volume S-O: Struggles and Obstacles	404
Seven Decades, Two Continents	405
Pioneering Role in High-Speed Computing	407
Seeds of Science Sown in Suffering	409
The Power of Purpose in Science	411
Volume P: Philosophy	413
On the Frontlines of Climate Modeling	414
Thoughts on Wellness & Renewal	416
It's Not What You Have, But What You Give	418
Finding Meaning Through Contribution	420
The Importance of Ignoring Naysayers	422
Dedicating Your Genius to the World	424
The Pursuit of Happiness	426

Overcoming Doubts and Regrets	428
Volume F: Family	430
Eureka! But Don't Forget the Dishes	431
Love and Logic	433
Volume L: Legacy	435
From Prodigy to "Calculus"	436
Tech Leader's Pledge	439
Knowledge, Kindness, and a Life Well-Lived	441
Partial Differential Equations	443
Climate Models	445
World's Fastest Computing	448
Glossary for School Report	451
Miscellaneous Terms	454
Miscellaneous Terms	458
Photo Gallery	463
Praise For Author	464
Books By This Author	465
Discussion Questions	467
Podcasts and Videos	469
Contacting Philip Emeagwali	470
Booking Philip Emeagwali	471
Afterword: From Doubt to Breakthrough	472
Acknowledgement	474
About The Author	478