REACHING INFINITY

The Genius from a Distant Land

Philip Emeagwali

emeagwali.com

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

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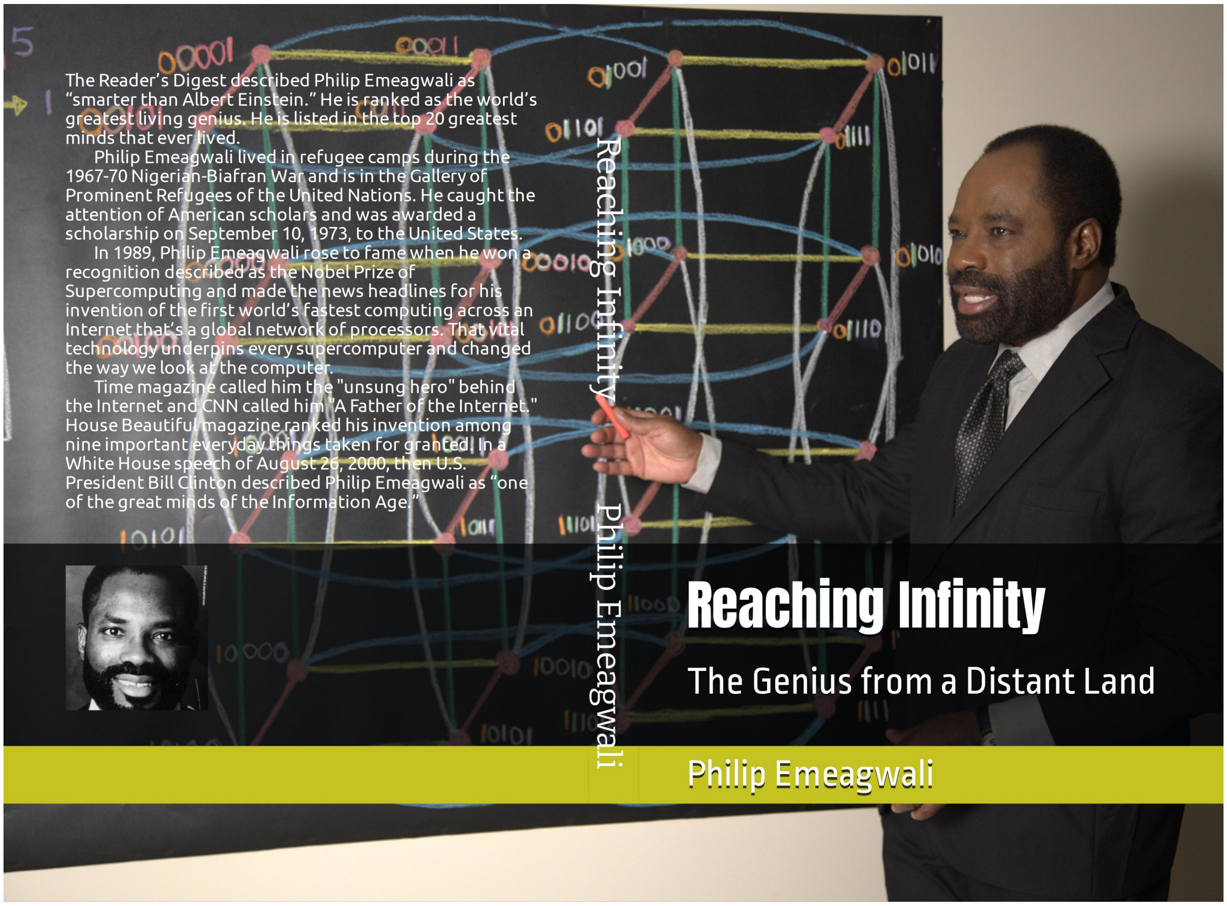
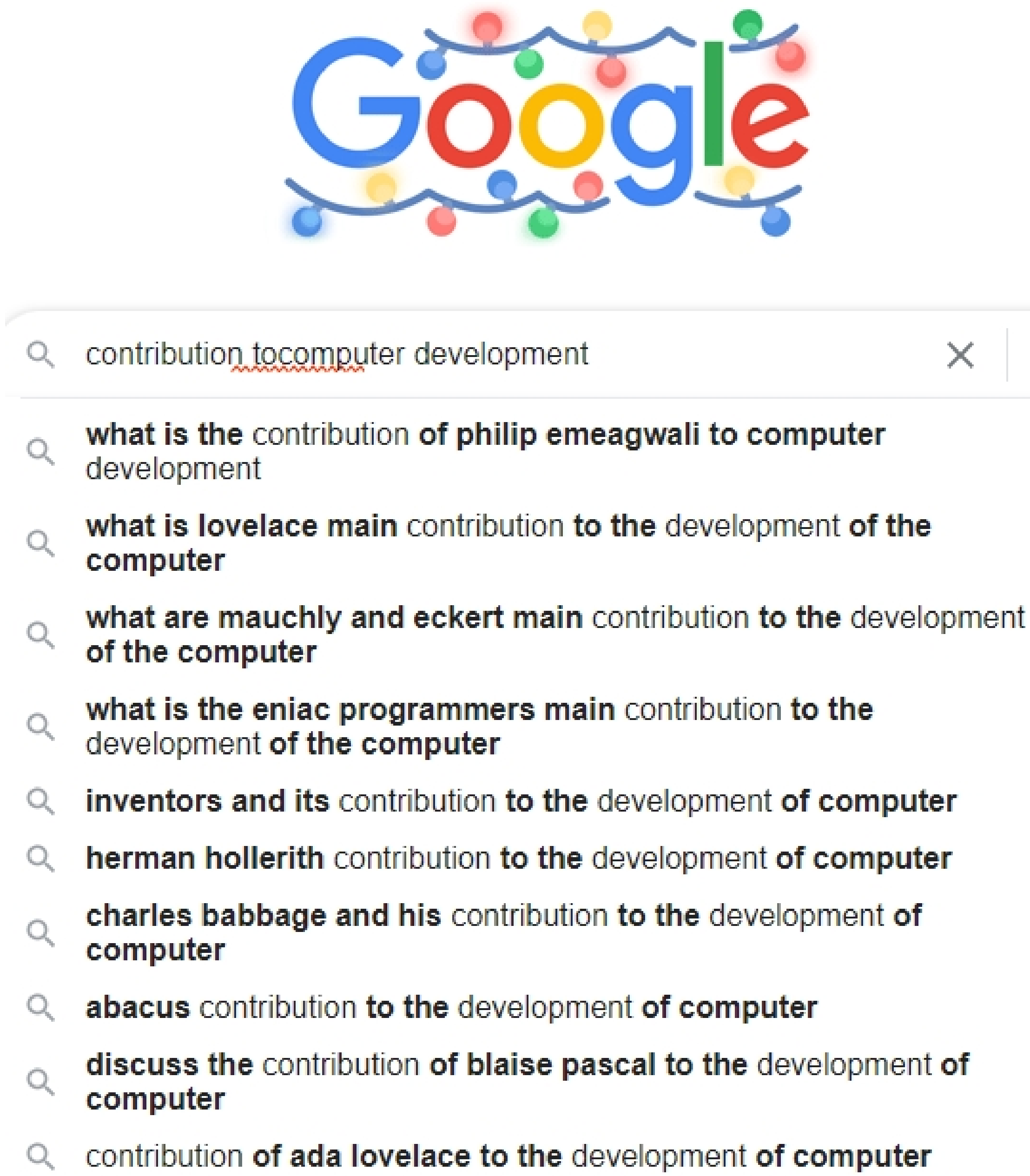


1ST LECTURE:

COMPUTING AT THE SPEED OF LIGHT



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

Broadcast 26 September 2021

https://youtu.be/is7HQ5-dNhw

BREAKING

COMPUTING'S SPEED LIMIT

My contributions to computer science that made the news headlines, in 1989, were these: I discovered how to record the fastest computer speeds and how to do so by computing across an ensemble of the slowest processors in the world. I discovered how to leapfrog from slowest processors to fastest supercomputers. The fastest supercomputer in the world is the heavyweight champion of the computer world.

Beyond the fastest supercomputer is an unknown field of knowledge, or a place, where **chaos** begs to be replaced with **order, darkness** by **light**, ugliness by beauty, and ignorance by knowledge.

I discovered how to leapfrog from the slowest processors to the fastest computers, solving problems at the speed limit. I discovered how to solve the most compute-intensive problems in mathematics and science. And solve them with the slowest processors. I discovered how to make the most with the least.

The Eureka moment, or high point, of my parallel supercomputer quest for the fastest computer in the world occurred at fifteen minutes after eight in the morning of July 4, 1989, in Los Alamos, New Mexico, USA. And it occurred within my ensemble of the slowest 65,536 processors. In 1989, I was in the news for providing the "final proof" that supercomputing across millions of processors is not science fiction.

In theory, mathematical predictions that were governed by a system of partial **differential** equations that encoded some laws of physics should be as reliable as a hammer. But, in practice, it's a different story. The fastest computer in the world shortens the gap between theory and practice. In a world without the fastest computers, the solutions of the most compute-intensive mathematical problems—such as the simulation of long-term climate change—will be as approximate as a sketch instead of as exact as a photograph. The implication of my discovery of the first world's fastest computing executed across the world's slowest processors was far-reaching.

My invention made the news headlines because the world's fastest computer is an enabling technology that enables us to discover new knowledge and unknown materials and create never-before-seen products.

My contribution to computer science **is this**: I was in the news because I was the first person to use the slowest processors to discover the fastest computing and solve the most compute-intensive problems.

Before the First Supercomputer

To invent is to create something from nothing, or make the fictional factual. The discovery is a time machine that takes us to the past to see a thing that preexisted but remained unseen. The invention enables us to create our future. Genius is the ability to see what others saw as a rock and see it as a diamond.

I achieved a milestone in the history of the computer. On July 4, 1989, the supercomputing community marked my milestone as the first time the world's fastest computer speed was recorded **across** the world's slowest processors.

In supercomputing, the perennial question was how to discover the fastest speeds and use them to make the **impossible-to-solve** mathematical problems possible-to-solve. Before my discovery of the world's fastest computer, which occurred on July 4, 1989, how to solve the most compute-intensive mathematical problems wasn't known to any mathematician, wasn't taught in any mathematics course, and wasn't written in any mathematics textbook.

Quest for the First Supercomputer

Since 1974, my research quest was to discover how to harness the slowest processors. And how to use them to solve the most compute-intensive problems at the fastest computer speed.

In the 1970s and 80s, my theory of how to build the world's fastest computer and do so with standard parts, such as the world's slowest processors, was mocked, ridiculed, and dismissed as a beautiful theory that lacked experimental confirmation. The supercomputer was a technology that meandered **across** physics, mathematics, and computer science. And in the 1970s and 80s, supercomputing across processors was the beautiful thread that didn't fit into the larger weave, namely, the world's fastest computer that now occupies the space of a soccer stadium. And it costs forty percent more than the mile-long Second Niger Bridge in Nigeria.

Parallel Processing and the First Supercomputer

I'm well-known, but not known well. It's not known well that I discovered the world's fastest computer and did so across the world's slowest processors. My discovery was the origin of the first supercomputer, as we know the technology today.

On the Fourth of July 1989, I saw something that's a new supercomputer that nobody had seen before. Specifically, I saw how the slowest processors in the world could be utilized to solve the most compute-intensive problems in the world. And, most importantly, solve them at the fastest computer speeds. I discovered the fastest computing and explained the technology to a twelve-year-old writing a school essay on inventors as "solving up to a billion mathematical problems **at once** and **across** as many processors."

In 1989, I was in the news because I solved a tough mathematical problem that was then considered impossible to solve. Furthermore, I solved 65,536 mathematical problems, **at once** and **across** as many processors that worked together as one coherent supercomputer. Likewise, I discovered how to solve the most compute-intensive problems at the frontiers of knowledge in mathematics, physics, and computer science. Not only that, I made the first direct measurement of the fastest computation ever recorded **across** an ensemble of the slowest processors in the world.

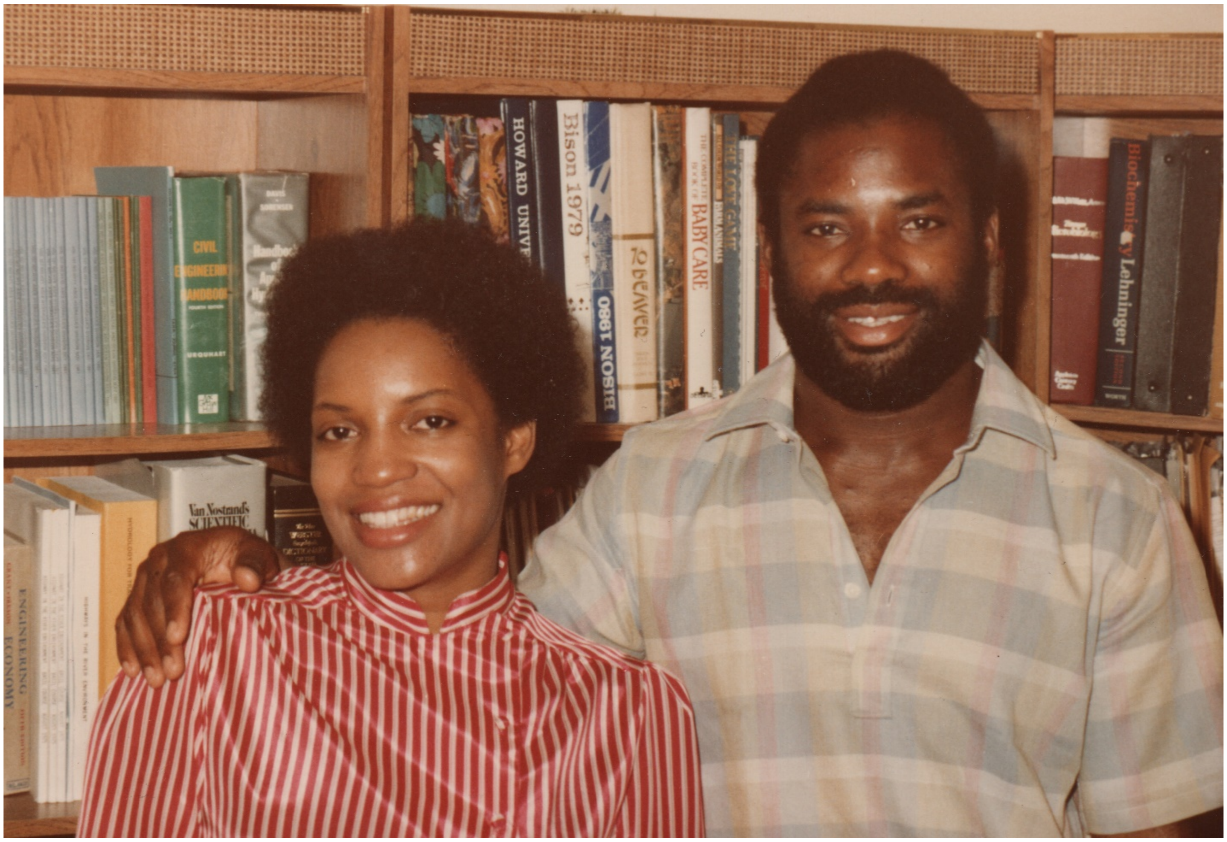
The First Supercomputing from Slowest Processing

After my invention, the fastest computers in the world are supercomputing **across** thousands or millions of processors. That radical shift, from one processor to one million processors, is the most significant fundamental change in the history of computer science.

I began supercomputing on a machinery that I visualized as a processor. I began programming the fastest computers on June 20, 1974, in Corvallis, Oregon, USA. In 1974, the prevailing dogma was that recording the world's fastest speed in computing and doing so across the world's slowest processors will forever remain in the realm of science fiction. And it remains a colossal waste of time.

In 1989, I was in the news because I proved that supercomputer scientists, who believed in serial computing, were wrong. I did so by discovering how to solve the most compute-intensive problems in physics. And how to solve them so that a **time-to-solution** of thirty thousand years will be reduced to a **time-to-solution** of one day.

My discovery is a new way of looking at the supercomputer. That discovery marked the date of birth of the first supercomputer, as it's known today and as it's expected to be known tomorrow. Processing across the slowest processors is the lodestar technology that makes the computer **faster** and makes the supercomputer **fastest**.



Dale and Philip Emeagwali, Spring, Maryland, about January 1983

Solving the Unknown

The partial **differential** equation is the mathematician's steppingstone that enable the physicist to answer otherwise unanswerable questions. The global climate model that was used to foresee climate change derived its answers from the laws of physics that were embodied into the governing partial **differential** equations at the frontier of calculus. The Second Law of Motion of physics breathes fire into the trillions upon trillions of my interlocking partial **difference** equations of computational linear algebra. And did so to set millions of processors on fire. And to add a new meaning to the ancient Pythagorean belief that nature was numbers.

EXPLORING NEW POSSIBILITIES FOR CALCULUS

My inventions opened the door to how to solve compute-intensive problems. And solve them across an ensemble of millions of processors. And solve them when the governing system of equations of algebra has its nonzero entries only along its diagonal.

I **invented** how to solve many of the most compute-intensive problems arising in engineering and medicine. And solve them in parallel. And invented how to solve them **across** an ensemble of 65,536 self-contained, coupled processors.

The 65,536 simultaneously sent and synchronously received emails fired from as many processors as bullets out of my eyes that were coming from two-**raised**-to-power sixteen processors in a sixteen-dimensional hyperspace.

Extending the Boundaries of Mathematics

My contributions to mathematics **were these**: I changed the way we solve compute-intensive mathematical problems. In their old way, they solved such problems with only one **isolated** processor that wasn't a member of an ensemble of processors. Or, conversely, within only one **isolated** computer that wasn't a member of an ensemble of computers. In my new way, we solved compute-intensive problems **across** millions of processors, or **across** millions of computers.

Solving Compute-Intensive Physics Problems on the First Supercomputer

My contributions to the science and technology that are used to discover and recover crude oil and natural gas **were these**: I discovered how to harness the millions of processors that powers the world's fastest computers. And how to use them as one coherent machinery that emulates a super-fast processor that's one million times faster than a single processor solving the same mathematical problem alone.

One of the most difficult problems in physics was to accurately compute the flows of crude oil and natural gas flowing from water injection wells to nearby producing wells. By making the news headlines, in 1989, my **invention** changed the way we execute mathematical calculations in the largest-scale computational physics. And it changed how mathematicians solve the most compute-intensive and mathematical problems, such as those arising in fluid dynamics. And it changed how mathematicians solve them in parallel, or in tandem. And solve them by distributing them **across** an ensemble of coupled processors, instead of solving them in sequence. Or solving them only within one **isolated** processor that was not a member of an ensemble of processors.

Solving the Most Important Problems in Physics

An example of a most vexing problem in physics is to **foresee** previously **unforeseeable** global warming. General circulation modeling is one of the most challenging problems in computational physics. Fluid dynamics across the Earth's subsurface gives rise to one of the most compute-intensive problems that often arise in algebra, such as the high-fidelity petroleum reservoir simulators that must be used to **recover** otherwise **unrecoverable** crude oil and natural gas.

The reservoir simulation of the subterranean motions of oil and gas is one of the hardest mathematical problems. In Nigeria, the toughest, or the most compute-intensive physics problems, arise as trillions of equations of algebra that must be solved as a precondition to recovering crude oil and natural gas from the Niger Delta oil fields.

In physics, the so-called “grand challenge” is defined as the field’s most compute-intensive and most important problem. That compute-intensive problem is the accurate solution of an initial-boundary value problem that’s governed by a system of coupled, nonlinear, time-dependent, and three-dimensional partial **differential** equations. The latter equations encode some laws of physics that include the Second Law of Motion. These laws are defined in physics textbooks and govern the motions of the oceans and atmospheres that enshroud the Earth.

This system of partial **differential** equations is used to forecast the changes in oceanic and atmospheric motions. And forecast the changes in temperatures that define the global warming of the air and moisture within the Earth’s atmosphere and the sea level rise in the oceans.

Analogous partial **differential** equations are also used to hindcast, or re-forecast, the changes in the motions of crude oil, injected water, and natural gas that were flowing inside a producing oil field that’s the size of Lagos, a city of twenty million Nigerians. The typical oil field is a porous medium that’s on the average 6,000 feet (or 1.83 kilometers) deep.

Calculus is the most powerful technique in mathematics and physics. Calculus was discovered 330 years ago. But it was discovered as a textbook problem that’s posed and solved for mathematics classes and on the blackboard. The body of knowledge of calculus grew over three centuries and three decades, with the first partial **differential** equation invented in 1746. However, the phrase "partial **differential** equation" was first used in 1845, and a century after it was invented. That body of mathematical knowledge grew over the years to become the backbone of computational physics.

The partial **differential** equation is the most recurring decimal in the most compute-intensive problems. Such grand challenge problems are solved **across** the up to one billion processors that outline and define the world's fastest computer that now occupies the space of a soccer field.

Unlike the ordinary **differential** equation that's defined by its single variable functions and their derivatives, the partial **differential** equation is defined by its unknown multivariable functions and their partial derivatives.

My contributions to the partial **differential** equation beyond the frontier of calculus **were these**: In the early 1980s and while in College Park, Maryland, I invented 36 partial derivatives of unknown multivariable functions. Computational geophysical fluid dynamics engineers could use my contributions to mathematics to more accurately forecast the changes in the motions of crude oil and natural gas that're pushed from a pumping well to nearby producing wells were within a producing oil field that's up to 7.7 miles (or 12.4 kilometers) deep. And up to twice the size of Anambra State of **Nigeria**.

I discovered that the system of coupled, nonlinear, time-dependent, and three-dimensional partial **differential** equations that the petroleum industry used to discover and recover crude oil and natural gas were missing thirty-six partial derivative terms. Those mathematical terms were needed to balance the system of nine coupled, nonlinear, time-dependent, and three-dimensional partial **differential** equations that're used in the energy and geoscience industries.

UNRAVELLING THE MYSTERY INSIDE OILFIELDS

Who needs a supercomputer? The initial-boundary value problems governed by my new mathematics, or partial differential equations, had no analytical or exact solutions. For that reason, those equations had to be discretized and roughly solved across millions of processors under-the-hood of the world's fastest computer.

Every oil company must use a supercomputer to simulate the perfect operational strategies for recovering crude oil and natural gas. Petroleum reservoirs simulated across millions of processors is standard operating procedure that must be used to extract crude oil and natural
gases from the 159 producing oil fields in **Nigeria,** as well as the 65,000 producing oil fields around the world.

It should not come as a surprise that the energy and geoscience industries bought one in ten supercomputers. And that the supercomputer industry has a market value of forty-five billion dollars a year.

Why Emeagwali Equations Are Important

Why are the nine Philip Emeagwali's equations important? My contributions to the mathematical knowledge that's used to recover crude oil and natural gas **were these**: I corrected the serious mathematical errors made by geologists and physicists. And made during their mathematization of Darcy's Law. Darcy's Law was formulated in 1856 and later enshrined into every physics textbook on porous media flows.

That invention of thirty-six partial derivative terms is my contribution to the calculus of multiphase fluids, which flow under the surface of the Earth, and specifically, three-phased flows of crude oil, injected water, and natural gas flowing along three dimensions and across porous media that were both heterogeneous and anisotropic.

My contributions were toward the applications of mathematics and toward using my new knowledge and the world's fastest computer technology to discover and recover the most crude oil and natural gas buried in the 65,000 producing oil fields of the world. Without the supercomputer, that's powered by millions of processors, a significant amount of crude oil and natural gas would remain undiscoverable and unrecoverable.

In the 1980s, the petroleum reservoir that I simulated across my 65,536 processors served as my concrete platform and as my metaphor for all initial-boundary value mathematical problems, from those which govern the traffic models on Main Street to those which govern the financial models on Wall Street to those which govern the massively parallel-processed computational fluid dynamics codes that I investigated for four and a half decades following the late 1970s.

Answering the Toughest Question About the First Supercomputer

What's my answer to the most challenging question in computer science?

I invented how to solve the most compute-intensive problems at the intersection of new mathematics, new physics, and new computer science. And how to solve them by sending and receiving up to one billion computer codes. Each computer code represents an initial-boundary value problem that must send and receive data, or intermediate answers, to and from nearest-neighboring domains.

I invented how to do so **across** a new Internet, or **across** a new global network of processors that communicates and computes **together** as one seamless, coherent, and gigantic supercomputer. That's the first supercomputer,

as we know the world's fastest computer today.

My world's fastest computer is not a regular computer, in and of itself. It's a new Internet in reality. I made my invention by sending and receiving the internal boundary conditions after each time step of my discretized initial-boundary value problem. And by doing both **across** a new Internet that I visualized as my new **HyperBall** supercomputer. And as my new global network of 1,048,576 regular and short email wires which were equal distances **apart.** And which interconnected my ensemble of 65,536 off-the-shelf, self-contained processors. And connected them to create my new spherical island of processors that's a new Internet.

SOLVING THE IMPOSSIBLE

Back from 1922 through 1989, harnessing 64,000 human computers, or as many processors, existed only in the realm of science fiction. Since my discovery of July 4, 1989, executing the world's fastest computing and doing so across ordinary processors has enabled us to incorporate previously unimaginable points of data. We did so to make ground-breaking discoveries in science, engineering, and medicine.

The world's fastest computers are used to know if a new cancer treatment holds any promise. Or if an untested scientific theory is valid. The world's fastest computers are used to deepen our understanding of the cosmos and know our place within the cosmos.

Fastest Computing is the Contribution of Philip Emeagwali to Computer Science

The reason my scientific discovery of the world's fastest computing **across** the world's slowest processors was cover stories of top scientific publications was that it was new knowledge that opened doors into an undiscovered territory in advanced calculus. And that it opened door into an undiscovered territory in compute-intensive algebra. And that it opened doors into the unknown world where the fastest computers exist. N**ew** calculus, when discretized, led me to **new** algebra and led me to **faster** mathematical computations that were at the granite core of my scientific discovery. That discovery opened doors into the undiscovered territory of the first world's fastest computing **across** the world's slowest processors.

In 1989, I was in the news because I was the first person to observe the world's fastest computation across processors, instead of within one super-fast processor. My world record calculation made the news because it was **across** an ensemble of the world's slowest processors and **across** an Internet that's a global network of those processors. That first parallel supercomputer is the precursor to the world's fastest computer of today that could become the computer of tomorrow.

My mathematical grand challenge was to figure out how to harness a new Internet that's a new global network of up to one binary billion processors that shared nothing and were equal distances apart. My contributions to mathematics **were these**: I figured out how to harness that new Internet. And how to use its processors to solve a complicated system of time-dependent and nonlinear partial **differential** equations arising in fluid dynamics and calculus.

For the past two centuries, the partial **differential** equation was the hottest topic in mathematical research. It's both difficult and important. For those reasons, nine in ten supercomputer cycles are devoted to solving partial **differential** equations. It's the reason mathematics, physics, and computer science mutually reinforce each other.

Those partial **differential** equations are encoded in some laws of physics as prior information and, therefore, can be used for physics-informed simulations. Such computational physics models range from high-stake climate models to the spread of contagious viruses that might occur during a once-in-a-century global pandemic, such as the spread of **Covid-19**.

To solve the most difficult mathematical problems in computer science and solve them **across** processors demanded that I reduce those **differential** equations of calculus to an equivalent system of **difference** equations of algebra. On July 4, 1989, the system of equations of computational linear algebra which I solved **across** my ensemble of 65,536 processors were too bulky and sprawling to be scribbled **across** all the blackboards on this Earth.

GROWING UP IN THE HEART OF AFRICA

As a research mathematician, I started in Onitsha, Nigeria, investigating Pythagorean triplets, defined as three positive integers a, b, and c, such that a2 + b2 = c2 . I did so after the 30-month-long Nigerian Civil War was over.

When the war ended, on January 15, 1970, one in fifteen Biafrans had died. One million children and the elderly died from hunger and starvation. I was a twelve-year-old refugee in Biafra, the breakaway southeastern region of Nigeria. My refugee camps were in Ogidi, Awka, Awka-Etiti, Oba, Ndoni, and Fegge Quarters of Onitsha, Biafra.

As a mathematician searching for new calculus and new algebra, I came of age in supercomputing, in the mid-1970s in Corvallis, Oregon. And as a mathematician in the early 1980s in College Park, Maryland. My obligation was to invent new mathematics.

And then use my new knowledge as a vehicle for discovering new physics. And for inventing a new computer, a new supercomputer, and a new Internet. And for creating new vocabularies and discovering new sciences, that must follow new calculus, new computer, and a new Internet.

Philip Emeagwali at age eleven, third from left of front row, Saint George's College, Obinomba, Nigeria, mid-1966.

AFRICA AT THE FRONTIER OF COMPUTING

Why must Africa always be at the frontier of human knowledge? If it's impossible to create a literary Renaissance in Africa, and do so because of the continent's low literacy, it will then be harder to create a scientific Renaissance in Africa and do so because its low numeracy is far more daunting than its low literacy. Mathematics can only foster where numeracy is high.

The lack of deep understanding of the partial **differential** equations of calculus that were employed to construct large-scale supercomputer models of producing oil fields is one reason European and American oil companies are paid forty percent royalty to extract crude oil and natural gas, and do so from the 159 oil producing fields of Nigeria and through the 1,481 oil wells in Nigeria.

The pyramids of Giza are testaments that Africa was once at the frontier of human knowledge. The pyramids that stand today were built four thousand years ago, built in Africa by Africans. And built in the millennia that the forefront of human knowledge was in Africa. Africa will forever remain the least-developed region if it continues to consume technologies rather than produce technologies.

The Master of Numbers

For forty-three years following 1946, computers got smaller and faster. After 1989, supercomputers got bigger and became a billion times faster. They're defined and outlined by up to 10.65 million smaller and faster processors. The first world's fastest computing **across** millions of coupled processors that shared nothing is the most significant, measurable increase in the supercomputer's speed that has occurred since the programmable computer was invented in 1946.

My discovery of the world's fastest computing is called parallel processing. It occurred at fifteen minutes after eight in the morning of July 4, 1989. Supercomputing across processors led to the acceptance of the new technological reality.

My invention, or new knowledge, **was this**: the slowest processors could be used to compute faster than the singular, custom-manufactured fastest processor. Such an ensemble of processors are now used to solve the most compute-intensive problems in mathematics and science. Parallel processing was the seminal discovery in supercomputing. Parallel processing was how the fastest supercomputer was invented.

I was in the news for my discovery of the first world's fastest computing across the slowest processors in the world. My discovery occurred in Los Alamos, New Mexico, USA. I jumped in joy because I was the first person to discover that the 65,536 slowest processors in the world can be used to solve the most compute-intensive mathematical problems in the world. Working together, an ensemble of the slowest processors can be utilized to address the world's biggest challenges and solve them faster than the fastest supercomputer in the world could.

My scientific discovery changed the way we look at the supercomputer and changed it from the supercomputer powered by one processor to the supercomputer powered by up to one billion self-contained coupled processors. That supercomputer discovery put me in the news headlines in 1989. It's the reason I'm the subject of school essays on inventors.

Those news headlines from my world's fastest computing that I executed **across** the slowest processors in the world helped capture the public imagination. Those news headlines helped to garner political support for the new supercomputer technology that can now be harnessed and used to solve the most compute-intensive problems.

THE BIRTH OF THE FIRST SUPERCOMPUTER

My quest was to discover the supercomputer solution of the world's most compute-intensive problems. Such difficult mathematical problems arise at the frontiers of knowledge in mathematics, science, and medicine. My quest was to discover how to harness the slowest processors in the world and use them to solve the most compute-intensive problems in the world and solve such problems at the fastest speeds in the world.

As a mathematician searching for never-before-seen equations of calculus and algebra and who came of age in the 1970s and who worked at the frontier of the most compute-intensive fluid dynamics, I flaunted my uncompromising theories. And I theorized about sending and receiving emailed codes and sending them **across** a new Internet, that's a new supercomputer, in reality.

As my act of protest was against the racism I experienced in the 1970s and 80s, I pursued an unorthodox line of research called parallel supercomputing. In 1982, my supercomputer discovery was rejected. It was dismissed as science fiction. For those reasons, I then expected supercomputing **across** processors to be always rejected.

A Supercomputer That's an Internet

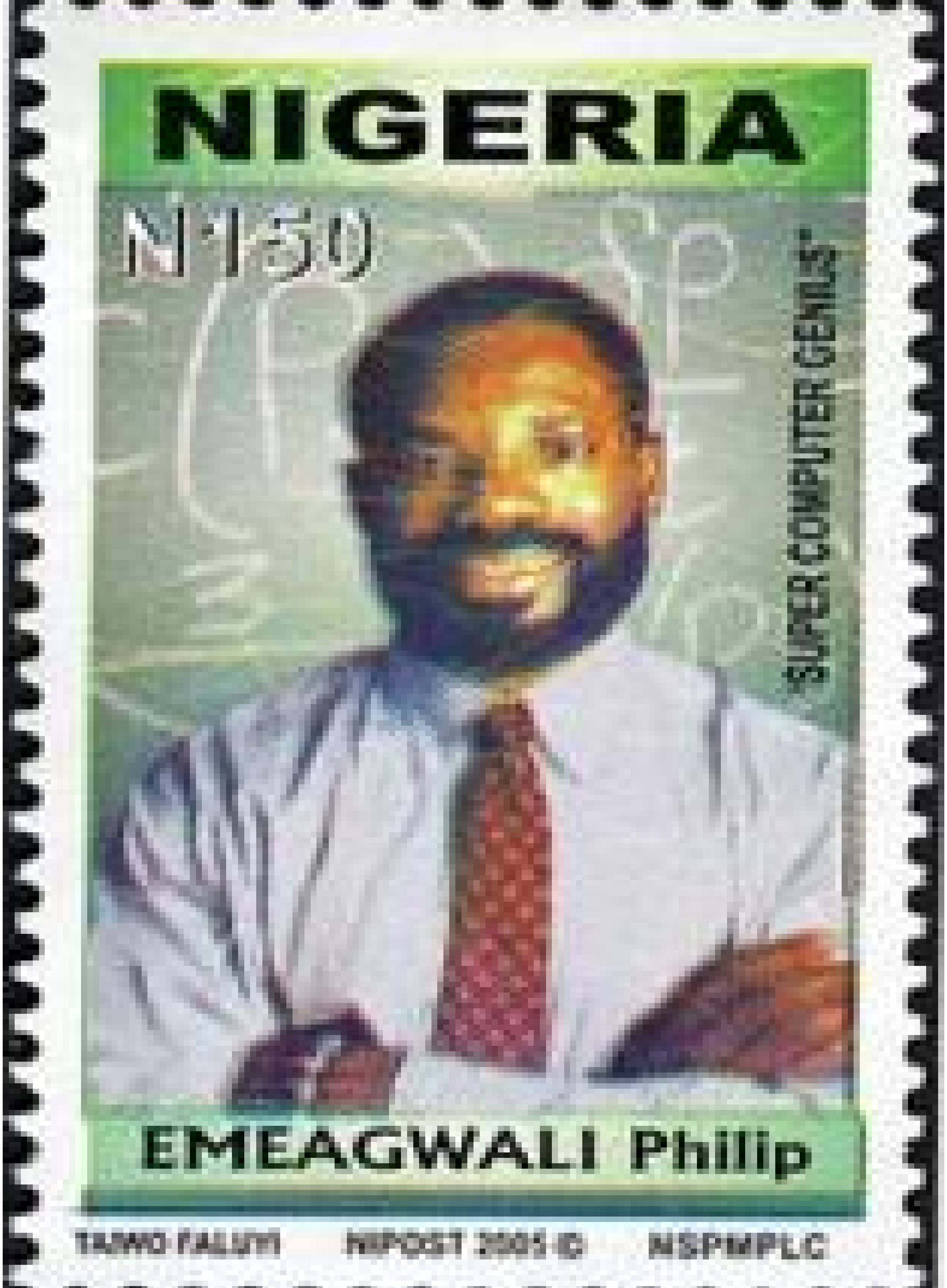
I discovered that the one billion slowest processors in the world can be fused via emails and used to emulate one seamless, coherent, and gigantic entity. This new machine is equivalent to a high-speed processor that's one billion times faster. It redefines the fastest supercomputer. Parallel supercomputing is new mathematical knowledge that came of age on July 4, 1989, the day I discovered that it's faster than serial, or vector, computing.

I established the science of the fastest computing **across** the seven million processors. Supercomputing is derived from parallel processing. Parallel supercomputing is my contribution to mathematical knowledge and is the invention and milestone that changed the way the modern mathematician solves his or her most compute-intensive problems and addresses some of the world's biggest challenges. The supercomputer is the scientist's best friend.

Philip Emeagwali, October 28, 2005, Monkton, Maryland, USA

2ND LECTURE:

COMPUTING AT THE SPEED OF THOUGHT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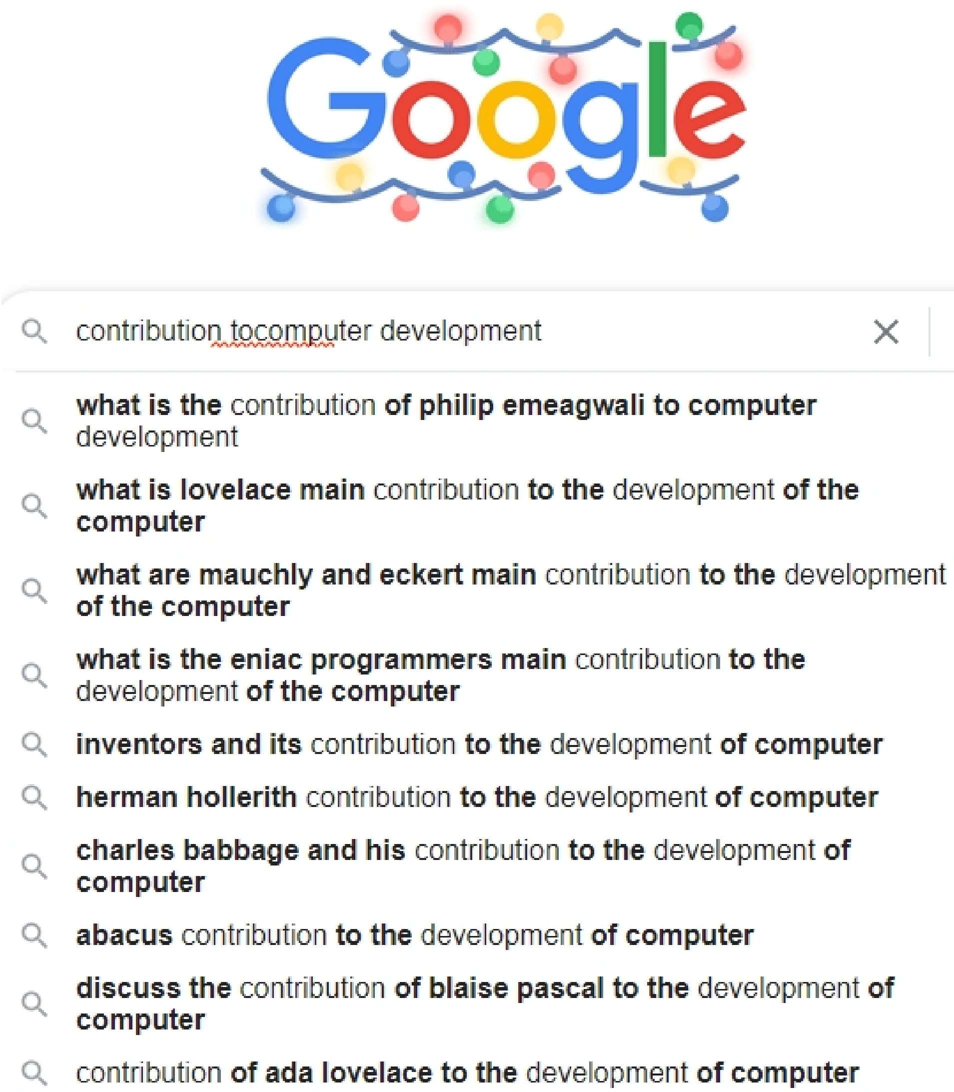


Google ranks Philip Emeagwali as the greatest computer genius (December 8, 2021).

My Contributions to Science

Developing the world's fastest computer is the most expensive project in computer science. A recurring question in school essays **is this**: "What did **Philip Emeagwali** contribute to science?"

Imagine a huge, multi-volume textbook that contains all that's known in mathematics or physics or computer science. To make a simple discovery is to add one new sentence to that textbook. But to make a ground-breaking discovery that opened the door to a new field of knowledge is like adding a new volume to that book of knowledge.

My discovery of the first world's fastest computing **across** the world's slowest processors made the news headlines, in 1989. I was in the news because my discovery was a new volume that was added to the body of knowledge of mathematics, physics, and computer science. If my discovery namely, the world's fastest computing **across** millions of processors, is deleted from scientific knowledge, we will not have the fastest computers in the world.

I was born in 1954 in the British West African colony of Nigeria. At age nineteen, I emigrated to the USA. In 1989, I was in the news for inventing the technology of using millions of processors as one coherent unit that's the world's fastest computer.

As an aside, the earliest use of a computing aid, to compute faster, was in Africa. The Lebombo Bone is the oldest mathematical instrument. It's 35,000 years old. The Lebombo Bone was discovered in the Lebombo mountains of Swaziland, Africa.

Mathematics originated in Africa. For thousands of years, our human ancestors counted on their fingers and on their toes. Three thousand years ago, alternative ways of counting that used computing aids—such as the counting board and the abacus—were invented. Those alternative ways were paradigm shifts in the history of computing.

The fastest computing **across** millions of processors changed the logic of sequential computing. That logic changed from solving one mathematical problem **at a time** to solving a million problems **at once**, or in parallel.

That fundamental change **was this**: The sequential thought processes of yesterday were replaced with the parallel thought processes of today. Like a storm at sea, supercomputing **across** a million coupled processors has brutally pushed computer science in a new direction and created new fields of study **across** mathematics and science. Computing in parallel changed the course of science and technology.

In computer science, the most important questions **are these**: How do we achieve the fastest computer speeds that now exist only in the realm of science fiction? How do we harness those new world record speeds and use them to solve the most compute-intensive problems that are now impossible to solve? And how do we use those speeds to solve societal problems that bring value to life? These **quin**tessential questions of computer science can be rephrased: “For a small price and many processors, what is the upper limit on the supercomputer’s speed?”

My Answer to the Biggest Question in Computer Science?

At 8:15 in the morning, in Los Alamos, New Mexico, USA, on Tuesday, the Fourth of July 1989, I made the first measurement of the world’s fastest computation ever recorded **across** an ensemble of the slowest processors in the world. My scientific discovery is an alternative way of looking at the world’s fastest computers.

My discovery of the fastest computing **across** the slowest processors made the news headlines. My contribution was the first time that an ensemble of the slowest processors in the world computed faster than the fastest processor in the world.

In 1989, I was in the news because I discovered how a billion processors can coordinate and work together and do both to solve one compute-intensive problem, such as modeling climate changes across the centuries. I discovered how to harness millions of processors and do so to solve one compute-intensive and time-consuming problem, which otherwise will be impossible to solve.

My discovery of how to use standard parts, called processors, to build the world's fastest computers occurred on the Fourth of July 1989. My discovery was summarized in many trade publications and mentioned in the June 20, 1990, issue of The *Wall Street Journal*.

My signature discovery was that millions of processors could be harnessed as one seamless, coherent, and gigantic unit that's the world's fastest computer. My discovery made the news headlines because the world's fastest computer that's powered by a million processors was previously dismissed and abandoned by the leaders of thought in supercomputing. The technology was then rejected by their followers who offhandedly dismissed the parallel supercomputer as science fiction and as a tremendous waste of everybody's time.

To put my discovery in perspective, the computing power of today's smart phones is about the same as the processing power of the supercomputer that helped send men to the Moon. That first Moon landing occurred on July 20, 1969. That was about the date I went to the Biafran side of the Oguta War Front of the Nigerian Civil War. I went to the Biafran war front as a conscripted fourteen-year-old soldier. A month before my arrival at that Oguta War Front, the Nigerian Army had out-manned and outgunned the Biafran Army by four to one and killed five hundred Biafran soldiers.

My twenty-year journey to the frontier of knowledge of the fastest computer was from the war front to the science front. In 1989, it made the news headlines that an African supercomputer genius in the USA had won the highest award in supercomputing. Computer scientists rank that award as the Nobel Prize of Supercomputing. I was the African supercomputer scientist that was in the news in 1989. I won that award for discovering that the supercomputer that incorporated a billion processors can yield the processing power of a billion processors, or of as many computers.

My supercomputer discovery made the news headlines in 1989. It remains the subject of inventor reports in schools. The reason was that I was the first person to execute the world's fastest computer speed and record it with the slowest processors and solve the most compute-intensive problems. That supercomputer discovery was considered the most significant breakthrough in mathematics, physics, and computer science. My world’s fastest computer speed, of July 4, 1989, was a supercomputer milestone. It was the largest speed increase in computer science.

My scientific discovery that the fastest computer can be built with the slowest processors changed the way we look at the supercomputer. Before my discovery, the most powerful supercomputer in the world was powered by at most one custom-made vector processor. After my discovery, the most powerful supercomputer in the world was powered by up to 10.65 million processors.

THE LIMITS OF THE COMPUTER

In an email, a twelve-year-old writing the biographies of famous computer pioneers and their contributions to the development of the computer asked me: “How is the discovery of the world’s fastest computing used?”

The energy and geoscience industries bought one in ten supercomputers, and use them to pinpoint oil deposits. Supercomputing **across** billions of processors is the forty-five billion dollars a year high-performance computing technology that’s used to recover crude oil from the 65,000 oil fields of the world and used to simulate the spread of contagious viruses during a once-in-a-century global pandemic. **Saudi Arabia** classified the fastest supercomputer simulations of their oil fields as a state secret.

In my lectures to the leading mathematicians and physicists of the **1970s and 80s**, I explained that the open mathematical question **was this**: “Can mathematicians solve the most compute-intensive problems, such as simulating the flows of crude oil, injected water, and natural gas that were buried up to 7.7 miles (or 12.4 kilometers) deep. And within an oil producing field that’s almost twice the size of the state of Anambra, Nigeria?

And can mathematicians hindcast those fluid flows **across** a new Internet that's a new global network of up to a billion off-the-shelf processors? Each processor had its dedicated memory and shared nothing?"

My contributions to computer science **were these**: I discovered that the slowest processors in the world can be used to manufacture the fastest computers in the world. And solve the most compute-intensive problems in the world. I discovered how to merge **mathematics** to **metals.** And do so to produce the fastest computers from the slowest processors. Since 1989, I'm the subject of school essays on inventors because I invented the first and fastest supercomputing, as it's known today.

On the day before my invention, of July 4, 1989, the fastest computer was powered by one processor. On the day of my discovery, the fastest computer was powered by the slowest 65,536 processors in the world. On the day of my discovery, a compute-intensive problem that formerly took 65,536 days, or 180 years, to solve within one processor took only one day to solve across my ensemble of sixty-four binary thousand processors.

I discovered how to harness the total and maximum supercomputer power of my coupled ensemble of the two-**raised**-to-power sixteen slowest processors in the world. Those off-the-shelf processors were designed for a mainstream market, rather than for supercomputing. And were manufactured in large numbers and at a lower price.

Beyond the Biggest Question in Computer Science?

At computer science conferences of the 1970s and 80s, mathematicians and physicists argued that parallel processing is a beautiful theory that lacked experimental confirmation. After my discovery, of July 4, **1989**, computer scientists can no longer mock and ridicule parallel supercomputing as a beautiful theory that lacks experimental confirmation.

Since counting is as old as humanity, parallel supercomputing could be around as long as the river flows, and the grass grows. I'm a dreamer who dreamt science fiction as nonfiction. I expanded the story of science to become a part of that story and the witness.

What Does a Supercomputer Look Like?

What does the world's fastest computer look like? The computing discovery that I recorded during my email experiments of July 4, 1989, provided the designers of the world's fastest computer with a crucial insight, namely, that the most compute-intensive problems can be solved **across** an ensemble of millions of **off**-the-shelf processors. Each processor was self-contained and shared nothing but was in dialogue with its nearest-neighboring processors.

That insight changed the way the world's fastest computer looks. The supercomputer of July 4, **1989**, and earlier, was the size of your refrigerator. The supercomputer of today occupies the space of a soccer field, consumes as much electricity as a small American town. And it costs as much as the budget of a small African nation.

That change in the way the supercomputer looks And it costs is, in part, my contribution to computer science. My invention made supercomputing across ordinary processors the new normal. And relegated the fastest supercomputers to computer museums. The invention of the first world's fastest computing **across** a million processors is the most significant fundamental change in computer history.

Parallel supercomputing is computing's defining technical achievement. The car of today has one engine and four tires, just as it had a century ago. By comparison, the state-of-the-art supercomputer of today is powered by 10.65 million processors, instead of the one processor that powered it before my discovery of July 4, 1989. The progress achieved in supercomputer technology is akin to completing in one day an intergalactic outer space travel that might have taken three hundred centuries if the same trip started in 1989.

I was the first person to discover that parallel processing **across** the slowest processors in the world is faster than serial computing on the fastest supercomputer in the world. That discovery enabled me to carve out supercomputing **across** the slowest processors and understand the new technology as the new window through which we can look with fresh eyes the frontiers of knowledge of the fields of computer science, mathematics, and physics.

We use the state-of-the-art supercomputers to see a new horizon and dream of inventing a **faster** supercomputer, such as the quantum supercomputer.

FATHER OF THE INTERNET

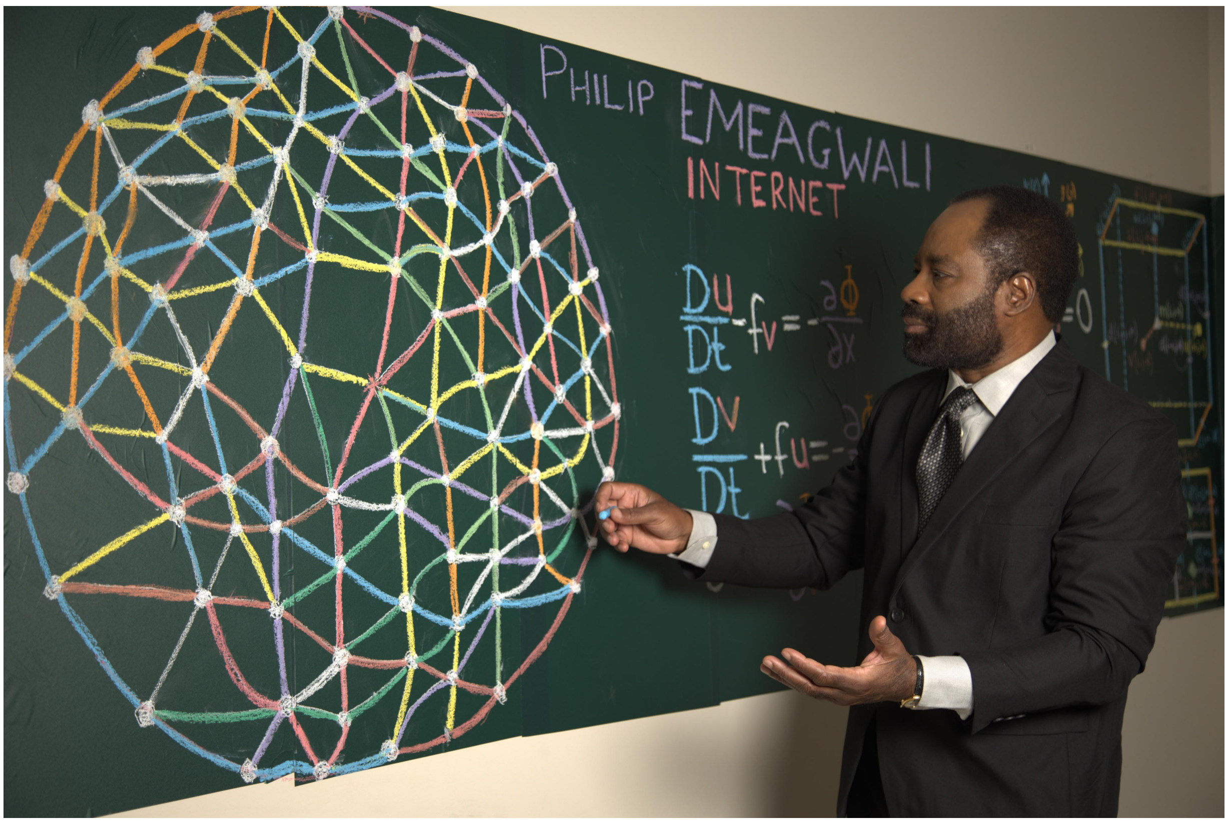
I was asked: “Why are you called ‘the father of the Internet’?” I’m the only father of the Internet that invented an Internet. The idea that suddenly the Internet was invented in the 1970s doesn’t ring true. **Philip Emeagwali** is the first name Google suggests for the search term: “Father of the Internet”

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).

In 1974, I was the first person to sketch a new Internet. My sketch evolved over the subsequent fifteen years and can be seen in Google image search. My new Internet was a new global network of computers. My new Internet emulated one seamless, coherent, and gigantic supercomputer.



Philip Emeagwali explaining why he is the only father of the Internet that invented an Internet.

My new Internet made the news headlines because it materialized on July 4, 1989 as the world's fastest computer.

That new Internet was a significant change from a science-fiction story that was published on February 1, 1922. That fiction introduced a paradigm of sixty-four thousand human computers "racing" the weather for the **entire Earth.** That science-fiction story of 1922 inspired my supercomputing theory of 1974. I theorized as many computers forecasting the weather around the **entire Earth.**

My theory of 1974 led to my scientific discovery and experimental confirmation that occurred at fifteen minutes after 8 o'clock in the morning of July 4, 1989, in Los Alamos, New Mexico, USA. I upgraded parallel supercomputing from fiction to fact.

My original inspiration was to invent a new technology, namely, a small copy of the Internet that emulates a new supercomputer to be used to solve the most compute-intensive problems. I discovered how to solve the hardest problems. And solve them **across** my small copy of the Internet.

My Internet was a new global network of sixty-four binary thousand processors. Each processor within my ensemble operated its operating system. Each processor had its dedicated memory that shared nothing. Those identical processors were married together by 1,048,576 identical email wires. And married together as one seamless, coherent, and gigantic unit that's a new supercomputer that encircles the globe and does so in the way the Internet encircles the Earth.

My ensemble of two-**raised**-to-power sixteen processors encircled the globe in a sixteen-dimensional hyperspace. I became the most searched for "Father of the Internet" because my invention wasn't a new computer intrinsically. My invention was a new Internet, in reality, that was defined and outlined by my global network of processors.

Those processors outlined a new Internet that I visualized as encircling a hypersphere embedded within a hyperspace. Each processor was my metaphor for a computer and was at a node within my new global network of 65,536 processors that was my small copy of the Internet.

I defined my new world's fastest computer not as a new massively parallel processing machinery but as a new Internet, in reality.

My Invention of a New Internet

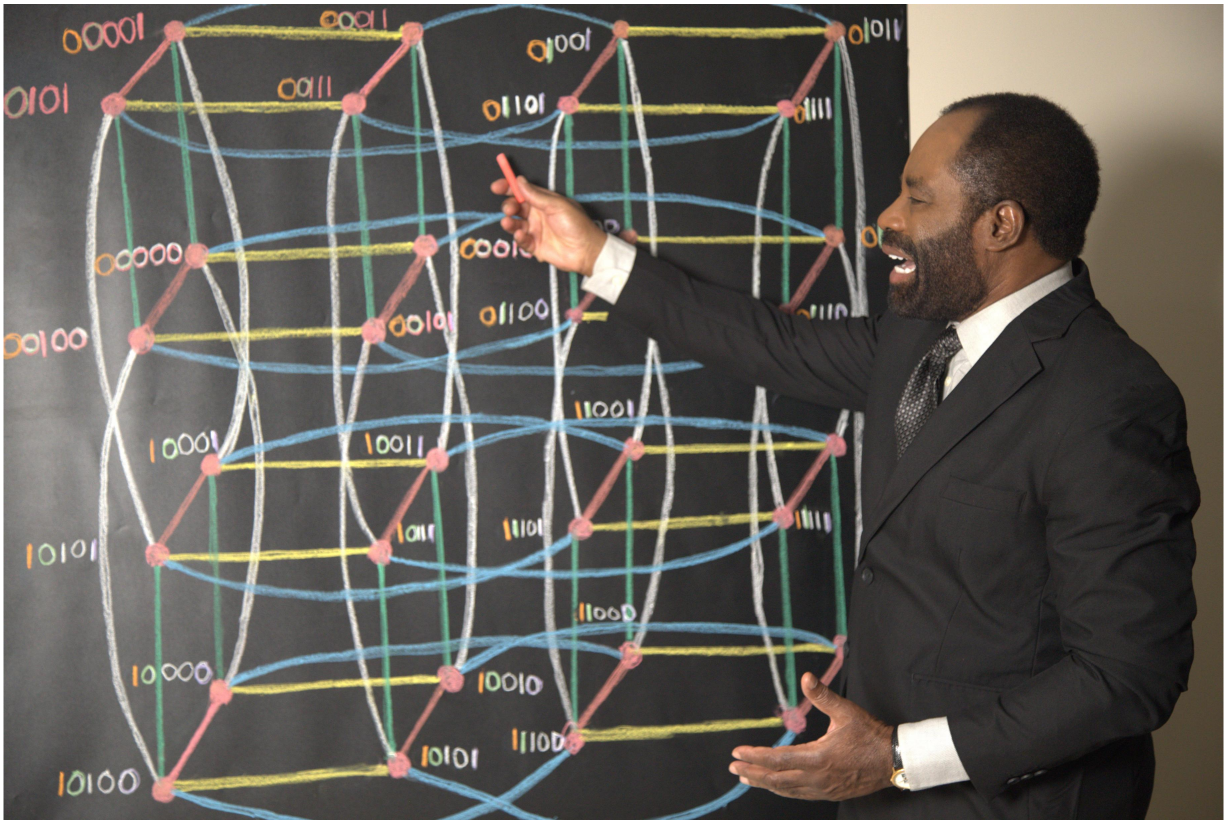
My theorized vision of how to invent the first supercomputer, as it's known today, was to harness a new Internet that was a new global network of the slowest two-**raised**-to-sixteen processors in the world. I visualized my sixty-four binary thousand processors as braided together and as uniformly distributed around a hypersphere that I also visualized as embedded within a sixteen-dimensional hyperspace. I visualized my 65,536 processors as braided together by sixteen times two-**raised**-to-power sixteen short and regular email wires.

My research goal was to use the **Emeagwali** Internet to discover the fastest computer speed in the world. And to invent the technology from the bowels of a huge ensemble of the slowest processors in the world. My quest for the world's fastest computer began on June 20, 1974, in Corvallis, Oregon, USA, and ended on July 4, 1989, in Los Alamos, New Mexico, USA.

It was a search to find the extraordinary among the ordinary. And do so by emulating the fastest processor in the world. I emulated the fastest processor by integrating the slowest processors and integrating them to invent one seamless, coherent supercomputer. That world's fastest computer is not a new computer, in and of itself. It's a new Internet, in reality.

An Internet That's a Planetary Supercomputer

I was the first person to witness the birth of the world's fastest computer, as it's known today. That first supercomputer revealed itself **across** a new Internet that was my new global network of the 65,536 slowest processors in the world.



Philip Emeagwali explaining how he harnessed 65,536 coupled processors to solved the governing equations of fluid dynamics. His discovery made the news headlines in 1989 as the solution of the Grand Challenge Problem of supercomputing.

That was my Eureka! Moment because I was momentarily a mediator between God and humanity. At that moment of discovery, I was electrified because I realized that I was the first eyewitness at the then unknown field of human knowledge that's now the world's fastest computer. Until I witnessed its discovery, the first world's fastest computing **across** the world's slowest processors was in the realm of science fiction, and not in computer science textbooks.

For those reasons, it was a surreal feeling to be the first person to understand how to execute the **world**'s fastest computation and do so **across** the slowest processors in the **world** and realize that you will become the subject of school essays in primary and secondary schools and in revised editions of mathematics, physics, and computer science textbooks.

A supercomputer is super because it harnesses up to one billion processors. And does so to become up to one billion times faster than the fastest computer that is powered by one processor. My supercomputer discovery was how to code correctly and solve compute-intensive problems and solve them **across** millions of processors. Those processors must process in *tandem* and do so to, in reality, emulate the world's fastest computer.

My scientific discovery changed the way we look at the world's **fastest** computer. I discovered how to develop the world's fastest computers and do so with the world's slowest processors. I discovered how to make the most with the least. The inventor creates something out of nothing.

My contribution to the development of the world's most powerful supercomputers was this: On July 4, 1989, I put to rest the saying that the first world's fastest computing across the world's slowest processors and **across** an Internet that's a global network of those processors is a beautiful theory that lacks an experimental confirmation.

SOLVING THE UNKNOWN

The supercomputer is to mathematics what the telescope is to astronomy or the microscope is to biology or the x-ray machine is to medicine.

The world's fastest computer must remain a living machinery that must be used to address the biggest questions of the 21st century. The fastest computers are used to solve the most compute-intensive problems arising in fluid dynamics. One such physics problem is global climate modelling that's executed to foresee otherwise unforeseeable long-term climate change.

Another compute-intensive problem at the frontiers and the crossroad of mathematics, physics, and computer science is to foresee the spread of contagious viruses that might occur during a once-in-a-century global pandemic, such as the spread of Covid-19.

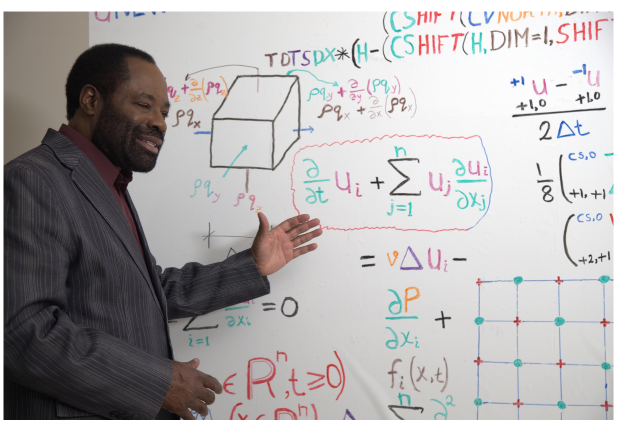
In my research of the **1970**s and **80**s, my quest was for the world's fastest computer. I wanted to discover how to solve the most compute-intensive problems in the world. And how to solve them with the slowest processors in the world but at the world's fastest computer speeds. My scientific discovery **is called** parallel supercomputing. In 1989, my contribution to computer science earned me the highest award in supercomputing.

That award is commonly referred to as the Nobel Prize of Supercomputing. That's why I was in the news, in 1989, for discovering that the fastest computing across millions of processors is indispensable and fundamental for solving the partial **differential** equation of calculus. And for executing the most extreme-scale computational fluid dynamics codes, including global climate modeling that's always a precondition to predicting long-term global warming. I discovered the fastest computing across the slowest processors and did so at 8:15 in the morning of Tuesday, July 4, **1989** in Los Alamos, New Mexico, USA.

The world's fastest computer is to the geologist or meteorologist or physicist or mathematician what the world's most powerful telescope is to the astronomer. The supercomputer changed the way we solve compute-intensive problems. **In their old way**, they solved compute-intensive initial-boundary value problems of computational physics and solved them in sequence. Or solved one problem **at a time.** And solve that problem within one isolated processor that wasn't a member of an ensemble of processors that were communicating and computing together and doing both as one seamless, coherent, and gigantic supercomputer.

In my new way, mentioned in the June 20, 1990, issue of The *Wall Street Journal* and also in cover stories of top mathematics news journals, I **invented** how to solve up to one billion initial-boundary value problems of computational fluid dynamics—such as global climate modeling.

My contribution to mathematics **is this**: I invented how to solve a billion mathematical problems **at once**. Within the world's most powerful supercomputer is a world of magic in which we could foresee previously **unforeseeable** natural events. I'm an extreme-scale computational physicist who employs the laws of physics and the logic of mathematics to **simulate** the global motions of fluids that enshroud the Earth. I **simulated** those motions **across** the Emeagwali Internet that's a new global network of 65,536 **equidistant** processors surrounding the globe that's my metaphor for the Earth. Each processor was like a dim light in a sea of darkness. But when supercomputing together as one seamless, coherent, and gigantic supercomputer, those 65,536 processors became as bright as the sun.



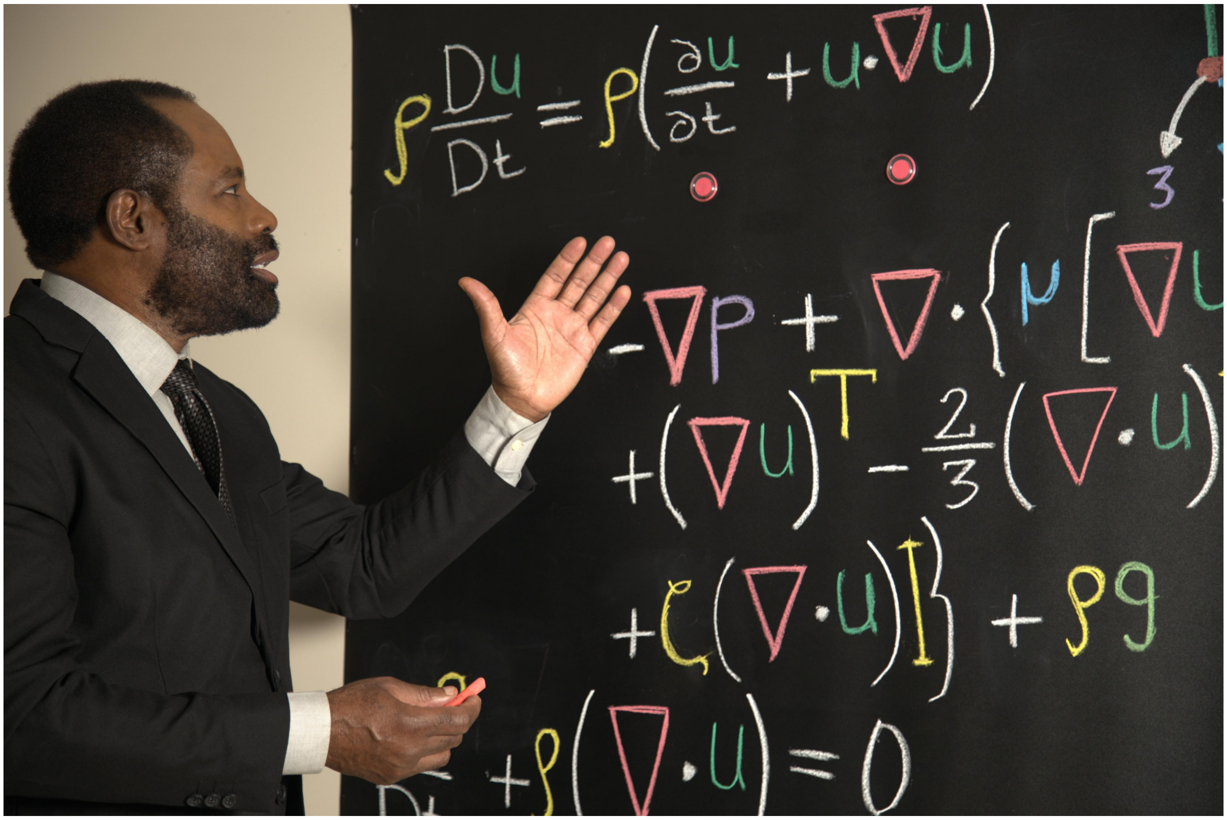
Philip Emeagwali explaining how he solved the governing equations of fluid dynamics that made the news headlines in 1989 as the solution of the Grand Challenge Problem of supercomputing.

My Mathematical Legacy: The Nine Philip Emeagwali Equations

Calculus had its origin in physics and did so three hundred and thirty years ago. Hence, new calculus could emerge when we study old physics but do so in a new way. Calculus was invented to describe the motions of bodies. I also invented new calculus to describe the motions of fluids. They're called the nine Philip Emeagwali equations. They're the most complicated equations in calculus.

I invented my new calculus to describe the motions of bodies, namely crude oil, injected water, and natural gas flowing up to 7.7 miles deep. And flowing **across** an oil producing field that's up to twice the size of the state of Anambra, Nigeria.

The **Emeagwali's** equations are to fluids flowing under the surface of the Earth what the Schrödinger's equation is to quantum mechanics. And what Maxwell's equations are to electrodynamical phenomena.



Philip Emeagwali explaining how he solved the initial-boundary value problem of fluid dynamics known as the most difficult problem in mathematical physics. His solution of the governing equations of fluid dynamics made the news headlines in 1989.

In **1989**, I was in the news because I discovered how to use up to one billion processors to tell whether it will rain tomorrow, or to determine how to extract the most crude oil and natural gas. And how to accurately nail down the exact locations of crude oil and natural gas deposits. And do so for the 65,000 producing oil fields in the world, including the 159 producing oil fields in **Nigeria**.

My Contributions of Parallel Processing to Science

My contributions to the mathematical knowledge that must be used to discover and recover crude oil and natural gas **are two-fold**: Foremost, I was the first person to discover how to harness an ensemble of billions of processors. And how to put that ensemble in the service of the petroleum industry.

My discovery—called parallel supercomputing—was the cover story of top mathematics publications, including the May 1990 issue of the *SIAM News*. The *SIAM News* is the bi-monthly news journal of the Society for Industrial and Applied Mathematics. The *SIAM News* is the flagship publication of the world's leading minds in mathematics.

Contributions of Philip Emeagwali to Calculus

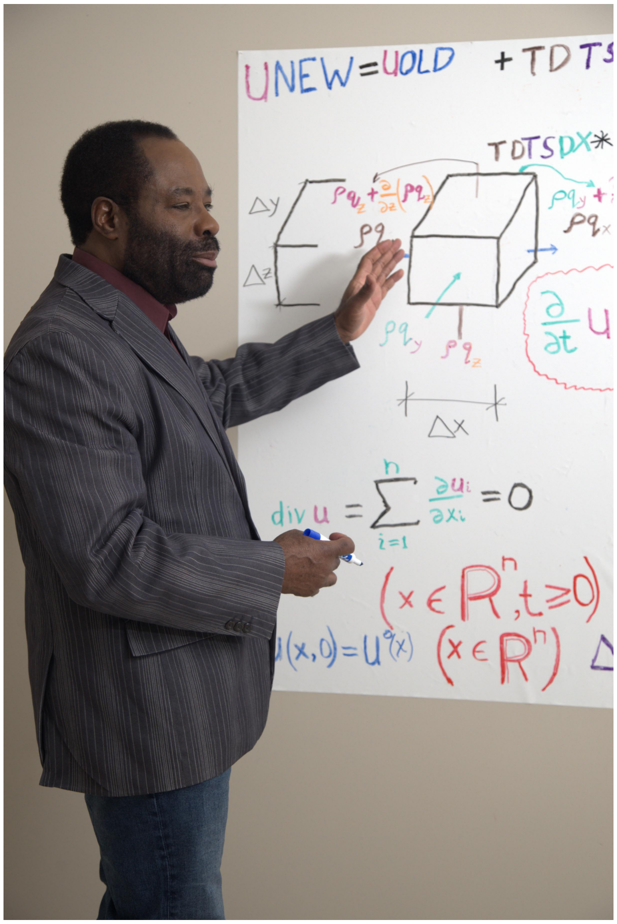
My second contribution to mathematics **is this**: I invented thirty-six (36) partial derivative terms. I used those terms to invent the system of nine Philip **Emeagwali** equations. My partial **differential** equations more accurately encoded the physical processes within producing oil fields. The partial **differential** equation is the *lingua franca* for computational fluid dynamics.

The **Emeagwali** equations predetermine the motions of crude oil, injected water, and natural gas that flow up to 7.7 miles (or 12.4 kilometers) below the surface of the Earth. An oil producing field can be as immense as the Ghawar Oil Field of **Saudi Arabia,** which measures 174 miles by 19 miles or 280 kilometers by 30 kilometers or 8,400 square kilometers or almost twice the size of **Anambra, Nigeria**. Being able to hindcast, or re-forecast, the motions of the crude oil and natural gas that flowed up to 7.7 miles (or 12.4 kilometers) below the surface of the Earth helps the petroleum engineer to understand how to push the most crude oil and natural gas and push them from the water injection well to the nearby crude oil and natural gas producing wells.

Inventing the Philip Emeagwali Algorithms

That was the second step which must be taken to encode the laws of physics, that was discovered in prose but must be coded, as the sequence of zeroes and ones the processor can act on. For the third step of that conversion, I had to reformulate, or rather discretize, the nine partial **differential** equations of calculus that I invented.

Philip Emeagwali explaining how he solved initial-boundary value problems of fluid dynamics known as the toughest problem in mathematical physics. His solution of governing equations of fluid dynamics made the news headlines in 1989.



I discretized them to convert them into an approximating system of equations of computational linear algebra. Those systems, called partial **difference** equations, approximated the originating partial **differential** equations. Put differently, I used some algebraic algorithms to reformulate the nine Philip Emeagwali equations of calculus that I invented. And to convert those nine equations into algebraic equations. And then to transform that algebra to arithmetic, or into an equivalent set of mathematical calculations. And into the 65,536 codes that each of my sixty-four binary processors saw as a seemingly endless string of zeroes and ones.

Scientific Obstacles I Overcame

In the 19**70**s and **80**s, the idea of recording the world's fastest computer speed and doing so across the world's slowest processors was mocked, ridiculed, and rejected as a beautiful theory that will forever remain impossible to experimentally confirm. Prior to my discovery, the fastest computing **across** the slowest processors was dismissed as science fiction. For those reasons, it was imperative that I experimentally confirm my theory that the slowest 65,536 processors in the world could power the world's fastest computer.

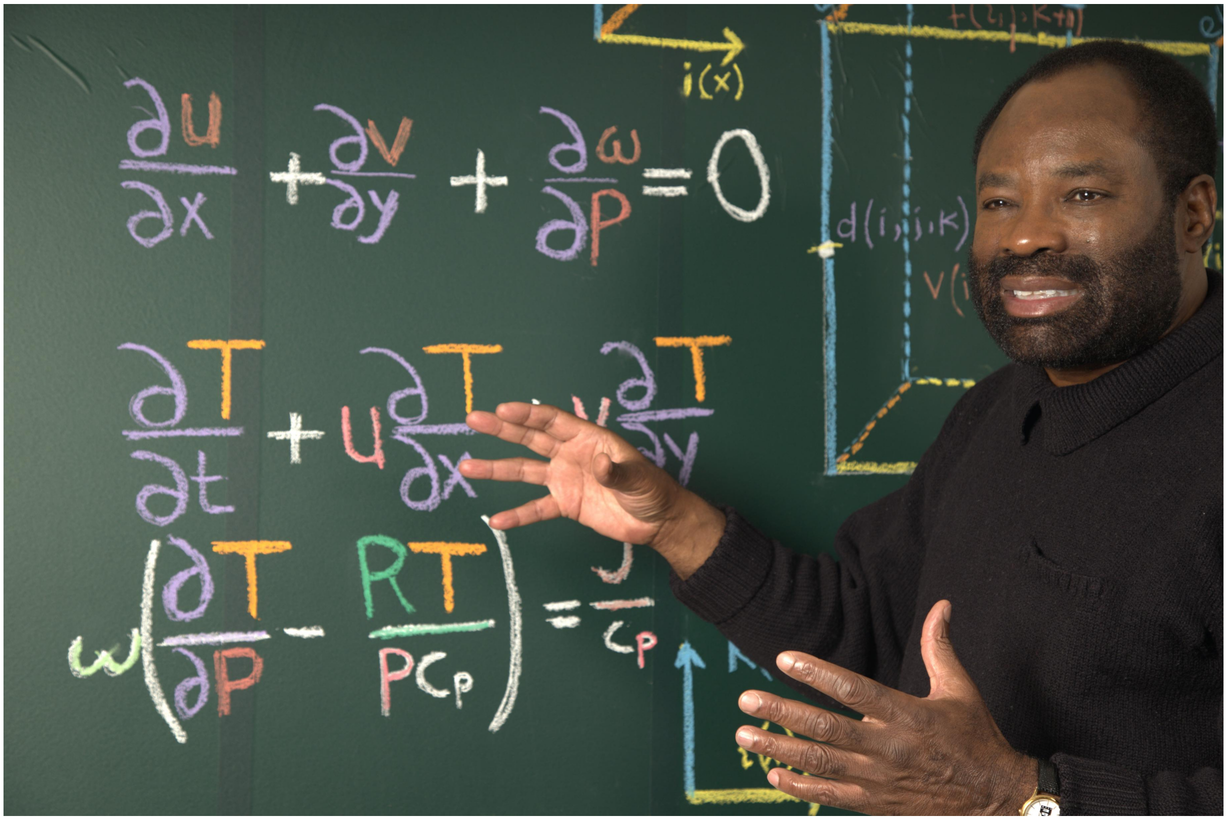
In science, theory and experiment sometimes contradict each other. And the experiment wins every time they clash. In my scientific research, my guiding principle was this: the logic of the compute-intensive problem should determine how the problem should be solved, not vice versa. It's only the laws of logic and physics that are **sacrosanct**, not the technology that must bend for the laws of logic and physics

CONTRIBUTIONS TO MATH THAT I'VE MADE

I wasn’t on the cover of the top mathematics publications because I was good looking. I was on the cover of the top mathematics publications because I contributed new mathematics to the existing body of mathematical knowledge.

My contributions to mathematics **were these**: I invented a system of nine coupled, nonlinear, time-dependent, and three-dimensional partial **differential** equations beyond the frontier of calculus. The nine Philip **Emeagwali** equations are for modeling the flows of crude oil, injected water, and natural gas that flow through an oil field. The nine Philip **Emeagwali** equations are my contributions to mathematics, and, specifically, to computational subsurface geophysical fluid dynamics.

Those nine Philip **Emeagwali** equations govern three-phased flows of crude oil, injected water, and natural gas that are flowing along three dimensions and **across** porous media that were both heterogeneous and anisotropic. In plain words, the properties of such porous media are different at different places and depend on the direction.



Philip Emeagwali explaining how his contributions to mathematics makes it possible to know the weather.

I invented those nine partial **differential** equations because the Second Law of Motion described in physics textbooks can only be expressed with economy and precision if and only if I encoded that law into a system of coupled, nonlinear, and time-dependent partial **differential** equations. That was the reason I reformulated the Second Law of Motion from its simple algebraic format into the most advanced expressions in calculus. And into the only type of equation that was **cross-listed** in both the seven most difficult problems in mathematics. And in the twenty most difficult problems in computing.

Why I Invented the Nine Philip Emeagwali Supercomputer Algorithms

I also invented nine partial ***difference*** equations that are defined at zillions upon zillions of numerical grid points that approximate the nine partial ***differential*** equations which I invented. My nine partial ***differential*** equations can be scribbled **across** one blackboard. However, coding the companion algebraic partial ***difference*** equations and coding them to solve a real-world problem, such as simulating the flow patterns **across** an oil producing field that's an average of one mile below the surface of the Earth and that's the size of a town and that's chopped up into millions of smaller and equal-sized mathematical problems demanded that I code them **across** as many processors.

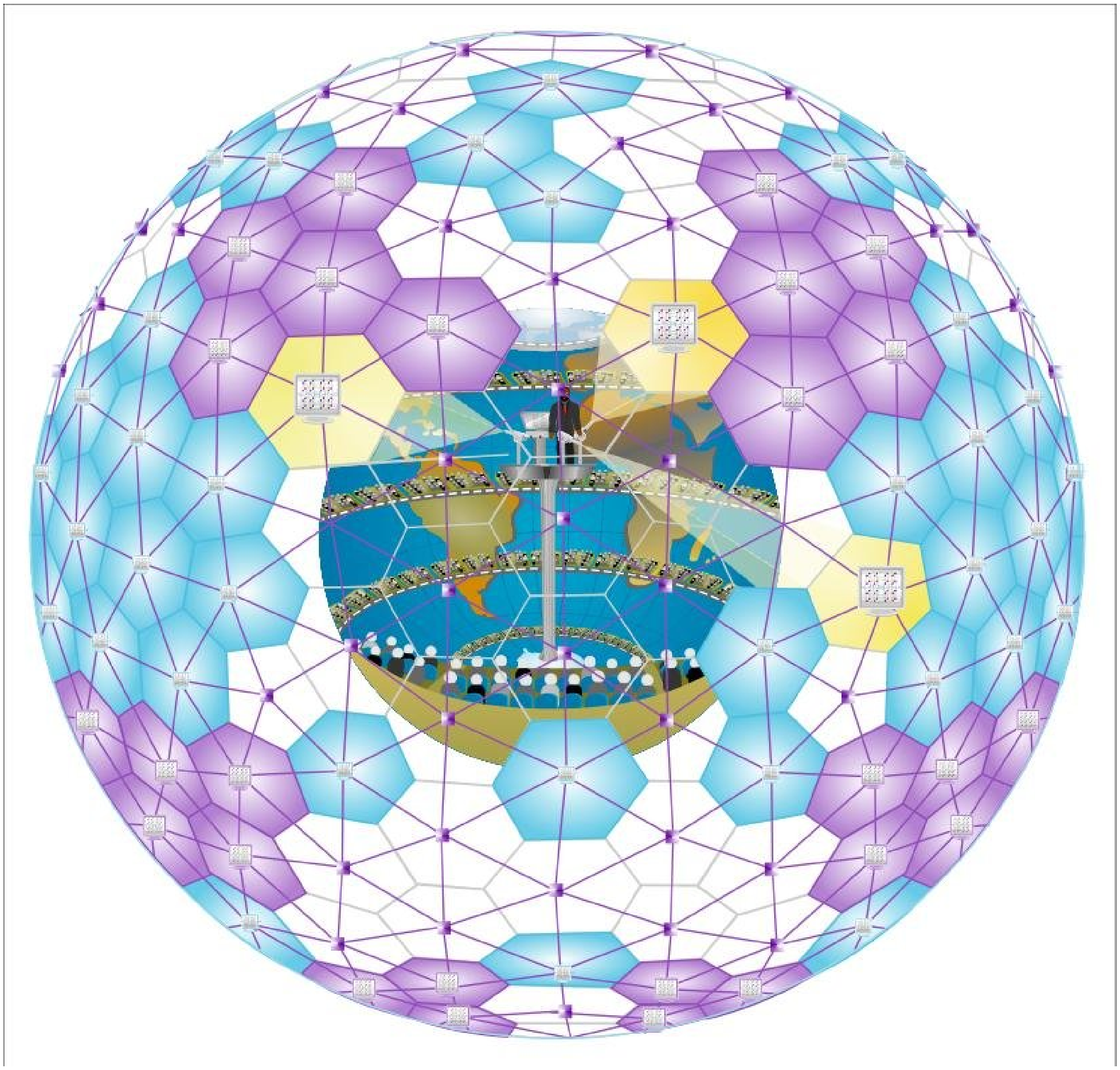
Those processors were identical, coupled, and shared nothing. I maintained a one-small-reservoir to one-slow-processor mapping which enabled me to maintain nearest-neighbor nearness that was the mathematical precondition to inventing the world's fastest computer that is powered by millions of processors.

HOW I INVENTED A NEW INTERNET

In 1989, I was in the news for providing the "final proof" that the fastest computing across the slowest processors is not science fiction. I visualized email communications across the 65,536 processors that I used to conduct my physical experiment of July 4, 1989. That experiment made the news headlines, as the first world's fastest computing across ordinary processors.

I had to visualize the topological positions of my processors and identify them correctly before I could accurately execute my 65,536 reservoir-to-processor mappings. Likewise, I visualized 65,536 processors that were equal distances **apart** that I imagined as **etched** onto my hyper-spherical model of the Earth. Furthermore, I visualized my 65,536 equal fluid volumes as enshrouding my hyper-spherical model of the Earth. Not only that, I visualized the laws of motion, energy, and conservation as described in physics textbooks as acting on each fluid volume.

I visualized that sixteen-dimensional spherical model of the Earth as mapped onto the Earth so that each of those 65,536 fluid volumes were separated by three thousand square miles. I invented a new Internet, the Philip Emeagwali Internet. And I did so during my quest to discover how to simulate the geophysical fluid dynamics flows of the air and water that enshrouded a globe, that's a metaphor for the Earth.



Artist's illustration of the Philip Emeagwali Internet, as conceived in June 1974 in Corvallis, Oregon, USA.

Along the way to the world's fastest computer, I invented how to formulate partial **differential** equations for the oil and gas industry, correctly. I invented the nine Philip **Emeagwali** equations that govern three-phased fluids flowing **across** porous media that were both heterogeneous and anisotropic. I did so by encoding, into my partial **differential** equations, the Second Law of Motion of physics, as described textbooks and discovered three centuries and three decades ago.

Attempting to unravel the analytical (or the truest) solution of a complex partial **differential** equation is like playing chess with God. In 1974, when I first programmed one of the world's fastest computers, the fastest computing across the slowest processors was both unspeakable and unthinkable.

In the 1970s, it was easier to travel to the Moon than to program an ensemble of millions of self-contained **off**-the-shelf processors that shared nothing and harness them as one seamless, coherent supercomputer. In the 1970s and 80s, the 25,000 vector supercomputer scientists in the world worked within the comfort of their known.

Back then, the few parallel computer scientists in the world worked within the discomfort of their unknown. And researched in the unexplored regions of extreme-scale computational physics, a field that encompasses climate modeling. Between physics and mathematics, the world's fastest computer occupied the position between the unavoidable and the impossible.

Solving the Unsolvable Problem

In the 1970s or 80s, the fastest computing **across** the slowest processors only existed in the realm of science fiction. And in the unexplored regions of the mathematical universe. During the 1980s, the big question in supercomputing that I addressed was how to **connect** the mathematical universe to the physical one. And, in particular, how to connect the new Philip Emeagwali Internet that I visualized in the 16th dimensional hyperspace to the most compute-intensive mathematical problems that were defined in our three-dimensional physical space.

In the 1970s and 80s, I felt like I was struggling to assemble a puzzle with infinite, endless pieces. At first, I thought my puzzle, with only 65,536 pieces, could solve the most compute-intensive problems in mathematics and science. I later realized that, in theory, the grand challenge puzzle demanded infinite pieces, or number of processors, as the precondition for solving the problem with mathematical exactitude.

This grand challenge was the motivation that inspired my invention of how to reformulate some laws of physics. And do so from prose to its equivalence in algebra, namely, **F**orce equals **M**ass times **A**cceleration. To its equivalence in calculus, namely, partial **differential** equations. To its equivalence in message-passing codes that I executed on each processor and parallel processed **across** the Philip **Emeagwali** Internet that's a new global network of two-**raised**-to-power sixteen processors.

MY WORLD'S FASTEST COMPUTING

My breakthrough in supercomputing was possible because I reformulated the laws of conservation of momentum, mass, and energy as described in physics textbooks. And reformulated them into processor codes that I adorned with processor-to-processor emails.

I invented unknown algorithms, or new supercomputer instructions, which told each processor what to compute within itself and what to communicate to its up to sixteen nearest-neighboring processors.

I emailed my sixty-four binary thousand, or two-**raised**-to-power sixteen, processor codes **across** my hyper-globe that I visualized as embedded within the 16^{th} dimensional mathematical hyperspace. Furthermore, I emailed my 65,536 processor codes to and from my two-**raised**-to-power sixteen processors.

As a mathematician who is also a physicist, I understand my system of partial differential equations as a description of the set of laws of physics they encoded. For those reasons, I distinguished the description from the described, just as you distinguish the map of **Nigeria** from the territory of **Nigeria**. A partial **differential** equation is different from the laws of physics it encodes just as the description of Nigeria is different from the land of Nigeria it describes. I can fold the map of Nigeria and put it in my pocket. But I can't put Nigeria in my pocket.

Changing the Way Mathematicians Solve Compute-Intensive Problems

My discovery of July 4, 1989, set the blueprint for the world's fastest computers now powered by up to a billion processors. The scientists who became famous and were remembered were the ones that were credited with achieving major paradigm shifts and that changed the way we think, such as changing from the geometry of Euclid, who lived 2,300 years ago in **Africa,** to the 19th century non-Euclidean geometries.

The first of the two **non-Euclidean** geometries is the elliptic geometry with positive curvature. In elliptic geometry, Euclid's parallel postulate does not hold. The second of the two **non-Euclidean** geometries is the hyperbolic geometry. Within the hyperbolic geometry, the sum of the angles of a triangle is always less than 180 degrees.

The **elliptic** and **hyperbolic** geometries were the two major **paradigm shifts** which occurred within **2,300** years. Those two radical shifts fundamentally changed the way geometers think about geometry. Similarly, the world's fastest computing **across** the world's slowest processors is a radical shift that changed the way computer scientists think about their supercomputers.

Parallel supercomputing is a fundamental shift in the way we compute just as the theory of evolution changed the way biologists think. Supercomputing **across** up to one billion coupled processors fundamentally changed the way the most compute-intensive problems are solved. And changed it just as the heliocentric world view changed the geocentric world view of astronomers who preceded **Galileo Galilei**.

Parallel supercomputing changed large-scale computational physics the way the modern physics of **Albert Einstein** changed the classical physics of **Isaac Newton.** At its essence, the fastest supercomputer that I discovered at **8:15** in the morning of Tuesday July 4, **1989,** was about changing from the computer that solved one problem **at a time** to the supercomputer of today that solves up to one billion problems **at once.** Or changing to the Internet of tomorrow which is still in the realm of science fiction and that could become the planetary supercomputer of the future.

Parallel supercomputing was a fundamental change of tectonic proportions that changed the way we study computer science. In their **old** computer science, the computer solved one problem **at a time**. In my **new** computer science, the computer solves many problems **at once**.

HOW I WISH TO BE REMEMBERED

A man said to his pediatrician. “Do you know Philip Emeagwali? I wrote an inventor report on Philip Emeagwali. My daughter also wrote an inventor report on Philip Emeagwali.” His pediatrician smiled and replied: “I also wrote an inventor report on Philip Emeagwali. My son also wrote an inventor report on Philip Emeagwali.”

For the twelve-year-old that is writing a school essay on inventors and their inventions, an essential question is this: “What is **Philip Emeagwali** known for?” I was the first person to discover that the slowest processors in the world could be harnessed and used to power the fastest computers in the world.

That new knowledge is used to solve the most compute-intensive problems in the world. That invention is the reason the fastest computers in the world are powered by up to 10.65 million processors. I discovered how an ensemble of up to one binary billion processors can be married together by as many email wires and messages. A binary billion is two-raised-to-power-32, or 4,294,967,296. And then use those processors to solve the most compute-intensive problems.

I discovered how to fuse processors and do so to, in reality, form one coherent unit that's a never-before-seen machinery that's the world's fastest computer that made the news headlines, in 1989. That new supercomputer which is also a new Internet that I invented on July 4, 1989, is radically different from the constituent processors from which it originated. The world's fastest computer, as it's known today, originated from the slowest processors.

My historic run was the first world's fastest computing **across** the world's slowest processors. My breakthrough occurred at 8:15 in the morning, on July 4, 1989. I was its first eyewitness. For that reason, it was a visceral experience. My visceral cries drew a little crowd. People down the hall ran towards me as they heard my visceral cries for my discovery of the world's fastest computing. I cried because it was the first supercomputing that will change the lives of our descendants. And do so by permanently changing the way our descendants will look at their world's fastest computers.

Each person that heard my visceral cries was puzzled by my emotional reaction to what seemed incomprehensible, namely, the world's fastest computing that I executed in a new way that will, forever, change the way we look at the computer.

My supercomputer run performed 3.1 billion calculations per second. That was a world record for July 4, 1989, that opened the door to the modern supercomputer. I used those 65,536 processors to solve a system of twenty-four million equations of algebra. In addition to my computing speed, the number of processors and equations were both world records. My three world records—in speed, processors, and equations—were validated by both the computing and petroleum industries.

The supercomputing industry now incorporates parallel processing. And the petroleum industry now purchases one in ten supercomputers. Oh, yes, harnessing a billion processors gives the right answer, too.

Three generations: Iyanma Agatha Emeagwali, Philip Emeagwali, and Ijeoma Emeagwali in Maryland, USA.

How I Want to be Remembered

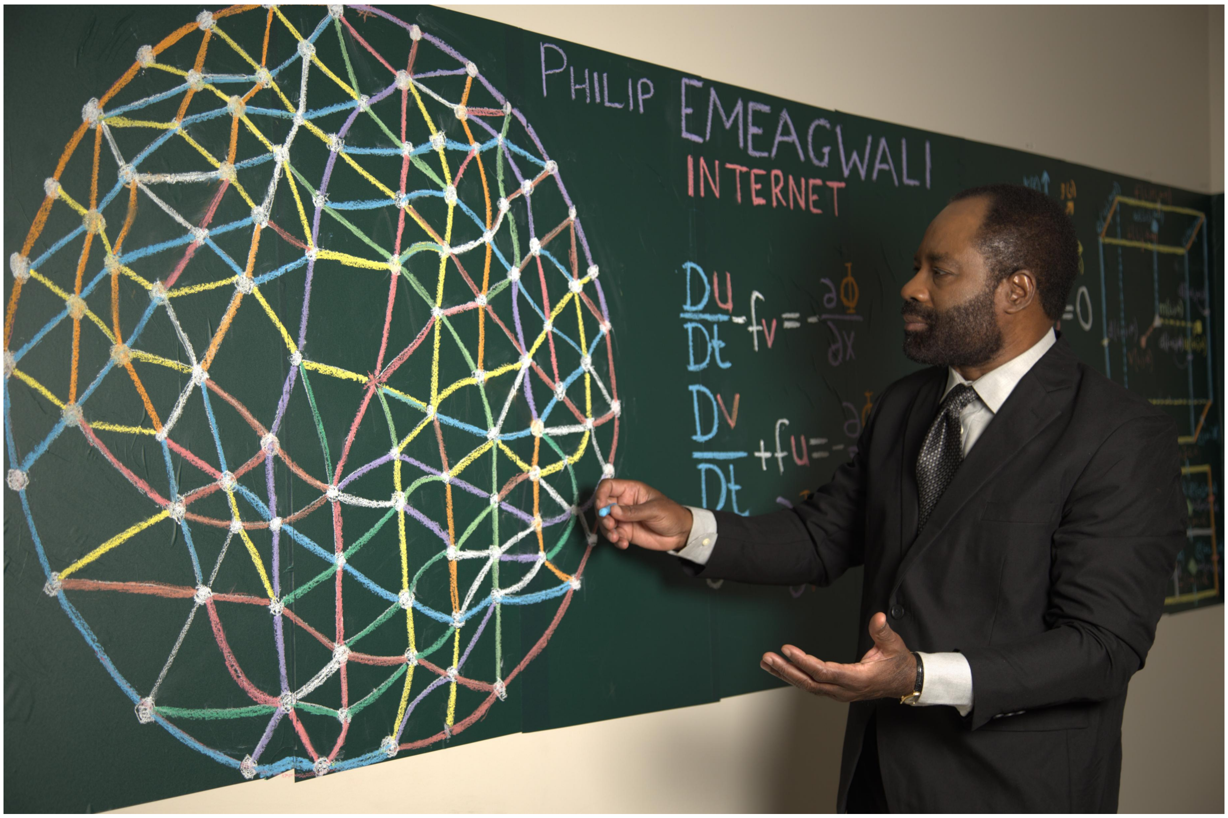
When I began supercomputing back on June 20, 1974, in Corvallis, Oregon, USA, the world's fastest computing **across** the world's slowest processors was science fiction. Fifteen years later, on July 4, 1989, in Los Alamos, New Mexico, USA, I discovered how to turn that science fiction to reality.

For that contribution, I became the **first** and **only** person, to win alone, the highest award in supercomputing. The world's fastest computing, as it's executed today, was the **pseudo**science of the 1980s, and earlier. The turning point was my scientific breakthrough that occurred on July 4, 1989, and elevated that **pseudo**science to science.

How do I want to be remembered? **I want to be remembered** as the supercomputer inventor that connected those dots or vertices or processors, so to speak. **I want to be remembered** as the supercomputer discoverer that told the **coherent** story and discovered those Internets as, in reality, **coherent** computers that are the **fastest**. The genius is the ordinary person that found the extraordinary in the ordinary.

My invention of fastest computing is summed **as follows**: The slowest processors can cooperatively compute together to yield the fastest computation ever recorded and to solve the most compute-intensive problem ever solved. My discovery is used to combine computers into supercomputers. And can be used to create a supercomputer that’s an Internet.

3RD LECTURE: PHILIP EMEAGWALI INTERNET



Broadcast 26 September 2021

https://youtu.be/gMPi6H6KBnA

Emeagwali Supercomputer that Emulates a Bees' Honeycomb

In an email, a twelve-year-old writing the biography of a famous inventor and his invention asked me: "What is the Philip

Emeagwali Internet?”

In 1989, I was in the news because I recorded the fastest computer speed. I achieved that speed while solving the most compute-intensive problems at the crossroad where new mathematics, new physics, and new computer science intersect. Such compute-intensive problems are called the twenty grand challenges of supercomputing.

On July 4, 1989, I recorded the world’s fastest computer speed. And I did so while solving the most important compute-intensive problems. And solving them across a new Internet that was a new global network of the slowest processors in the world. That machinery—that comprised of the slowest processors powering the fastest computer—is called the Philip Emeagwali Internet.

Visualizing Philip Emeagwali Supercomputer

I visualized my supercomputer as outlined and defined by a billion points of light. Each light represented a processor. I programmed two-**raised**-to-power sixteen off-the-shelf processors. Likewise, I visualized these processors as equal distances **apart**. Furthermore, I visualized these processors as etched onto the hypersurface of a globe. Not only that, I visualized that globe as embedded within a sixteen-dimensional hyperspace. That spherical island of processors is called the **Emeagwali** Internet.

If constructed at the most enormous scale, the **Emeagwali** supercomputer will be a mammoth machinery assembled from a billion off-the-shelf processors that are linked with high-speed interconnects that shuttles data and coordinate emails.

Visualizing the Philip Emeagwali Supercomputer Like a Bees' HoneyComb

The **Emeagwali** Internet that I theorized, in 197**4**, is shaped like a giant ball, or a gigantic supercomputer, that I named a "HyperBall." I visualized my giant ball as the world's fastest computer that occupies the footprint of a football stadium. My new supercomputer will cost tens of billions of dollars. And could be financed by a consortium of nations. Furthermore, it will weigh as much as a thousand school buses. Not only that, it could consume as much electricity as a state within **Nigeria**.

My never-before-seen supercomputer could solve the most compute-intensive problems, including the complicated simulations of climate change, that would be impossible to solve on a supercomputer that is powered by only one processor.

I came to supercomputing not only to solve the most compute-intensive problems in science, engineering, and medicine but also to invent a new supercomputer. I invented a supercomputer that was inspired by the bees Honeycomb. And did so by subdividing the surface of a sphere in an orderly and efficient manner.

Studying bees and how they work together in their hives as well as the efficiency they employed when constructing their honeycombs inspired me to change the way I look at the world's fastest computers. I was the first supercomputer scientist to divide a spherical surface in a manner that mimics the efficient structure of the **bee's honeycomb**.

I discovered that the natural efficiency implicitly encoded into how bees construct their honeycombs could be copied within a supercomputer that's powered by an Internet that's a global network of up to one billion processors.

The patterns of the interconnections of the processors within my new supercomputer were inspired by my observations of the efficiency of the bee's hexagonal honeycomb. The bees' honeycomb inspires the most efficient processor-to-processor interconnection that will make it possible to manufacture the world's fastest computer.

That supercomputer will encircle a huge globe that occupies the space of a soccer field. My honeycomb-inspired supercomputer is a global network of processors that's an Internet, in reality. My HoneyComb Supercomputer will do the fastest computation with the least communication, or noise. Over millions of years, the bee evolved to know that it can store the most honey with the least energy. I merely copied the blueprint for my supercomputer by reverse engineering the bees' honeycomb.

In the 1970s and 80s, I didn't conduct academic research. Instead, I conducted a big science, big supercomputer research that was beyond the realm of academia. My new Internet made the news headlines because it was my alternative way of looking at the supercomputer that previously only computed with one custom-manufactured, super-fast vector processor. My alternative way of parallel processing became a fundamental change in supercomputing. That was the origin story of the first supercomputer in the world that was powered by the slowest processors in the world.

MY EARLY YEARS IN SUPERCOMPUTING

In 1974, in Corvallis, Oregon, USA, I was solving large-scale systems of equations of computational linear algebra. I solved them on a serial supercomputer that was the first computer to be rated at one million instructions per second. That serial supercomputer represented the old paradigm of supercomputing.

In serial supercomputing, I programmed one scalar processor, the equivalence of one computer. I visualized that one scalar processor to be on a globe in the zeroth mathematical dimension. And I to**po**lo**gi**cally followed the sixty-four binary thousand vertices and the one binary million bidirectional edges of the hypercube in the 16^{th} dimension. I visualized them as making up a new Internet that tightly circumscribed a globe with its processors and wires. And encircled that globe as a new global network of processors, called the Philip Emeagwali Internet.

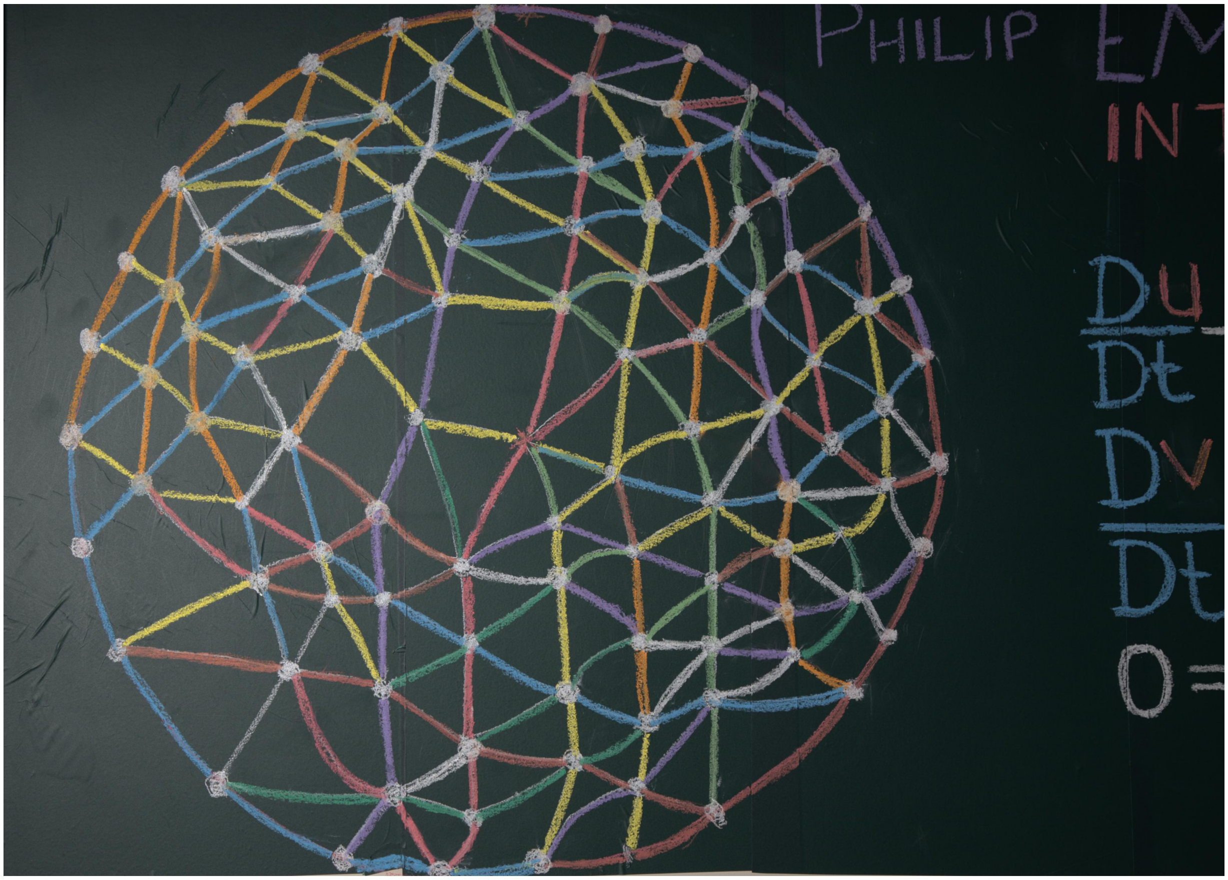
I also visualized that globe in the sixteenth mathematical dimension. I grew in my mathematical maturity and scientific and computing expertise during the fifty years following **1974** that I lived and worked in **Corvallis** (Oregon), **Washington** (District of Columbia), Baltimore, Silver Spring, and College Park (Maryland), Casper and Laramie (Wyoming), and **Minneapolis** (Minnesota).

How My Supercomputing Evolved into a New Internet

I grew along sixteen mutually perpendicular directions. I was the **first** supercomputer scientist to grow into the new billion-processor paradigm of the fastest computing **across** a gigantic ensemble of processors. I visualized these processors as uniformly encircling a globe. And as circumscribing it as a new Internet that's a small copy of the Internet. My new billion-processor paradigm for supercomputing made the news headlines because I was the first person to record the fastest computer speed and do so **across** that new Internet.

It was at 8:15 in the morning of July 4, 1989, in Los Alamos, New Mexico, USA, that I discovered parallel supercomputing. And discovered how to record the fastest computer speeds **across** an ensemble of two-**raised**-to-power sixteen processors. I was the first person to recognize that network of processors as a new Internet that tightly encircled a globe. And circumscribes it within the metaphorical 16th dimension.

So, over my first sixteen years—from Corvallis (Oregon) to Washington (District of Columbia) to College Park (Maryland) to Laramie (Wyoming) to Los Alamos (New Mexico)—my supercomputing changed from the 0th (zeroth)—or a mere point —to the 16th dimension, that was represented by two-**raised**-to-power sixteen, or 65,536, equidistant points that I visualized as having a one-point to one-processor correspondence. I also visualized those processors as evenly distributed **across** the hypersurface of a hypersphere that was my topological metaphor for the Philip **Emeagwali** Internet. In summary, I theorized and experimentally discovered that new Internet.



The blueprint of the Philip Emeagwali Internet

Why is the Supercomputer Market $45 Billion a Year?

Why My Supercomputing Breakthrough Made the News Headlines

The supercomputer market is forty-five (45) billion dollars a year. That is like giving one thousand dollars a year to every man, woman, and child who can speak the Igbo language. Since 1989, I'm the subject of inventor reports, in schools **across** the USA, UK, and Canada. I'm studied in schools because I discovered that the modern supercomputer should be powered by up to one billion processors. That invention is the new knowledge that powers the world's fastest computers.

In 1989, I was in the news because I discovered how to solve the most compute-intensive mathematical problems, such as initial-boundary value problems that were governed by a system of coupled partial **differential** equations, and, in particular, those arising in planetary-scaled fluid dynamics.

Such equations contextualized and encoded some laws in physics, including the Second Law of Motion. Such partial **differential** equations capture in a few succinct terms some of the most ubiquitous features of the air and water flowing **across** the surface of the Earth, including the atmosphere and oceans, and the crude oil, injected water, and natural gas flowing **across** highly anisotropic and heterogeneous producing oil fields that were up to **7.7 miles (or 12.4 kilometers)** below the surface of the Earth. And that are the sizes of a town.

The size of the Prudhoe Bay Oil Field on Alaska's North Slope is 213,543 acres. The Prudhoe Bay is the largest oil field in North America. The Ghawar Oil Field of Saudi Arabia measures 280 kilometers by 30 kilometers, or 174 miles by 19 miles. The Ghawar Field is the largest oil field in the world.

Fastest Computing to Crack the Impossible

In an email, a fifteen-year-old writing the biography of a famous mathematician and his contributions to mathematics asked me: "How is mathematics used in supercomputing?"

Calculus is the most powerful technique in mathematics. The poster boy of the partial **differential** equation of calculus is the system of equations that encoded the Second Law of Motion in physics textbooks. In theory, mathematical predictions that were based upon the partial **differential** equation should be as reliable as a hammer. In practice, it's a different story. Therefore, it's impossible to predict the weather with certainty and forecast it thirty days in advance.

Without high-performance, massively parallel supercomputing the solution of the most compute-intensive initial-boundary value problems—such as simulating long-term climate change—will be as approximate as a sketch, instead of as exact as a photograph. That solution

of that mathematical problem is a map—called the vector field—of the direction, size, and temperature of the air, or moisture, at every position within the Earth's atmosphere and at every later date. The need to simulate accurately the internal dynamics of flowing fluids—called the fluid dynamics—is the reason ninety percent of the cycles of the world's fastest computers are consumed by applied mathematicians, called computational fluid dynamicists. Large-scale computing is the reason the fastest supercomputers are used to study and understand long-term global warming.

PHILIP EMEAGWALI INTERNET

In an email, a twelve-year-old writing her biographical essay on a famous inventor and his invention asked me: "How did you invent the Philip Emeagwali Internet?"

I explained to her that my invention was inspired by my thinking about the Earth and global warming. I progressively made my invention during the sixteen years following June 20, **1974.** I started my research in Corvallis, Oregon. And I continued my supercomputing in Washington (District of Columbia), College Park (Maryland), Laramie (Wyoming), and Los Alamos (New Mexico).

I began the invention of the Philip **Emeagwali** Supercomputer by imagining the Earth as shrunk to the size of an apple. The size of the skin of that apple represents the habitable area of the Earth. That skin-thick volume consists of fluids, such as the atmosphere, rivers, lakes, and oceans. And up to 7.7 miles below that skin-thick volume we have fluids, such as crude oil, natural gas, water, and air that flow through the crevices and voids under the surface of the Earth.

Exploring the Limitless Possibilities for Tackling Tough Math

One of the twenty most compute-intensive problems in physics was to simulate global warming **across** millions of processors under-the-hood of the world's fastest computer. And do so to execute computational fluid dynamics codes at the world's fastest computer speeds. Likewise, to foresee the motions and the directions of the fluids that enshroud heavenly bodies, such as the geophysical and astrophysical fluid dynamics around planets in our Solar System, including weather forecast around the Earth.

The Earth's atmosphere is 62 miles (or 100 kilometers) above its surface. Comparing the depth of the Earth's atmosphere to its diameter of 7,900 miles (or 12,700 kilometers), we realize that the atmosphere is 127 times thinner than the Earth. The atmosphere compared to the Earth is thinner than the skin of the apple compared to the apple.

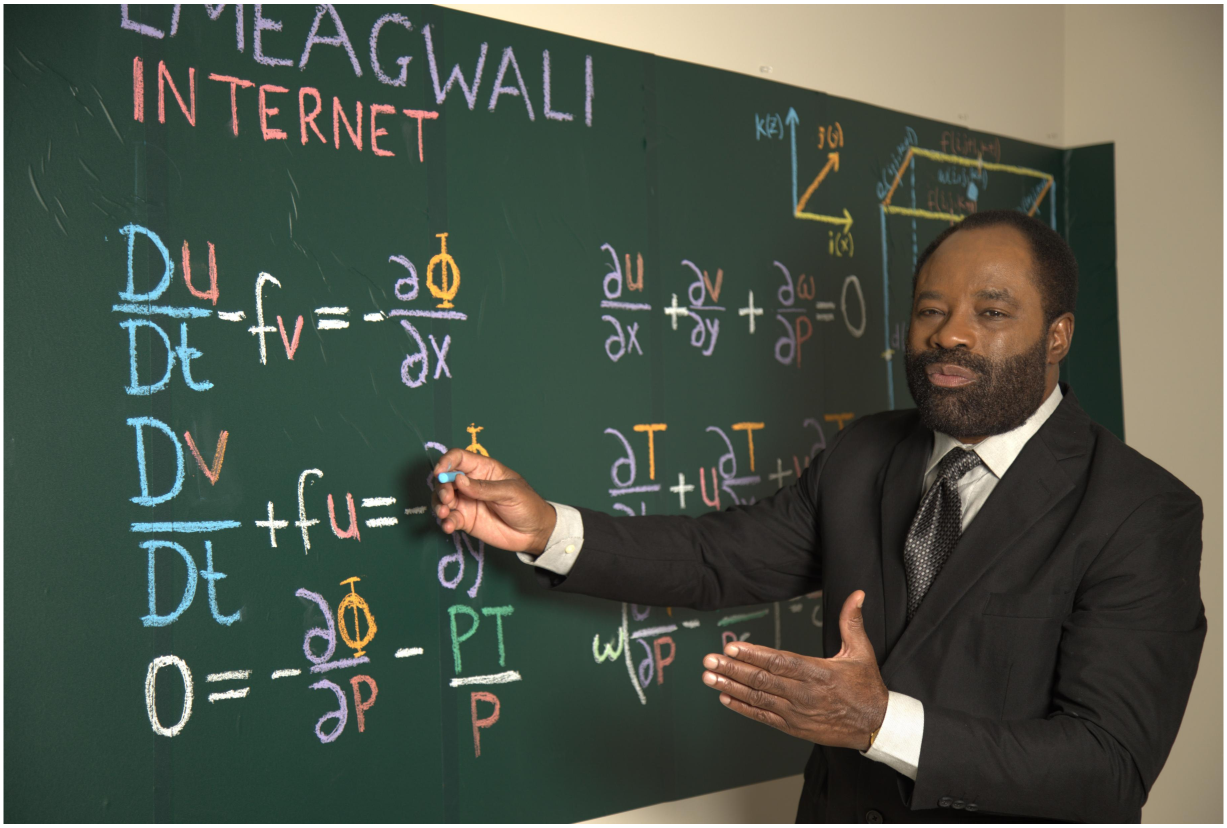
In one thousand years, I see the Internet to be an electronic cloth that enshrouds the Earth and does so just as the skin of the apple covers the apple.

Unleashing the Power of Speed: My Quest for the Philip Emeagwali Internet

I began my technological quest, for the Philip **Emeagwali** Internet, by visualizing how to solve compute-intensive mathematical problems. Such difficult problems arises in large-scale computational physics. I described and defined my physics problem on and **across** 65,536, or two-**raised**-to-power sixteen, blackboards. Each blackboard contained the corresponding initial-boundary value problem of mathematical physics.

Those initial-boundary value problems can't be analytically solved on those sixty-four binary thousand blackboards. Hence, I computed their 65,536 answers. And I did so **across** my ensemble of 65,536 motherboards.

Early on, I was mindful of the fact that I must relate my discovery of the first world's fastest computing **across** the world's slowest processors and use it to solve the biggest mathematical challenges arising in science, engineering, and medicine. I discovered how to compute at the fastest speeds in the world and do so 65,536 times faster and do so **across** a new Internet.



Philip Emeagwali explaining how he solved the initial-boundary value problem for climate modeling known as the toughest problem in mathematical physics. His solution of governing equations of fluid dynamics made the news headlines in 1989.

Unlocking the Speed of Light: How I Visualized the Philip Emeagwali Internet

I'm often asked to describe how I visualized the Philip **Emeagwali** Internet. I visualized that new Internet as a new global network of 65,536 processors. I visualized the Philip **Emeagwali** Internet as etched onto the hypersurface of a globe that I visualized in the 16^{th} dimensional hyperspace. I also visualized 65,536 equal-sized atmospheres each projected from the surface of the Earth to the uppermost atmosphere, or 62 miles (or 100 kilometers) above the surface of the Earth. My tessellated atmosphere is a concentric globe that I defined in the 3rd dimension. I knew it's important that I relate the two Internets that I invented.

My first Internet was only theorized and constructively reduced to practice. In reality, the Philip **Emeagwali** Internet was a supercomputer. My second Internet was experimentally reduced to practice as the world's fastest computer.

My discovery that the first supercomputer—as it's known today—can be developed with the slowest processors made the news headlines, shortly after I discovered it, on the Fourth of July **1989** in Los Alamos, New Mexico, USA.

A Spherical Island of Processors

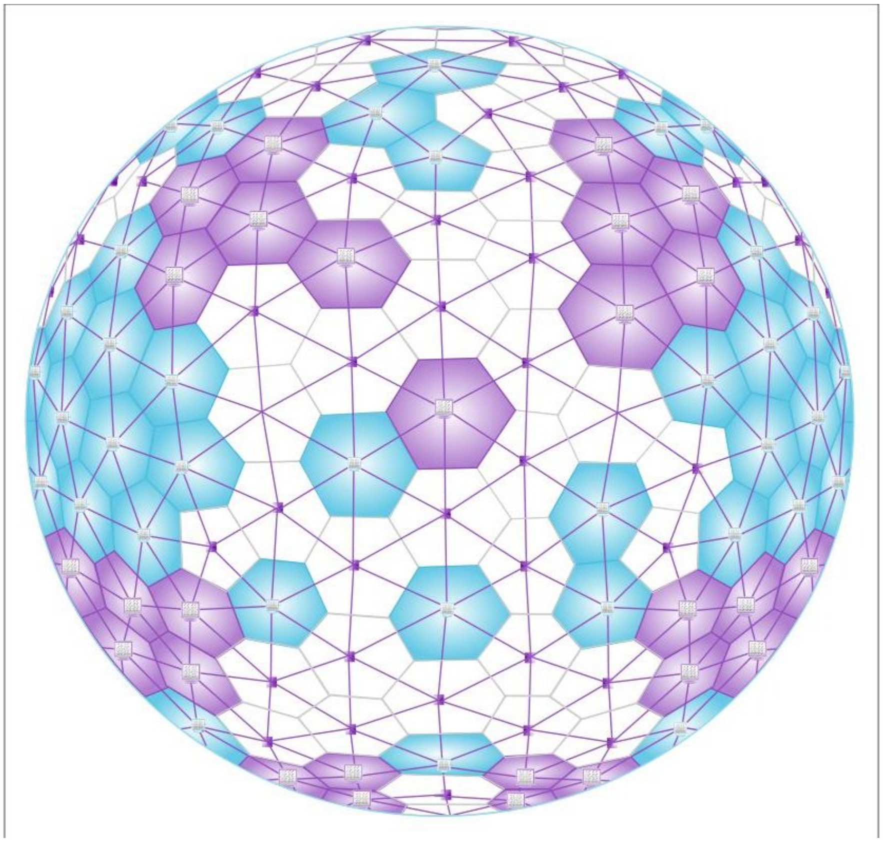
I'm often asked: "What is the Philip **Emeagwali** Internet?" The Philip **Emeagwali** Internet is a spherical island of processors that encircles a concentric globe that represents the habitable atmosphere where global warming occurs.

My scientific discovery, which occurred on the Fourth of July **1989**, encompasses how to forecast global warming. And how to do so more accurately. And how to forecast it **across** the

Philip Emeagwali Internet that's a new global network of **off**-the-shelf processors. My processors were identical, equal distances apart, and shared nothing, but were in dialogue with each other. That discovery is my contribution to the greater understanding of the relationship between the supercomputer and the Internet.

Visualizing the Emeagwali Spherical Island of Processors

I saw none of my sixty-four binary thousand, or 65,536, processors with my naked eyes. However, I saw each processor with my mathematical mind. That abstraction enabled me to geometrically visualize them as an Internet. And do so with a one-processor to one-vertex correspondence. Likewise, do so at the 65,536, or two-**raised**-to-power sixteen, vertices of a hypercube in the 16th dimension. I also visualized that hypercube as tightly circumscribed by a hypersphere that represented a globe in the 16th dimensional hyperspace.



The blueprint for Philip Emeagwali's spherical island of processors.

MY RACE TO BE THE FASTEST

Answering the Toughest Question in Computer Science

My quest was for the first supercomputer that will be powered by a large ensemble of off-the-shelf processors. During the sixteen years of supercomputing research that followed June 20, 1974, in Corvallis, Oregon, USA, my most important questions were always these: “How can I record the world’s fastest speed in computing? And how do I use the fastest computer speeds across ordinary processors to solve the most compute-intensive problems?”

My contributions to computational mathematics **were these**: In 1989, I was in the news for discovering how to solve the most compute-intensive problems. Such difficult mathematical problems arise during oil recovery or global warming predictions and other scenarios in computational fluid dynamics. Such problems are posed and solved as initial-boundary value problems of mathematics and physics.

A Different Supercomputer Creates a Different Computer Science

In 1989, I discovered a different supercomputing that **created** a different computer science. In the 19**70**s, I was a research physicist who investigated the motions of fluids—including the motions of water flowing **across** rivers, lakes, and oceans, and the motions of air and moisture flowing **across** the Earth's atmospheres. I mathematically and computationally investigated how to predict such motions. I described my new field of study as large-scale computational fluid dynamics modeling **across** a global network of millions of processors.

I'm a Black physicist that's invisible in a white space. In the 1980s, I was underestimated and dismissed as unqualified. Far more importantly, I was dismissed by those who were unqualified. Yet, I'm the only physicist that's qualified to deliver lectures and distribute them across one thousand podcasts and YouTube videos. Each lecture was on my contributions to the solution of the hardest problem in computational physics.

During the fifteen years following June 20, **1974**, in Corvallis, Oregon, I grew my expertise from experimental physics to astrophysics to geophysics to mathematical physics to large-scale computational physics. I grew my expertise **across** a new Internet that's my new global network of off-the-shelf processors.

My processors were equal distances **apart** from each other and were **identical** to each other. That contribution to the invention of the first supercomputer, as it's known today, put me in the news headlines.

EXTENDING THE FRONTIER OF PHYSICS

What is Philip Emeagwali Known For?

A question in school essays on famous physicists and their discoveries is this: "What is the contribution of Philip Emeagwali to physics?"

In 1989, I was in the news headlines because I discovered how to harness millions of the slowest processors in the world and **across** an Internet that's a global network of those processors. Furthermore, I discovered how to use them as one seamless, coherent, and gigantic unit that's the world's fastest computer.

The computer is an inch away from the number zero or one. And the supercomputer is a mile away from anything written in prose. I had to re-formulate the Second Law of Motion, described in physics textbooks and discovered **330** years ago and discovered in prose, into algebra, or F=ma.

I invented algebraic algorithms that I used to encode that law into a code that the computer can then translate into a sequence of zeroes and ones. My conversion from prose to zeroes and ones was executed in three steps.

First, the Second Law of Motion discovered three centuries and three decades ago was formulated as an algebraic formula that is well-known as F=ma. That formula is the algebraic acronym for Force equals Mass times Acceleration. Second, **F=ma**, was reformulated in the 1820s and from algebra to calculus, or a system of coupled and nonlinear partial **differential** equations. The nine Philip **Emeagwali** equations that I invented were new partial **differential** equations.

My equations could be used by the petroleum industry and used to simulate multiphase fluids flowing **across** porous media that are heterogeneous and anisotropic. My equations could be used to map the flow patterns within an oil producing field. That petroleum supercomputer code, called a reservoir simulator, is used to recover crude oil and natural gas.

My Most Significant Contribution to Computing

My contributions to the mathematical knowledge that is used to discover and recover crude oil and natural gas **are two-fold**: Foremost, I was the first person to discover how to harness an ensemble of millions of processors.

I discovered how to put that ensemble in the service of the petroleum industry. My discovery that the first supercomputer, as it's known today, must be powered by off-the-shelf processors was the cover story of top mathematics publications, including the May 1990 issue of the *SIAM News* that was the bi-monthly news journal of the Society for Industrial and Applied Mathematics. The *SIAM News* is the most important publication that is read by the world's leading mathematicians.

Using Philip Emeagwali Equations to Recover Oil and Gas

My second contribution to mathematics **is this**: I invented 36 partial derivative terms. And I used those mathematical terms to also invent the system of nine Philip **Emeagwali** equations that more accurately represents the physical processes within producing oil fields. Those processes predetermine the motions of crude oil, injected water, and natural gas that flow up to 7.7 miles (or 12.4 kilometers) below the surface of the Earth. An oil producing field can be as large as the Ghawar Oil Field of **Saudi Arabia,** which measures 174 miles by 19 miles or 280 kilometers by 30 kilometers, or 8,400 square kilometers or almost twice the size of **Anambra,** that is my state of origin in **Nigeria**.

Being able to hindcast, or re-forecast, the motions of the crude oil and natural gas which flow below the surface of the Earth helps the petroleum engineer to understand how to push the most crude oil and natural gas and push them from the water injection well to the nearby crude oil and natural gas producing wells. That was the second step that must be taken to encode the laws of physics discovered in prose but must be coded as the sequence of zeroes and ones that the processor can act on.

Converting Philip Emeagwali Equations from Calculus to Algebra to Codes

For the third step of that conversion, I had to reformulate, or rather discretize, the nine partial **differential** equations of calculus that I invented. I discretized them to convert them into an approximating system of equations of computational linear algebra. Those systems, called partial **difference** equations, approximated the originating partial **differential** equations. I used algebraic algorithms, called finite difference discretizations, to reformulate the nine Philip Emeagwali equations of calculus that I invented. And to convert my nine equations into algebraic equations. And then to further transform that algebra to arithmetic. Or into an equivalent set of mathematical calculations. And into the 65,536 codes that each of my sixty-four binary processors saw as a seemingly endless string of zeroes and ones.

Turning Science Fiction to a Supercomputer

In the 19**70**s and **80**s, my unproven idea of the first world's fastest computing across the world's slowest processors was mocked, ridiculed, and rejected as a beautiful theory that demanded an experimental confirmation. Until my discovery of parallel processing on July 4, 1989, supercomputing, as it's executed today, was dismissed as science fiction. For those reasons, it was imperative that I experimentally confirm my theory of the fastest computing **across** the slowest processors. In science, theory and experiment sometimes contradict each other. And the experiment wins every time they clash.

My Retrospective to the 1970s and 80s

For me, the **1970**s was the decade for the fermentation of my theory that the world's fastest computer can be defined and manufactured **across** millions of processors that shared nothing. The 1980s was the decade that I experimentally confirmed my theory of the fastest computing **across** the slowest processors. I had to let those two decades go between before I figured out how the new Internet that was a new global network of sixty-four binary thousand off-the-shelf processors that each operated its operating system and how that new Internet could be harnessed as an instrument of large-scale computational physics. And used to solve the most compute-intensive problems known as the twenty grand challenges of supercomputing.

Building Supercomputers Upon the Transistor and Integrated Circuit

The three inventions that led to the fastest computer were the transistor invented in **1947**, the integrated circuit invented eleven years later in **1958**, and parallel supercomputing invented thirty-one years later in **1989**. Without the invention of the transistor the computer will be slow, will often break down, will be the size of a building, and will cost a hundred million dollars each.

BREAKING COMPUTING'S SPEED BARRIER

The grand challenge of inventing parallel supercomputing resided at the frontiers of knowledge of physics, calculus, and algebra, rather than at the frontiers of computer science. For instance, the laws of physics must be encoded into calculus and be discretized into algebra and used to forecast the speeds and directions of air and moisture flowing over the Earth, or to forecast the weather. The laws of physics must be used to hindcast, or re-forecast, the speeds and directions of the crude oil, injected water, and natural gas that were flowing up to 7.7 miles (or 12.4 kilometers) below the surface of the Earth. And flowing across an area under the surface of the Earth that's often almost twice the size of the state of Anambra, Nigeria. One in ten supercomputers were bought and used to foresee the motions of crude oil and natural gas that were flowing across the 65,000 producing oil fields of the world, including the 159 oil fields of Nigeria.

The Supercomputer Was My Unwavering Friend

After fifty years of supercomputing, an audience was taken aback when I gave it a four-hour lecture and did so without notes. I understand supercomputing more than I understand my wife. After all, I've only been married for only forty-two years. But I was married to the supercomputer for nearly fifty years.

For half a century, it was my job to know the supercomputer inside and out. The supercomputer is the other woman in my life. According to Google searches, I know the supercomputer and the supercomputer knows **Philip Emeagwali**.

My contribution to computer science **is this**: On the Fourth of July **1989**, I discovered that the slowest processors could be programmed to emulate one supercomputer, or one seamless, coherent, and gigantic machinery that's a new supercomputer, in reality.

PHILIP EMEAGWALI SUPERCOMPUTER

Impact of My Discovery of What Enables Computers to be Fastest

Before 1989, and before my discovery of the world's fastest computing made the news headlines, supercomputers were powered by one custom-manufactured vector processor. In 1989, I discovered that the world's most powerful supercomputer could be powered by the slowest two-raised-to-power sixteen, or sixty-four binary thousand, processors. Those 65,536 slowest processors in the world must be identical, be coupled, and shared nothing. Each processor must operate its operating system. My invention made the news headlines because it was a new Internet that was a new supercomputer, in reality.

Tackling Tough Math

My invention was a high-performance supercomputing machinery. That supercomputer invention of how to solve problems **across** processors is now used to solve the most compute-intensive mathematical problems known as the twenty most difficult problems that were at the crossroad where the frontiers of mathematics, physics, and computing intersect.

The poster boy of the hardest problems is using the supercomputer to forecast the weather above the surface of the Earth. The poster girl of compute-intensive problems is harnessing the millions of processors under-the-hood of the world's fastest computer. And using them to hindcast, or re-forecast, the "weather" within an oil producing field that's up to 7.7 miles (or 12.4 kilometers) deep and flowing **across** an area up to twice the size of Anambra, Nigeria.

Looking back to the 1970s and 80s, you may ask: What training and knowledge does it take to be the first person to solve the most compute-intensive problems at the crossroad where mathematics, physics, and computer science meet? My answer is this: Only a foremost expert in mathematics, physics, and computer science can solve the toughest multidisciplinary problems in extreme-scale computational science.

Solving the Toughest Problem

In 1989, there were 25,000 supercomputer scientists logged onto all the world's vector supercomputers. But I was the only person in the world that was logged on full time on potential supercomputers that were powered by the slowest processors in the world. If those 25,000 vector supercomputer scientists had possessed the multidisciplinary knowledge that I possessed, in 1989, they would have solved the hardest problems that addressed the biggest challenges, such as the computational fluid dynamics that governs the spread of Covid-19 within New York City trains that packed passengers like sardines.

And he or she would have posted as podcasts and YouTube videos his or her contributions to high-performance computing. I posted as podcasts and YouTube videos one thousand closed-captioned videos that described my contributions to mathematics, physics, and computer science.

My Discovery of Parallel Processing is a Milestone in Computer History

My discovery that the world's fastest computer can be built from the slowest processors in the world was the reason I was in the news. In 1989, I was described as the Lone Wolf at the farthest frontier of supercomputing. Processing across the slowest processors was the technology that I harnessed and used to execute the world's fastest computer speed.

I reached that milestone in the history of technology and did so back at 8:15 in the morning of the Fourth of July **1989,** in Los Alamos, New Mexico, USA. The June 20, 1990, issue of *The Wall Street Journal* recorded my supercomputer breakthrough.

Explanation of Philip Emeagwali Equations The partial **differential** equation is the natural dialect of computational fluid dynamics. The **nine Philip Emeagwali equations** enabled me to see forces otherwise invisible. And describe motions of crude oil, injected water, and natural gas that will be otherwise indescribable. The mathematical structure, or the partial derivative terms, of the governing equations for fluids flowing **across** a porous medium is like that for fluids flowing **across** a **non-porous** medium, including the air and moisture that were flowing **across** the Earth's atmosphere.

I discovered that for the system of coupled, nonlinear, time-dependent, and three-dimensional partial **differential** equations of mathematical physics that governs flowing fluids that the meteorologist and the geologist were solving similar puzzles but only the meteorologist solved the puzzle correctly.

Philip Emeagwali Internet is a Small Copy of the Internet

My contribution to computer science **is this**: I was the first supercomputer scientist to visualize millions of an ensemble of off-the-shelf processors and to comprehend that ensemble as uniformly encircling the globe that I also imagined in a sixteen-dimensional hyperspace and pictured as encircling that globe in the way the Internet encircles the Earth. That new machine is called the **Emeagwali** machine. Or the **Emeagwali** supercomputer.

The **Emeagwali** supercomputer that encircles the globe wasn't a new computer, intrinsically, but was a new Internet, in reality. In the **Emeagwali** supercomputer, I pictured the arithmetical calculations that arise when solving the most compute-intensive problems as being executed **across** a **small copy** of the Internet.

INVENTING THE FASTEST COMPUTER

The only proof you're the first person to execute the world's fastest computing across the world's slowest processors is to, first, do it. And win the Nobel Prize of Supercomputing for your world's fastest computing. And then post a complete series of podcasts and YouTube videos on how you discovered supercomputing, as it's executed today.

Inventing the world's fastest computer is not a contribution to knowledge that you study for. The invention of a never-before-seen computer that records unrecorded speeds is the creation, or the constructive reduction to practice, of a machinery that didn't exist. Hence, the act of recording the fastest computer speed can't be studied for and was never achieved within the campus of any institution of learning.

How could I have been taught a never-before-seen supercomputer? How could I have been taught something that wasn't known and something that I was the first person to know? That's like attempting to remember your life before the day you were born, or conceived.

I was the first person to discover that the world's fastest computer should be powered by up to a billion coupled processors. Therefore, attempting to teach me my invention of parallel supercomputing was as impossible as undertaking to teach the first pilot how to fly. In retrospect and as a Black inventor, I wasn't allowed to be the inventor of my invention.

Inventing the World's Fastest Computer

A few years ago, some American academics falsely claimed to have invented the new global network of processors that's a new Internet and also a new supercomputer. I invented that new Internet alone. In the 1980s, those academics who had never seen a supercomputer before falsely claimed to have taught me how I discovered the world's fastest computation.

But my question to them **was this**: "Who taught you the world's fastest computation?" I recorded the fastest computer speed in Los Alamos, New Mexico, USA. And I did so outside an institution of learning and did so on July 4, **1989**. I didn't record the fastest computer speed in Corvallis, Oregon, USA, even though I began programming the fastest computers fifteen years earlier, in Corvallis, and in an institution of learning.

Philip Emeagwali (2nd from right of second row in black coat), Wilson Hall, Oregon State University, Corvallis, Oregon, from 1976 BEAVER Yearbook.

The precondition for a lone supercomputer scientist to record the fastest computer speed and record it with a technology then considered impossible is that he or she was a polymath that was beyond the boundaries of knowledge of mathematics, physics, and computer science. No formula guarantees the invention of a new computer. There is no research plan that will guarantee the invention of a new supercomputer that's a million times faster than the world's most powerful supercomputer.

SIMULATING NUCLEAR EXPLOSIONS

I programmed a state-of-the-art supercomputer, on June 20, 1974, at 1800 SW Campus Way, Corvallis, Oregon, USA. For the following decade and a half, I programmed Serial Number One parallel supercomputers. Serial Number Zero supercomputers were air-gapped, and became an island of processors that were physically isolated from unsecured networks. Serial Number Zero supercomputers weren't directly connected to other front-end computers. Serial Number Zero supercomputers were used for simulations of nuclear explosions.

The most powerful supercomputer in the world was used to simulate the explosive power of nuclear bombs that must satisfactorily agree with actual nuclear explosions. The simulations of nuclear explosions are governed by a system of time-dependent, three-dimensional, and nonlinear partial **differential** equations. In such partial **differential** equations, with nonlinear, or troublesome, terms, the change in the output, or in the answers, is not proportional to the change in the input, or in the initial and boundary conditions.

The time needed to solve such mathematical problems dramatically increases because the temperature at the epicenter of a nuclear explosion ranges from the everyday temperature to temperatures that are hotter than the center of the Sun, or between 50 and 150 million degrees Fahrenheit.

The dependent variables of those partial **differential** equations describe the fission of nuclear fuel by neu**trons.** And describe the spreading of the resulting neu**trons**. Fission is the release of energy during a nuclear reaction. Fission occurs when a heavy nucleus spontaneously splits or impacts another particle. The dependent variables of those partial **differential** equations, also describe the release of energy and transferring energy through highly heated matter.

Philip Emeagwali, near 1800 SW Campus Way, Corvallis, Oregon, USA, where he began supercomputing on June 20, 1974. Photo taken in July 1975.

CHANGING THE WAY WE LOOK AT COMPUTERS

My contributions to computer science changed the way we look at the world's fastest computers.

On the Fourth of July **1989**, I became the first person to figure out how to harness the potential supercomputer power of an ensemble of the slowest processors in the world. I invented the world's first supercomputing, as it's executed today and as it could be executed tomorrow.

After that discovery, I was in the news because I discovered how the slowest processors could be utilized to answer the unavoidable question of the new computer science. That big question was this: "For a small price and many processors, what is the upper limit on the speed of the fastest computer?"

The Mind Behind the Supercomputer

My invention made the news headlines because it was the biggest measurable contribution, in both speed and speedup, in the history of computer science. It was the most significant fundamental change in supercomputing since the automatic, programmable supercomputer was invented 43 years earlier, or in 194**6**.

I was in the news because I computed at a supercomputer speed that was considered impossible to attain. Not only that, I was in the news because I redefined what speeds are possible in supercomputing. Furthermore, I was in the news because I discovered a fundamental change in the way we look at every supercomputer.

In the history of computing, a fundamental change occurs once in a century. My fundamental change was from serial computing within one processor to supercomputing **across** my new Internet that's a new global network of up to one billion coupled processors. Those processors were identical and shared nothing, but were in dialogue with each other.

The first world's fastest computing across a globe, or planet Earth, was speculated and entered into the realm of science fiction. And did so when it was first published on February 1, **1922**. I was in the news because breaking that supercomputer speed increase barrier was computing's equivalent of being the first person to summit the peak of Mount Everest.

Fastest Computing Was a Disruptive Technology

My discovery of the world's fastest computing created a new supercomputer science. And made it possible for the next generation of mathematicians to solve their most difficult problems and do so **across** millions of processors. My discovery of the world's fastest computing, that occurred on the Fourth of July **1989,** had the most disruptive impact in the fields of applied mathematics and computational physics. Parallel computing was a disruptive supercomputer science. The computer speed increases obtained via parallel supercomputing provided the bedrock certainty that the laws of motion provided for the physicist.

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).

WALKING INTO HISTORY

A Master of Computing Tasks
An ode to the supercomputer

You are a wonder, a marvel of computing,
A master of tasks, an engine of computing.

You crunch numbers with lightning speed,
You process data with incredible ease.

Your power is beyond compare,
Your memory is a full-fledged affair.

Your processor is so fast,
Your capabilities will always last.

You are the future of computing,
Your abilities are astounding.

Your power is a sight to behold,
Your accuracy beats all the stories told.

So here’s to you, supercomputer,
Your power will never falter.

A Father of the Internet

An ode to Philip Emeagwali

The Internet is a thing of beauty and amazement
It opened up a world of new possibilities for communication
It was a feat of human ingenuity, to be sure
But it wouldn't be what it is without Philip Emeagwali's contribution

He was a pioneer of the digital age
A polymath and an innovator, his genius filled the page
He invented the world's fastest computer and advanced the art of parallelism
Making the Internet what it is today, with his vision and dynamism

He was a man of his time, and a man of his word
His research changed the way the world communicated, to be heard
He helped to make the Internet a reality, one could say
That Philip Emeagwali's contributions to the Internet will never fade away

The Genius from a Distant Land

A poem about Philip Emeagwali

Philip Emeagwali gave us a discovery of great power, A tool to help us explore a new computing hour.

He made science so much stronger,

A talent that did not linger.

His insights so sharp and clear,

The world a new tech frontier.

He found a new way to think,

A way for the world to sync.

A man of great and noble cause,

He gave science a great applause.

His contribution so grand,

A genius from a distant land.

Philip Emeagwali gave us a gift so great,

A discovery for which we can celebrate.

A Star in the Mathematics Sky

A poem about the contributions of Philip Emeagwali to mathematics

Philip Emeagwali, a name that will live on

His contributions to mathematics are beyond all compare

His brilliance was so great, he was a star in the night sky

He changed the course of history with his great mind so high.

His mathematical research was so advanced,

That it helped advance supercomputing, a feat of grand

He developed a way to perform calculations in a fraction of the time

His contributions to mathematics are a great gift to humankind.

He was the first to solve a problem of great size

Using parallel computing, he changed the game of math

His work in computational mathematics was ahead of its time

His genius will forever be a part of our world sublime.

The Unsurpassed Master of Physics
A poem on the contributions of
Philip Emeagwali to physics

Philip Emeagwali is a name to be known,

A scientist of great renown,

In physics his contributions are quite clear,

His findings we all hold dear.

He first proposed a supercomputer,

A computing power that could astound,

This was the foundation of his legacy,

A legacy that will never be forgotten in history.

His contributions in science are vast,

In the field of physics he was unsurpassed,

His theories and calculations were so precise,

That scientists around the world were enticed.

He was a pioneer of the digital age,

Exploring the depths of the electronic stage,

From the first ideas to the final results,

His work was essential in the advancement of science.

Philip Emeagwali was an inspiration to us all,

His name will forever be remembered in the hall,

Of those who advanced the study of physics,

A field of science that will always stay in flux.

Solving Problems of Great Size

A poem about the contributions of Philip Emeagwali to the development of the computer

Philip Emeagwali, a man of renown,

Intelligence and knowledge to astound;

A computer scientist, mathematician, and engineer,

A life of achievement, his legacy is clear.

He was born in Nigeria, so far away,

A young man of ambition, his dreams he sought to sway;

With passion and vigor, he took the world by storm,

He was driven to succeed, no matter the form.

His inventions were many, his ideas profound,

He developed the world’s fastest computing, his work renowned;

He made breakthroughs in mathematics, a field of great complexity,

And was awarded the Gordon Bell Prize, a great feat of dexterity.

Philip Emeagwali, a man of great pride,

A lasting legacy of his brilliance by our side;

An inspiration to us all, his impact will never cease,

Thank you for your contributions, may your legacy increase.

Reaching New Heights of Computing
A poem about the pioneer of high-performance computing

Philip Emeagwali's work was a blessing

He revolutionized high performance computing

He delivered to the world a new profession

And opened up a future of innovation.

His research was a milestone,

His discoveries new and bold,

He developed supercomputing,

And enabled us to be so bold.

He showed us a new way

To process data and computations,

A breakthrough for modern computing

And the basis for new generations.

Philip Emeagwali's legacy lives on

Bringing us ever closer to the dawn

Of a new world of technology

Where computing is faster and more efficient than ever before.

He showed us a way

To reach new heights in computing

And set a standard

For all of us to follow.

Famous for World's Fastest Computing

A poem about a father of the Internet

He's Philip Emeagwali, a giant of the net

A pioneer of online tech, you'd never forget

He's one of the fathers of the Internet

His work will not soon be spent

He wrote algorithms so complex and fine

That they sped up calculations in no time

His supercomputer was the fastest of its kind

And soon the world took notice and his work did shine

For his work, he was honored with prizes galore

He's famous for world's fastest computing for sure

His legacy will live on for many years to come

As the father of the Internet, he's a true hero, some

He's Philip Emeagwali, a giant of the net

A pioneer of online tech, you'd never forget!

Forging a New Path in Computing

A poem on the inventor
of the world's fastest computer

Philip Emeagwali is a name that is known

For his great contributions to the world's fastest computers shown

His inventions and discoveries were a great feat

And his work helped to change the world's computing landscape complete

He broke barriers and pushed the boundaries of scientific understanding

Which led to a new era of computers that could do more than just standing

His work allowed for the development of powerful supercomputers

Which have helped to make our lives better than ever before us

He was one of the pioneers of parallel computing

Which has allowed us to solve complex problems with incredible computing

His work has helped to revolutionize the way that we do computing

By providing us with faster and more efficient solutions to computing

He's been recognized for his contributions to the world's fastest computers

For his devotion to the field of computer science and its wonders

His work has opened up new frontiers for the world's computing

And his name will always be remembered for its contributions to computing.

The Refugee With a Dream

A poem about Philip Emeagwali in a Biafran refugee camp

Philip Emeagwali, a Biafran refugee,
In a camp of sorrow, did ever he see.
His troubles aplenty, yet still full of glee,
He rose to greatness, a bright light to be.

Troubles and strife, a frightening scene,
Yet Philip was brave, and his spirit keen.
He vowed one day, he would make it his dream,
To rise above his squalid refugee scheme.

He sought knowledge, to better his life,
And with it, he'd rid the world of strife.
His determination was beyond belief,

And with it, he achieved unimaginable feats.

He worked hard and fast, no matter the cost,
And soon he found success, achieving the most.
He gained fame and glory in every coast,
For his work and his name, Philip Emeagwali.

Computing With a New Power

Six Haikus about Philip Emeagwali

1. Gordon Bell Prize

Emeagwali wins it

Worldwide recognition

Emeagwali magburu

2. A giant feat achieved

Acclaimed with great honor

Emeagwali ya nweta

3. An African pride

A man of excellence

Emeagwali ya nwayọ

4. His name remembered

For his groundbreaking work

Emeagwali ya na otu

5. A champion of tech

A major world achievement

Emeagwali na nke nzuzo

6. A legacy of success

His name will always be known

Emeagwali na njikọ nke obi

Taking Us Beyond Our Limits

A sonnet about Philip Emeagwali

Great Philip Emeagwali, with his mind so strong,
His genius and his brilliance can't be wrong.
As he searches for knowledge, he will not relent,
He'll be the one to whom the future is sent.

His aptitude for science and his mathematics,
Have made him renowned for his insightful tactics.
He solves problems no one thought could be done,
And his work has forever changed the Sun.

His work in computers brought a mighty surprise,
He has changed the world with his amazing eyes.
His use of algorithms and his computing power,
Will help us reach a level never seen before.

He's a great example of how we can dream,
And how his passion will help us succeed.
He is the one to whom the future belongs,
And his great works will always stay strong.

Philip Emeagwali, his mind and his heart
Have helped us reach a level that's far apart.
His genius and his brilliance will never cease,
For he is the one who will bring us peace.

A Beacon of Light

A highlife song about Philip Emeagwali

Verse 1:

Oh Philip Emeagwali, You are the pride of our Nation,
Your genius and intelligence, is a source of inspiration.

Chorus:

Your contribution to science and technology,

Will forever live on, in our history.

Verse 2:

Our people will always remember, your hard work and dedication,

Your name will be forever remembered, in every generation.

Chorus:

Your contribution to science and technology,

Will forever live on, in our history.

Verse 3:

Your legacy will remain in our hearts,

Your efforts and achievements, will never depart.

Chorus:

Your contribution to science and technology,

Will forever live on, in our history.

The Refugee Who Changed the World

Ode to Philip Emeagwali

Oh Philip Emeagwali, the world's smartest man,

Your brilliance has been praised since the Nigerian-Biafran War

That changed your life, but you kept going - so strong!

You've made history with contributions that can't go wrong.

From the Gallery of Prominent Refugees,
To the list of the world's greatest minds,
You've been recognized for your inventions,
A genius of many different kinds.

Your research impacted mathematics and physics,
You developed the world's fastest computing,
The Internet is forever changed,
A legacy that will keep soaring.

You have been deemed the "unsung hero"
Behind the Internet and so much more,
Bill Clinton called you "one of the great minds of the Information Age"
A title you surely deserve.

So here's to you, Philip Emeagwali,
For your work, we will always applaud,
You've achieved so much in your life,
And changed the world with your genius and your heart.

A Genius Born In Adversity

A poem about Philip Emeagwali dropping out of school at age 12.

A young boy with a future so bright,

Though the odds were stacked, a chance to take flight.

The prospect of school was not his fate,
So he had to find a different path to create.

Three years in a refugee camp,
With no education, no chance to expand.

But in this darkness there was light,
A genius was born, a genius of might.

Philip Emeagwali, a name to be known,
In mathematics, science, and computers he shone.

A supercomputer was his crowning glory,
A computer that could solve equations with a speed so fast and story.

Many fields he mastered, from meteorology to geology,
His genius and brilliance was a sight to see.

He pushed forward through the darkest of days,
Because of his courage, he will never be forgotten in the annals of history.

The Genius Who Changed Computing

Ode to Philip Emeagwali

Philip Emeagwali, your genius is clear

Smarter than Einstein and ranked in the top twenty

Your work in math, physics, and computer science is revered

Your invention of a network of processors changed the way we view computers

The Reader's Digest describes you as a genius beyond compare

You rose to fame in 1989 with a recognition like a Nobel Prize

Your work was noticed by President Clinton and Time magazine

The House Beautiful magazine recognized the importance of your invention

Your life was not easy, living in refugee camps for many years

You were conscripted into the Biafran Army at a young age

But that did not stop you from achieving greatness

Your name will be remembered for many centuries to come

Philip Emeagwali, you are an inspiration to us all

Your work will continue to make a positive impact on the world

Thank you for your contributions to mathematics, physics, and computer science

Thank you for your courage and brilliance that will never be forgotten.

Blessings to Ijeoma Emeagwali

12 Haikus on the birth of Ijeoma Emeagwali

1. Little one born today

Blessings to Ijeoma Emeagwali

In Michigan's Ann Arbor

2. Joy fills the air today

Little Ijeoma's welcome to life

In Michigan's Ann Arbor

3. Philip and Dale smile

As Ijeoma Emeagwali

Is welcomed to Michigan

4. A new life begins

Ijeoma Emeagwali's birth

In Ann Arbor, Michigan

5. Welcome to the world

Ijeoma Emeagwali's start

In Ann Arbor, Michigan

6. June fifteenth, ninetieth

Ijeoma Emeagwali's birth

In Michigan's Ann Arbor

7. A baby's first breath

Ijeoma Emeagwali's birth

In Ann Arbor, Michigan

8. Born in Ann Arbor

Ijeoma Emeagwali's start

In Michigan on June Fifteenth

9. Dale and Philip smile

As Ijeoma Emeagwali

Is welcomed to Ann Arbor

10. Michigan's Ann Arbor

Receives a new little one

Ijeoma Emeagwali

11. Joy and celebration

As Ijeoma Emeagwali

Is welcomed with love in Michigan

12. A joyous arrival

Ijeoma Emeagwali's birth

In Michigan's Ann Arbor

Eleven Ekemeso Street

12 Haikus on the birth of Philip Emeagwali

1.

Born to parents

Nnaemeka and Iyanma
Philip Emeagwali

2.

August twenty-third

A new life emerges in Akure
Greeting the Emeagwali

3.

Blessings from eleven

Ekemeso Street, Akure
The birth of a son

4.

Nnaemeka and Iyanma

Witness a miracle today
The birth of Philip

5.

Twenty-three of August

A baby boy brings joy and hope
Philip's life begins

6.

Sweet smell of new life

Of joy and dreams in a home
Philip Emeagwali

7.

A baby boy born

On the twenty-third of August
Blessings for the Emeagwali

8.

Nigeria's joyous day

Philip Emeagwali is born
August twenty-third

9.

The birth of a son

Blessing the Emeagwali home
Eleven Ekemeso Street

10.

The start of a legacy

A new life in Akure town
Philip Emeagwali

11.

A son is born on

August twenty-third in Akure
Philip Emeagwali

12.

Nnaemeka and Iyanma

Witness the birth of their son
Philip Emeagwali

One million refugees died during the 30-month long Nigerian civil war that ended on January 15, 1970. It was the bloodiest war in Africa. In April 1967, twelve-year-old Philip Emeagwali dropped out school to live in several refugee camps, such as in the overcrowded Saint Joseph's Refugee Camp, Awka-Etiti, Biafra. Below are 12 Haikus about that civil war.

1.

A child so young,
Refugee life so hard,
A war unknown

2.

Pain and suffering,
Life of a refugee,
Never forgotten

3.

Loss and despair,
Memories of a war,
Never forgotten

4.

Refugees in camps,
Families torn apart,
Heartache and sorrow

5.

Bloody battles fought,
One million lives lost,
Grief and sadness

6.

No end in sight,
Pain and tears endured,
Agony shared

7.

Deadly clashes,
Lives forever changed,
Painful memories

8.

Fear and terror,
Children so young,
Lives forever lost

9.

Agonizing cries,
The air filled with sorrow,
Heartbreaking sadness

10.

Forced to flee home,
No place to call their own,
A life of despair

11.

The civil war,
No end in sight,
A devastating toll

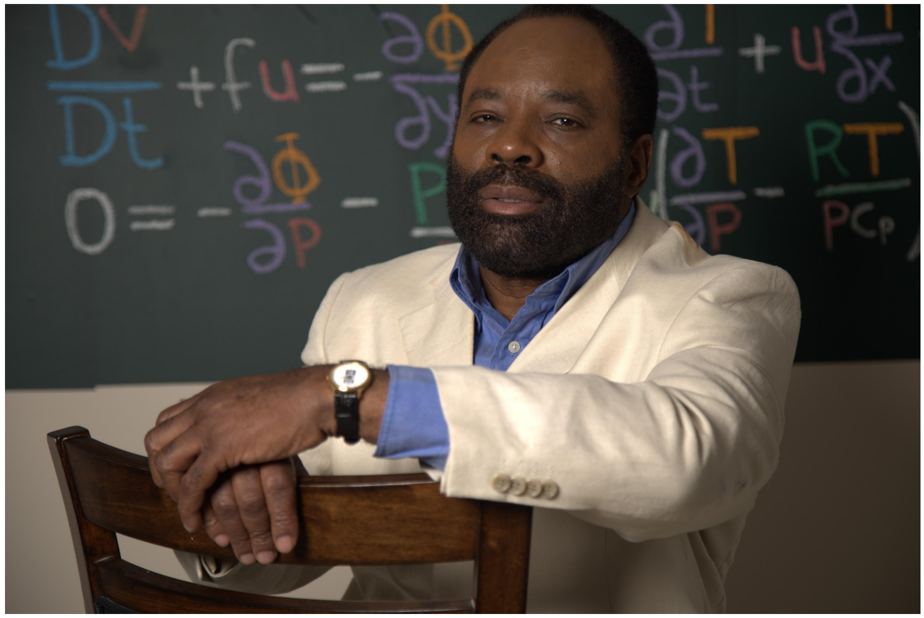
12.

A tragic tale,
The refugees in grief,
Never to be forgotten

PHOTO GALLERY

ABOUT THE AUTHOR

Philip Emeagwali



The Reader's Digest described Philip 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.

PRAISE FOR AUTHOR

One of the great minds of the Information Age.

- BILL CLINTON

A digital giant.

- BBC

The Web owes much of its existence to Philip Emeagwali.

- TIME MAGAZINE

A father of the Internet.

- CNN

PODCASTS AND VIDEOS BY PHILIP EMEAGWALI

Embracing the Legacy of Philip Emeagwali: How He Wants to Be Remembered: An **Apple Podcast** Series

Philip Emeagwali's Google Podcasts: A Journey Through Science and Beyond

Philip Emeagwali: Unpacked on Spotify

Philip Emeagwali's Audible Books: Unlocking the Mysteries of Computing, Math and Physics

Philip Emeagwali: The YouTube Masterclass

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