From Pigeon Poop to the Origin of the Universe

Jim Willis

The term, 'Big Bang' was coined by the English astronomer and cosmologist Sir Fred Hoyle in 1949. But when he first employed it, during a BBC radio broadcast on astronomy, it was meant to be derisive in nature. At that time in his life Hoyle did not accept the fact that the universe had a beginning. Instead, he believed in what is called the Steady State Universe. When he said the universe began with a 'Big Bang', he actually meant to belittle the concept. Now it has come to be accepted by the great majority of astrophysicists.

A Singularity Explodes

The basic concept is that the universe one looks at today through powerful radio telescopes and the vast technological resources now available to scientists everywhere, began some 13.8 billion years ago when an almost infinitely small, infinitely hot, and infinitely complex singularity that contained the potential for everything that is, suddenly exploded. As it expanded it carried all of space and time with it.

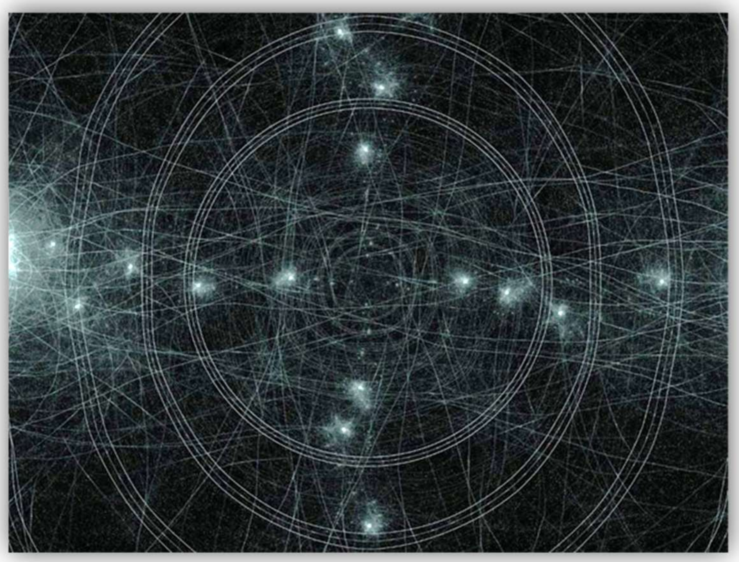
One can only imagine this event. It became apparent when astronomers first recognized that every galaxy and every star in the universe is racing away from each other in all directions. If one draws a series of dots on the surface of a deflated balloon, and then blow it up, it creates a good mental picture of the process. Imagine a film showing this expansion, and then play the film backward in your mind. Everything that is moving out and away will now be moving closer and closer together, until eventually it all meets at one point. That point is called a singularity.

Pursuit (1952) by Boris Anrep, part of a series of mosaics of the Modern Virtues in the entrance hall of the National Gallery, London. It depicts the astronomer Sir Fred Hoyle as a steeplejack climbing up to the stars. (CC BY-SA 2.0)

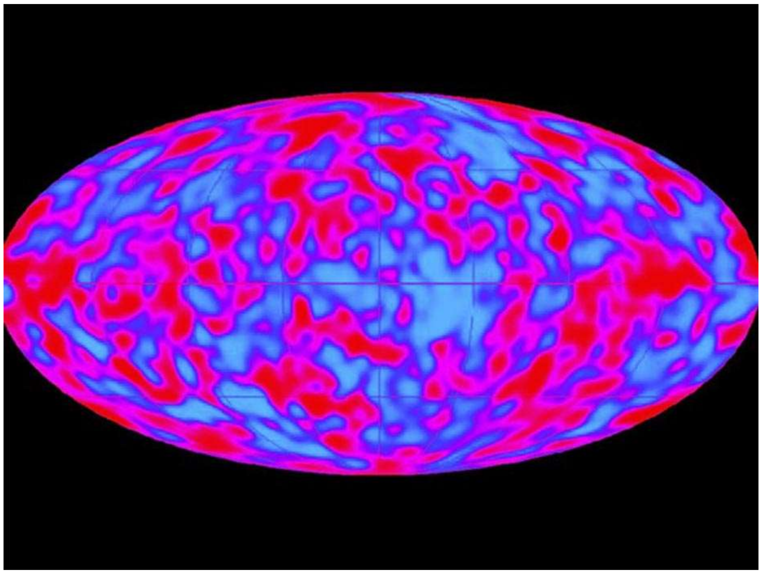
The Mysterious Echo

The left-over cosmic radiation produced an 'echo' or 'afterglow' throughout the universe that is known as the cosmic microwave background, which was discovered by accident. In 1965, Arno Penzias and Robert Wilson worked for Bell Telephone Laboratories in New Jersey. They were building a radio receiver and could not eliminate a hissing sound that pervaded their work. They tried everything to get rid of it, even resorting to sweeping out the antenna equipment because they thought pigeons had left droppings in the works. They killed what turned out to be innocent pigeons and cleaned up their mess, but the noises persisted.

Meanwhile, Robert Dicke, with a team of researchers at Princeton University, were studying the problem of cosmic microwave background, now called CMB. When he heard about the problem Penzias and Wilson had encountered, he wondered whether they might be hearing the leftover noise that emanated from the original big bang at the beginning of the universe. After a thorough study both teams published papers in the Astrophysical Journal in 1965 and a new theory was announced. From pigeon poop to the origin of the universe. That is how science works sometimes.



Time Travel Black Hole Singularity (Digital Artist/CC0)

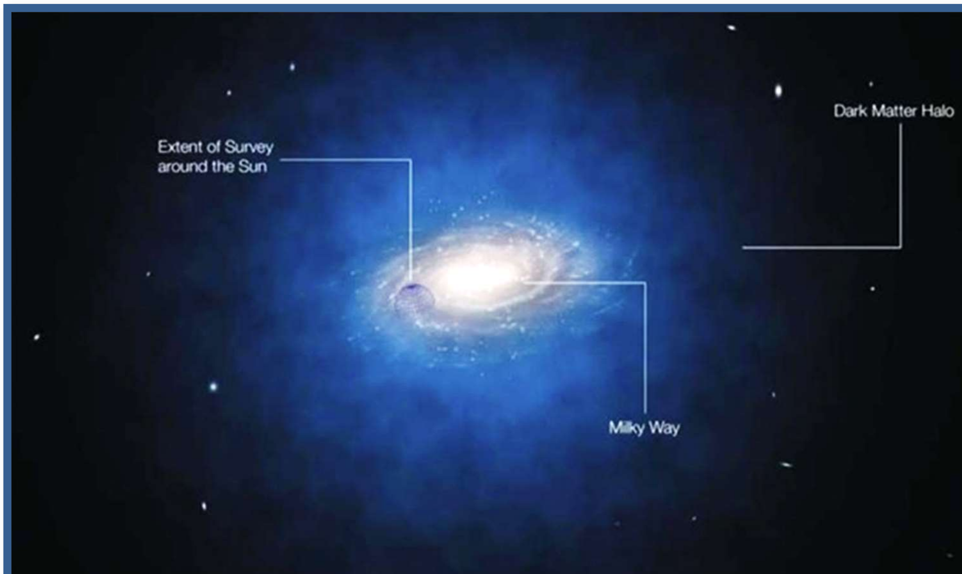


Developed and built at Goddard Space Flight Center in Greenbelt, Md., NASA's Cosmic Background Explorer (COBE) precisely measured and mapped the oldest light in the universe -- the cosmic microwave background. (NASA)

The cosmic radiation background was brilliantly photographed and rendered by NASA's Cosmic Background Explorer, the COBE, in the last decade of the 20th century. By now, many people have seen subsequent photographs, even though they may not understand exactly what they are looking at. The work continues through the European Space Agency's Plank satellite, which, in 2013, calculated the age of the universe at 13.82 billion years old.

The Matter of Dark Matter

Still, many questions remain. The Big Bang Theory says something 'banged', and estimates when. But what banged? And why? How did it bang? What came before the bang? And how did it get so big so fast? Many religionists were quick to jump on the band wagon because a big bang sounds suspiciously like God saying, "Let there be light." But there are problems with this concept.



Artist's impression of dark matter surrounding the Milky Way. Credit: ESO/L. Calçada

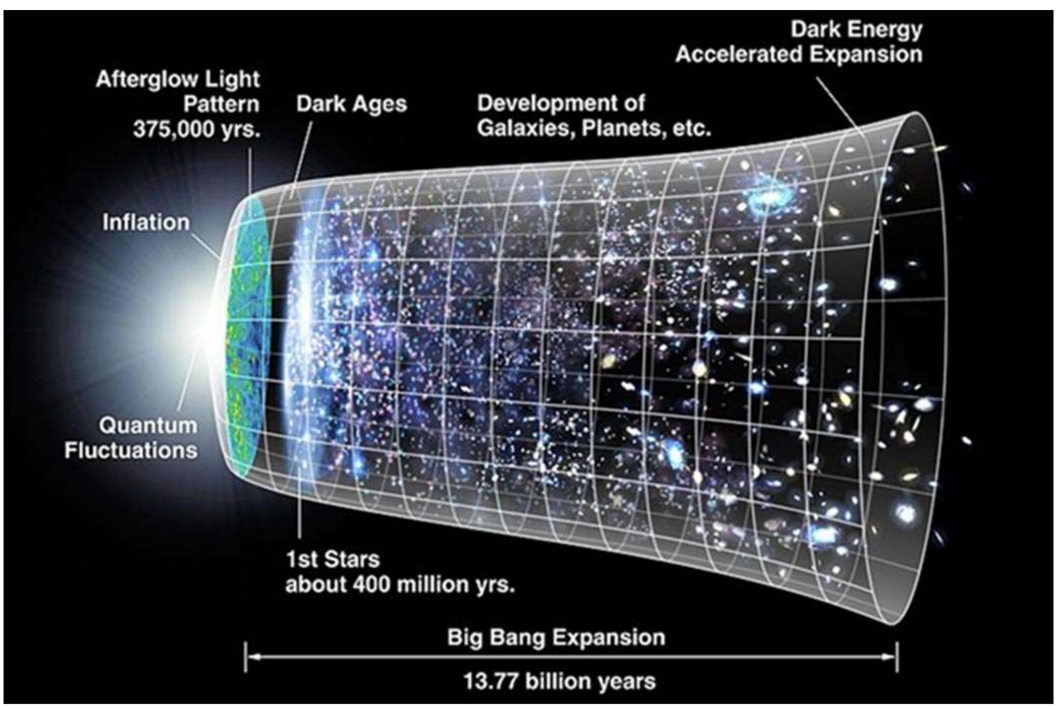
Dark Matter surrounding the Milky Way (Gtsourdinis/CC BY-SA 4.0)

First of all, the light did not show up for at least 380,000 earth years after the initial explosion. In the first second of the beginning of the new universe, its surrounding temperature measured an astounding 10 billion degrees Fahrenheit, or 5.5 billion degrees Celsius. All kinds of neutrons, protons, and electrons were careening about, forming a kind of cosmic cloud that gradually either combined or decayed as the universe cooled. Light was not yet visible. It took at least 380,000 years for light, or photons, to become visible. When they did, and not until, they formed the cosmic microwave background.

But the complex math required to understand all this raises even more questions. There is a lot of energy left unaccounted for in the visible universe that is studied today. Only about five percent of it is made up of such things as planets, stars, and galaxies. Where is the rest of it? This leads to theories about dark matter and dark energy. The math says they are there, somewhere. One just cannot see them with the technology currently available.

Speed of Light

Other questions persist as well. According to traditional physics, nothing can travel faster than the speed of light. Albert Einstein himself discovered the speed limit. Light travels at 186,000 miles (299,792 kilometers) per second. Consider traveling around the world, moving at the speed of light, one would be able to follow the equator seven and a half times around in one second. To make matters worse, since its inception, the universe has undergone what physicists call ‘epochs’. But many of these epochs were contained within the first second of its existence. As a matter of fact, current theory holds that more happened in the first second after the big bang than has happened in the last 13.8 billion years.



CMB Timeline NASA/WMAP (Public Domain)

A quick run-down of the history of the universe would illustrate:

The One Second Epochs

Zero to 10-43 seconds: The Planck Epoch

Very little is known about this time period. It is about as close to 'in the beginning' as one will ever be able to go using today's knowledge. Einstein's General Relativity formulas propose a gravitational singularity, but it might be that the four fundamental forces that govern everything in existence (electromagnetic, weak nuclear, strong nuclear, and gravitational) were all somehow unified at this point, held together in perfect symmetry. Picture a sharp pencil standing upright on its point. It looks great, but it cannot last. Rather quickly, something has to give. How big was the universe back then? Not big enough to even imagine. Technically, estimates run to an area described as one Planck Length. That is 10-20 times as big as a proton. As for its temperature, one would not want to vacation there. It is so hot that at that temperature the laws of physics cease to exist.

10-43 to 10-36 seconds - The Grand Unification Epoch

The main event during this epoch was that the force of gravity separated from the other three forces, which remained unified. The very earliest elementary particles and antiparticles began to form.

As for its temperature, one would not want to vacation there.(WikiImages/CC0)

10-36 to 10-32 seconds - The Inflationary Epoch

This may be the hardest epoch to understand. Somehow the strong nuclear force asserted itself and separated from the pack. The universe underwent such an expansion that to call it 'rapid' is a bit silly. In a fraction of a second, much faster than the speed of light allows, the universe expanded from an infinitely small point to the size of a grapefruit. How? No one understands. Why? That is even murkier. But the expansion is still going on today. It is just not happening so fast.

10-36 to 10-12 seconds - The Electroweak Epoch

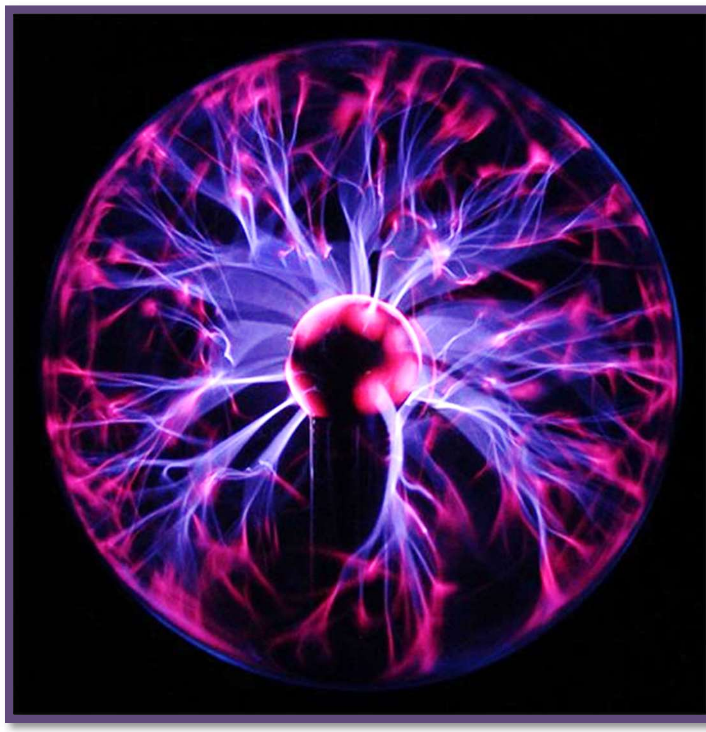
All kinds of weird, exotic particles interacted during this epoch. They are called W and Z bosons, and the newly discovered Higgs boson. This formed the recently discovered Higgs field, which slows down particles so that their energy becomes mass, allowing the future formation of the material universe that is known today. In other words, energy was now converted to mass, thus making possible Einstein's great equation, E = mc2 (Energy equals mass times the speed of light squared).

10-12 to 10-6 seconds - The Quark Epoch

Now things start to get familiar. The universe cooled down to a mere 10 quadrillion degrees so the four familiar forces (Electromagnetic, weak nuclear, strong nuclear, and gravitational) that govern everything could now begin to work their magic. It still was a pretty formidable place. Quarks, electrons, and neutrinos formed in huge numbers and began to collide, annihilating each other. But by a mysterious process called baryogenesis, one quark in every billion pairs survived. Why is this important? Because they soon combined to form matter.

10-6 to 1 second - The Hadron Epoch

During the Hadron Epoch the temperature of the universe cooled to a balmy trillion degrees. This allowed quarks to form hadrons such as protons and neutrons. When electrons began to collide with protons they fused together to form neutrinos that had no mass, but could travel through space freely, if one considers that by this time space was only a little bigger than the size of a basketball. Still, even given the limited room to maneuver they reached nearly the speed of light. They continue their explorations to this very day, but now they have a lot more room to move around. The only rule they follow is that their overall charge and energy must be conserved.



Matter as a Plasma Globe (Luc Viatour / CC BY-SA 3.0)

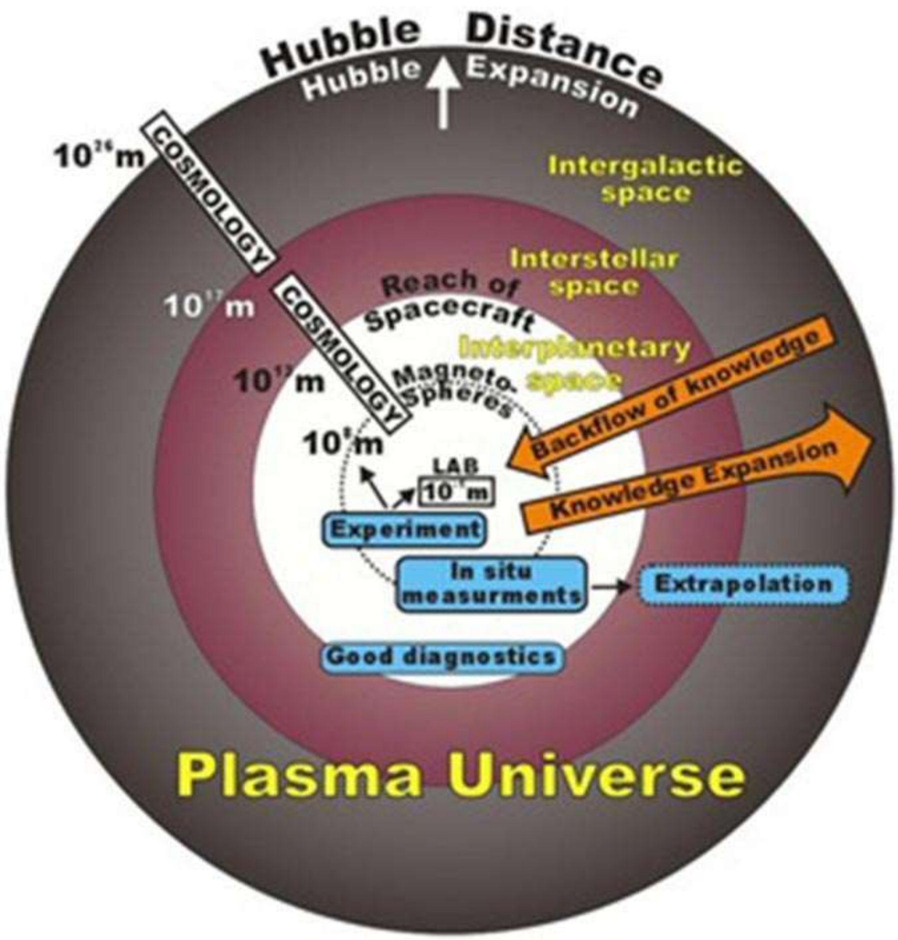
The Three Minute Epochs

1 second to 3 minutes - The Lepton Epoch

This epoch lasts all of three minutes, minus one second, long. Most of the hadrons and antihadrons have collided and annihilated each other, so leptons and antileptons now dominate the material substance of the universe. Electrons and positrons are free to collide. When they do, energy is freed up in the form of photons. When the photons collide, they form pairs of electrons and positrons.

3 minutes to 20 minutes - A Time of Nucleosynthesis

Spring comes to the early universe. The temperature falls to a billion degrees or so, and atomic nuclei begin to form through a process called nuclear fusion. But, as is often the case with Spring, its time is short. After 20 minutes or so it becomes too cool for fusion to work, and things begin to take on a semblance of what one might begin to call normalcy.



Plasma Universe (Hannes Alfvén/CC BY-SA 2.5)

The Hundred Thousand Years Epochs

From 3 minutes to 240,000 years - The Photon Epoch

It is now summer in the universe. It fills up with plasma — kind of a thick soup of electrons and atomic nuclei. Photons rule in terms of energy output. There is still a lot of contact between photons, electrons, and atomic nuclei, but things are relatively calm.

240,000 to 300,000 years - Let There be Light!

It is a nice day in the universe. Temperatures fall to about 3,000 degrees, roughly the current temperature one finds on the surface of the sun. All sorts of things can now happen. But the most important, at least from a human perspective, is this: Light begins to shine! It is the earliest epoch one can actually observe. Photons are now free to move about, the same photons that make up the cosmic background radiation. In other words, this is the first universe one can begin to observe and study. It consisted of a dim fog formed by about 75% hydrogen and 25% helium, with just a pinch or so of lithium thrown in for good measure.

Stars were born. The image is from the European Space Agency. It is listed as the LH 95 star forming region of the Large Magellanic Cloud. The image was taken using the Hubble Space Telescope.
(European Space Agency (ESA/Hubble)/ CC BY-SA 4.0)

The Millions to Billions Years Epochs

300,000 to 150 million years - The Dark Age

Just when things started to get interesting, winter descended upon the universe. For a little less than 150 million earth years there were photons around. In other words, there was light. But no stars had formed yet. The light was diffused and activity slowed way down. It would have been a boring time to be around, and mysterious 'dark matter' ruled the day. But expansion continued, as it does to this day. So, it was only a matter of time until things picked up.

150 million years to one billion years - Re-ionization

The first step forward began when quasars formed as gravity began to collapse pre-structures into themselves. This caused intense radiation levels that re-ionized their surroundings. Hydrogen, having already gone through a metamorphosis a few epochs ago, changed once again.

The universe reversed course and changed back to consisting of a sort of ionized plasma. Small pockets of these gasses began to clump together and collapse under the weight of gravity. They soon became hot enough to trigger nuclear fusion again, and the first stars were born. They had relatively short life spans, but they were big—at least a hundred times bigger than our sun. Cosmologists call them metal-free Population III Stars. Eventually they were followed by Population II and finally Population I Stars, each class being formed by the material left behind when the earlier population stars, called supernovas, collapsed under their own weight. Clumps of these stars formed around each other, drawn together by gravitational forces. They formed clusters, and then super clusters.

Plato and Aristotle, depicted here in The School of Athens, both developed philosophical arguments addressing the universe's apparent order (logos) by Rahpael (1509) (Public Domain)

Home At Last

8.5 to 9 billion years ago - Home at Last

Finally, our solar system emerged out of the chaos. Our sun was formed — a rather late generation star that incorporated the collapsed, exploding material from generation after generation of stars that previously existed, had their day in the sun, so to speak, and then imploded. Our solar system, formed by more exploding debris, formed about five billion years ago. All in all, it took between eight and nine billion years after the Big Bang to make our 'hood.' It still wasn't ready for us. That took a lot more time. But in the end, out of nothing — something. And out of chaos — order.

This excerpt is adapted from Hidden History: Ancient Aliens and the Suppressed Origins of Civilization, by Jim Willis. Published by Visible Ink Press. Released on May 1, 2020, and available for pre-order at Amazon.com. It is here used by permission of the publisher.

Top Image; Universe Explosion (Gerd Altmann/CC0)

References

Christian, D. 2018. Origin Story: A Big History of Everything. New York, Boston, London: Little Brown and Company.

Herbert, N. 1985. Quantum Reality. New York, NY: Random House.

Scharf, C. 2014. The Copernicus Complex: Our Cosmic Significance in a Universe of Planets and Probabilities. New York, NY. Scientific American.

Tegmark, M. 2014. Our Mathematical Universe: My Quest for the Ultimate Nature of Reality. New York, NY: Vintage Books.

Willis, J. 2019. Lost Civilizations: The Secret Histories and Suppressed Technologies of the Ancient. Detroit, MI: Visible Ink Press.