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Review Paper

History of Universe: Past to Present

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Abstract
In the present study, we throw light on the chronological development of the universe. The universe grows from being fraction of an inch to the present day accelerating universe. The universe consist of all matter and space including stars, galaxies, planets and space between them. A number of observations shows that the present day universe is in accelerating phase. The reason for this accelerating expansion is still unknown to cosmologists and physicist. The universe starts from the explosion of a single point of infinite density and experienced inflation for a very short period of time in the early universe called inflation. Then the universe shows decelerated expansion in medieval era and again the present day universe is in accelerating phase.
Keywords: *Accelerating, universe, inflation, decelerated.*

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I. Introduction

Cosmology is the branch of science which deals with the universe growth, it's present and ultimate fate. The history of the universe and how it is grown is accepted as Big-Bang model of the universe. According to Big-Bang model of cosmology, the universe began as incredibly hot, dense point approximately 13.5 billion years ago, which is known to be as the age of the universe. The universe starts from being fraction of an inch to the present day universe. The universe came into existence with Big-Bang when the universe age was 10^{-34} of a second. The universe experienced a huge explosion from a single point known as inflation, in which space itself expanded faster than the speed of light. During this period, the universe became doubled in size at least 90 times. The universe increased from subatomic-sized to almost golf-ball-sized. After inflation the growth of the universe continued, but at a slower rate. As space expanded, the universe cooled and matter formed. One second after the Big Bang, the universe was filled with neutrons, protons, electrons, anti-electrons, photons and neutrinos. The observations of cosmic microwave background, which contains the afterglow of light and radiation left over from the Big Bang is an important step to paint the clearer picture of the early universe. In 2001, NASA launched the Wilkinson Microwave Anisotropy Probe (WMAP) mission to study the conditions as they existed in the early universe by measuring radiation from the cosmic microwave background. Among other discoveries, WMAP was able to determine the age of the universe about 13.7 billion years old.

The Universe First Growth

When the universe was very young something like a hundredth of a billionth of a trillionth of a trillionth of a second it underwent an incredible growth spurt. During this burst of expansion, which is known as inflation, the universe grew exponentially and doubled in size at least 90 times. The universe was expanding, and as it expanded, it got cooler and less dense. After inflation, the universe continued to grow, but at a slower rate. As space expanded, the universe cooled and matter were formed. Light chemical elements were created within the first three minutes of the universe's formation. As the universe expanded, temperatures cooled and protons and neutrons collided to make deuterium, which is an isotope of hydrogen. Much of this deuterium combined to make helium. For the first 380,000 years after the Big Bang, however, the intense heat from the universe's creation made it essentially too hot for light to shine. Atoms crashed together with enough force to break up into a dense, opaque plasma of protons, neutrons and electrons that scattered light like fog. About 380,000 years after the Big Bang, matter cooled enough for electrons to combine with nuclei to form neutral atoms. This phase is known as ”recombination,” and the absorption of free electrons caused the universe to become transparent. The light that was unleashed at this time is detectable today in the form of radiation from the cosmic microwave background. Yet, the era of recombination was followed by a period of darkness before stars and other bright objects were formed.

Cosmic Dark Ages

Roughly 400 million years after the Big Bang, the universe began to come out of its dark ages. This period in the universe's evolution is called the age of re-ionization. This dynamic phase was thought to have lasted more than a half-billion years, but based on new observations, scientists think re- ionization may have occurred more rapidly than previously thought. During this time, clumps of gas collapsed enough to form the very first stars and galaxies. The emitted ultraviolet light from these energetic events cleared out and destroyed most of the surrounding neutral hydrogen gas. The process of re-ionization, plus the clearing of foggy hydrogen gas, caused the universe to become transparent to ultraviolet light for the first time.

The Invisible Stuff in the Universe

In the 1960s and 1970s, astronomers began thinking that there might be more mass in the universe than what is visible. Vera Rubin, an astronomer at the Carnegie Institution of Washington, observed the speeds of stars at various locations in galaxies. The mysterious and invisible mass became known as dark matter. Dark matter is inferred because of the gravitational pull it exerts on regular matter. One hypothesis states the mysterious stuff could be formed by exotic particles that don't interact with light or regular matter, which is why it has been so difficult to detect. In the early 1990s, one thing was fairly certain about the expansion of the universe. It might have enough energy density to stop its expansion and recollapse, it might have so little energy density that it would never stop expanding, but gravity was certain to slow the expansion as time went on. Granted, the slowing had not been observed, but, theoretically, the universe had to slow. The universe is full of matter and the attractive force of gravity pulls all matter together. Then came 1998 and the Hubble Space Telescope (HST) observations of very distant supernovae that showed that, a long time ago, the universe was actually expanding more slowly than it is today. So the expansion of the universe has not been slowing due to gravity, as everyone thought, it has been accelerating. No one expected this, no one knew how to explain it. But something was causing it.

Eventually theorists came up with three sorts of explanations. Maybe it was a result of a long-discarded version of Einstein's theory of gravity, one that contained what was called a "cosmological constant." Maybe there was some strange kind of energy-fluid that filled space. Maybe there is some-thing wrong with Einstein's theory of gravity and a new theory could include some kind of field that creates this cosmic acceleration. Theorists still don't know what the correct explanation is, but they have given the solution a name. It is called dark energy.

The Expanding and Accelerating Universe

In the 1920s, astronomer Edwin Hubble made a revolutionary discovery about the universe. Using a newly constructed telescope at the Mount Wilson Observatory in Los Angeles, Hubble observed that the universe is not static, but rather is expanding. Decades later, in 1998, the prolific space telescope named after the famous astronomer, the Hubble Space Telescope, studied very distant supernovas and found that, a long time ago, the universe was expanding more slowly than it is today. This discovery was surprising because it was long thought that the gravity of matter in the universe would slow its expansion, or even cause it to contract. Dark energy is thought to be the strange force that is pulling the cosmos apart at ever-increasing speeds, but it remains undetected and shrouded in mystery. For thousands of years, astronomers wrestled with basic questions about the size and age of the universe. Does the universe go on forever, or does it have an edge somewhere? Has it always existed, or did it come to being some time in the past? In 1929, Edwin Hubble, an astronomer at Caltech, made a critical discovery that soon led to scientific answers for these questions: he discovered that the universe is expanding.

The ancient Greeks recognized that it was difficult to imagine what an infinite universe might look like. But they also wondered that if the universe were finite, and you stuck out your hand at the edge, where would your hand go? The Greeks' two problems with the universe represented a paradox- the universe had to be either finite or infinite, and both alternatives presented problems. After the rise of modern astronomy, another paradox began to puzzle astronomers. In the early 1800s, German astronomer Heinrich Olbers argued that the universe must be finite. If the Universe were infinite and contained stars throughout, Olbers said, then if you looked in any particular direction, your line-of-sight would eventually fall on the surface of a star. Although the apparent size of a star in the sky becomes smaller as the distance to the star increases, the brightness of this smaller sur- face remains a constant. Therefore, if the Universe were infinite, the whole surface of the night sky should be as bright as a star. Obviously, there are dark areas in the sky, so the universe must be finite.

But, when Isaac Newton discovered the law of gravity, he realized that gravity is always attractive. Every object in the universe attracts every other object. If the universe truly were finite, the attractive forces of all the objects in the universe should have caused the entire universe to collapse on itself. This clearly had not happened, and so astronomers were presented with a paradox. When Einstein developed his theory of gravity in the General Theory of Relativity, he thought he ran into the same problem that Newton did: his equations said that the universe should be either expanding or collapsing, yet he assumed that the universe was static. His original solution contained a constant term, called the cosmological constant, which cancelled the effects of gravity on very large scales, and led to a static universe. After Hubble discovered that the universe was expanding, Einstein called the cosmological constant his ”greatest blunder.” At around the same time, larger telescopes were being built that were able to accurately measure the spectra, or the intensity of light as a function of wavelength, of faint objects. Using these new data, astronomers tried to understand the plethora of faint, nebulous objects they were observing. Between 1912 and 1922, astronomer Vesto Slipher at the Lowell Observatory in Arizona discovered that the spectra of light from many of these objects was systematically shifted to longer wavelengths, or redshifted. A short time later, other astronomers showed that these nebulous objects were distant galaxies.

References

[1]. A.G. Riess, et al., Astron. J. **116**, 1009 (1998).
[2]. A.G. Riess et al., Aston.J. **116**, 1009(1998).
[3]. S.Perlmutter et al., Nature **391**,51(1998).
[4]. S.Perlmutter et al., Astrophys.J.**517**,565(1999).
[5]. D. N. Spergel et al., Astrophys. J. Suppl.**148**, 175(2003).
[6]. A. Eienstein, Annalen Phys. **49**, 769 (1916); Sitz. Preuss. Akad. Wiss. Phys. **1**, 142 (4) (1917); Annalen Phys. **69**, 436 (1922).
[7]. A. Friedmann, Zeitschriftfür Physik **10**, 377–386 (1922).
[8]. G. Lematre, Annales de la Socit Scientifique de Bruxelles **47**, 49 (1927).
[9]. E.P. Hubble, Proc. Nat. Acad. of Sci. USA **15**, 168 (1929).
[10]. A.H.Guth, Phys. Rev. D **23**, 347 (1981).
[11]. S. Hawking, (1998) A Brief History of Time, Bantam Dell Publication, USA.
[12]. A.R. Liddle, Introduction to modern cosmology, Wiley, New York, (2003).