

The History of Early Universe

The Big Bang

The urge to trace the history of the Universe back to its beginnings is irresistible. Mythological views for the creation of the Universe are different from the scientific views. The former is based on faith, belief, imagination and may be, to some extent, fantasy. The latter is based on the outcome of various experiments made much after the birth of the Universe. Be that as it may, fact is that there is nothing which does not exist. Something was in existence many ages back. That was neither discovered nor was within the ambit of our knowledge. Dimension and shape of the thing which existed before the birth of the Universe was, therefore, unknown to us. There was, however, a strong desire. The desire of creating something. For birth of anything, it has to break a resistance. With the strength of the desire, the thing came out breaking the resistance. The result was a huge explosion in the beginning. The nature of the explosion was different. It was not eccentric. The centre of the explosion was at different places though the explosion took place at the same time and with the same intensity. All the space was filled with every particle of matter rushing apart from every other particle. We could not comprehend such an event. All the space might have covered all of an infinite Universe or all of a finite Universe. This is now popularly known as '*Big Bang*'



Cosmic Soup

Within a centisecond, the Universe attained a temperature of hundred billion (10^{11}) degrees Centigrade. In such a hot condition, none of the components of ordinary matter, namely, molecules, atoms, or even the nuclei of atoms, could have held together. The matter which rushed apart in this explosion consisted of elementary particles, namely, large numbers of *electron*, the negatively charged particle, and *positron*, a positively charged particle having same mass as the electron. In the early Universe, number of *positrons* was almost exactly equal to the number of *electrons*. Besides, there was roughly similar numbers of various kinds of *neutrinos*, ghostly particles with no mass or electric charge. Finally, the Universe was filled with light consisting of particles of zero mass and zero electrical charge known as *photons*. Every photon carries a definite amount of energy and momentum depending on the wavelength of the light. Number and the average energy of the *photons* were almost same as for electrons or positrons or neutrinos. These particles – *electrons, positrons, neutrinos, photons* – were continually being created out of pure energy, and then after short lives, were being annihilated again. Their number, therefore, was not preordained, but fixed by a balance between processes of creation and annihilation. This process of creation and annihilation gave rise to a kind of *cosmic soup*. Density of this cosmic soup at 10^{11} degree centigrade temperature was about four billion times that of water. There was also a small contamination of heavier particles, namely, protons and neutrons. The proportions were roughly one proton and one neutron for every billion electrons or positrons or neutrinos or photons. The cosmic soup began to expand. With the continuation of the expansion, the temperature dropped, reaching thirty billion degrees Centigrade after about one-tenth of a second; ten billion degrees after about one second; and three billion degrees after about fourteen seconds. This was cool enough for the electrons and positrons to annihilate faster than they could be recreated out of the photons and neutrinos. The energy released in the annihilation of matter temporarily slowed the rate at which the Universe cooled, but the temperature continued to drop, finally reaching one billion degrees at the end of the first three minutes. It was then cool enough for the protons and neutrons to begin to form into a complex nuclei, starting with the nucleus of heavy hydrogen which consists of one proton and one neutron. The density was still high enough to enable these light nuclei to rapidly assemble themselves into the most stable light nucleus, that of helium, consisting of two protons and two neutrons. At the end of the first three minutes, the contents of the Universe were mostly in the

form of light, neutrinos, and antineutrinos. There was still a small amount of nuclear material, consisting of about 73 percent hydrogen and 27 percent helium, and an equally small number of electrons left over from the era of electron-positron annihilation. The matter continued to rush apart, becoming steadily cooler and less dense. Much later, after a few hundred thousand years, it became cool enough for electrons to join with nuclei to form atoms of hydrogen and helium. The resulting gas, under the influence of gravitation, began to form clumps, which ultimately condensed to form the galaxies and stars.

Other versions

Of many other theories which attracted the academia, *Steady-State* Model and *String Theories* are popular. In the *Steady-State Model*, it is considered that the Universe has always been just about the same as it is now. As it expands, new matter is continually created to fill up the gaps between the galaxies. In *String Theories*, matter is described in terms of strings not in terms of particles. Strings are tiny one – dimensional discontinuities in space-time. They can be in any one of an infinite number of modes of vibration, each one of them is different species of elementary particle.

Conclusion

‘Our minds are finite, and yet even in the circumstances of finitude, we are surrounded by possibilities that are infinite, and the purpose of life is to grasp as much as we can of that infinitude’ said *Alfred North Whitehead*. With this frame of mind, the questions that haunted human minds for thousands of years are – ‘Is the Universe Infinite?’; ‘Is it expanding continuously?’; ‘Is new (baby) Universe being created every moment?’ .A large number of philosophers, scientists, poets have given their divergent views. While the issues are still unresolved with a robust scientific theory, humans believe that they have some special relation to the Universe; that they are somehow connected with the Universe. May be for that reason, when we, in the silent mode, look at the clear blue sky or when we look at the earth from an airplane at 35000 feet, we become stoical. We realise that we are a part of this vast Universe. Whether it is finite or infinite does not matter. The more the Universe seems comprehensible, the more it also seems pointless.

