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RESEARCH ARTICLE

A CONCEPT OF SINGLE UNIVERSE

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ABSTRACT

The Universe is all about space, time and their contents like planets, stars, galaxies, and all other forms of matter and energy. While the actual size of the entire Universe is still unknown, it is only possible to measure the observable universe. The physical Universe is defined as all of space- time. The contents contains various types of energy, such as electromagnetic radiation and matter, and so planets, moons, stars, galaxies, and the contents of intergalactic space. The Universe also includes the physical laws which influence energy and matter, such as conservation laws, classical mechanics, and relativity. The universe is all about totality of existence, things which had been exists or which will exists. It would also include the concept of cosmos, world. With further experiments, it is known from its result that our sun is one of trillion stars present in our galaxy called the "milky way", which perhaps is one of trillion galaxies of universe. So there are many stars which have their own planets. At large scale the galaxies are spread uniformly in all the direction, which suggests that there is neither a centre and nor the edge of universe.

INTRODUCTION

In early times the scientific models of the Universe developed, were geocentric which places Earth at the centre of the Universe. Later, more accurate astronomical observations led by Nicolas to develop the heliocentric model with the Sun at the centre of the Solar System. The big bang theory comes under the cosmology of the universe. By this theory we can say that time and space had come a long way i.e. both together 13.799±0.021 billion years, with fixed energy and matter which gradually as the time increased became less dense as the universe is expanding continuously. When the explosion take place it takes time cool down, once it is cooled it allows subatomic particle and then simple atoms to form, Then there is a formation of giant clouds then they merged with gravity to form galaxies and everything which we observes today. Today we can see the universe till the light has passed which is 13.7 billion years and beyond that, we would find only the darkness. By studying the galaxies and their movements we can confirm that there is more matter then what we can see. The unseen matter is known as the dark matter. Scientist with their experiment has strong evidence of the presence of dark matter. Lambda –CDM model is the vastest excepted model of our universe. It is been assumed that 69.3 % of the mass and energy is in the form of dark energy due to which the

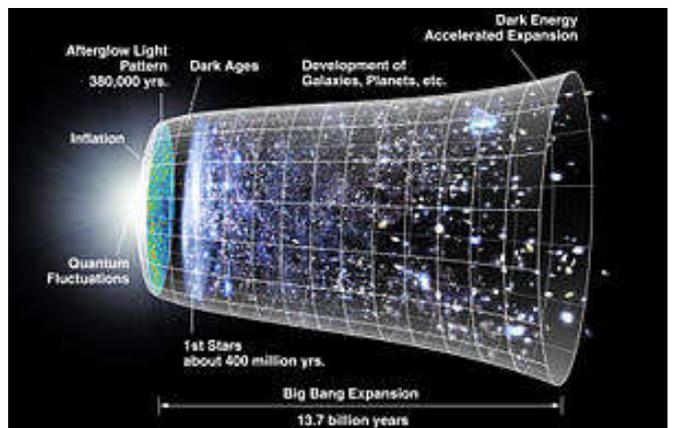
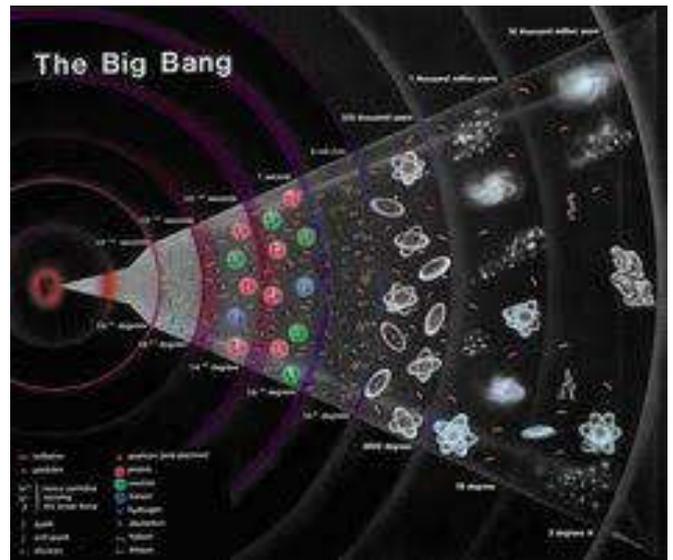
expansion of the universe in today's date is possible. The things which we can see are only about 0.3% of the whole universe and the baryonic matter is 4.9%. There are many theories given by scientists and philosophers about the fate of the universe, some of them refuse to speculate, the information of earlier stages would ever be accessed. There are some scientist who proposes the theory of multiverse in which universe is the one among many that exists.

Literature Review

Big bang theory is the model explaining the evolution of the universe. This model suggests that earlier the universe was dense and hot but gradually it expanded and cooled. This model is based on assumptions like homogeneity and isotropy of space. Lambda –CDM is the version with lambda (cosmological constant) and dark matter. It is the best model present among today's model which gives the better observation of the universe. This big bang model has the information about correlation of the distance, red shifts of galaxies, ratio of hydrogen to helium atoms and microwave radiation in the background. Planck – epoch is the hot initial dense stage, a small period from time zero to one Planck time which is 10^{-43} seconds. At the time of Planck epoch, all types of energy and mass were concentrated into a dense state, and gravity (currently the weakest by far of the four known

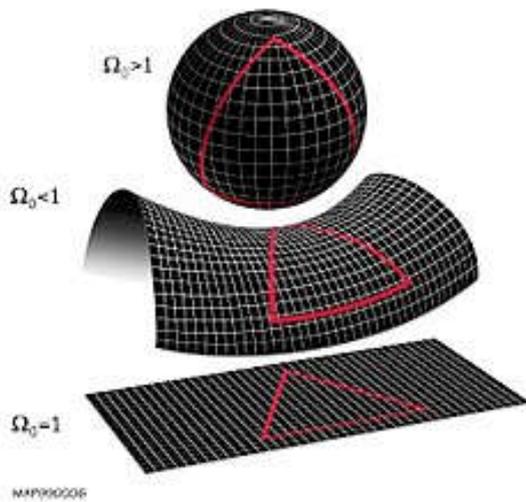
forces) it is believed that it is strong as the other fundamental forces, and all the forces may have been one. Since the Planck epoch, space had expanded to its present scale, with a very short and intense period of cosmic inflation believed to have occurred within the first half Planck time. This was a very different expansion from those which we can see around us today, in which objects in space did not physically move but the metric that defines space itself changed. The objects cannot move faster than speed of light but this is not applied to the metric governing the space time. The explanation of space is flat and it is much larger than the light travelled till now in the very earlier stage. The four fundamental forces were separated at the time of first few seconds of the universe existence. The subatomic particles that were formed after the universe cooled down from its hot state is known as the quark, hadrons⁷, and lepton epochs. These epochs together surrounded about less than 10 seconds of time from the Big Bang. These primary particles associated with larger combinations, including stable protons and neutrons. It was then formed more complex atomic nuclei through nuclear fusion. This is, known as Big Bang nucleosynthesis which was only lasted for about 17 minutes and ended about 20 minutes after the Big Bang. So the reaction which occurred was fast and simplest. The helium was made by the 25% of neutron and proton by mass of the universe, with small quantity of deuterium (a form of hydrogen) and small amount of lithium.

Any other element formed, were in very tiny quantities. The hydrogen nuclei are nothing but the remaining% of the protons remained in the universe. The universe entered a period called photon epoch after nucleosynthesis completed. During this period, to form neutral atoms universe was way too far (it was very cold), hence it contained a hot, dense and foggy plasma of negatively charged electrons, and nuclei. It take 377000 years to form a stable atom from electrons and nuclei as till this much years the universe was very hot. This was the first time electrons and nuclei were combining. The universe was transparent as the neutral atom was transparent for many wavelengths of lights that differ from the plasma. When this atoms formed the photons were released which can still be seen which forms the cosmic microwave background (CMB). As the energy of a photon decreases with its wavelength, the energy density of electromagnetic radiation decreases more quickly than that of matter when the universe expanded. After 47,000 years, the energy density of matter became larger and began to dominate behaviour of the universe in the large scale. With the end of radiation-domination era and matter dominated era was started. The tiny fluctuations within the universe's density led to concentrations of dark matter forming at the earlier stages of the universe. By gravity, ordinary matters where attracted to form a large gas clouds and than stars and galaxies, the dark matter was most dense of all; the least dense were the voids. The first stars formed known as the population-3 after 100-300 million years which were probably very large, luminous, non metallic and short-lived because of them the gradual re ionization of the Universe takes place between 200-500 million years and 1 billion years, It also seed the universe with elements heavier than helium, through stellar nucleosynthesis. The mysterious or scalar energy known as the dark energy is also present in the universe, also its density are not changed over the time. The density of matter is less than the density of dark energy, after the universe had sufficiently expanded for about 9.8 billion years marking the beginning of the present dark-energy-dominated era. Due to the presence of dark energy, expansion of the universe is accelerating.



Properties

It is difficult to define the size of the universe. Due to the finite speed of light and continuous expansion some regions of the space would never interact with ours in the whole lifetime of the universe acc to the relativity theory. By assuming that the Lambda-CDM model accurately, scientist calculate the age of universe which describes the evolution of the Universe from a very uniform, hot, dense primordial state to its present state and measuring the cosmological parameters which constitute the model. An observation is made with this expansion that the light coming from the other distant galaxies have been red shifted. During their journey the photon emitted is stretched so its wavelength becomes longer with lowering its frequency. Analysts suggest the increasing of spatial expansion. Space-time events are relative to the motion of an observer and are not absolute spatially and temporally. Space-time is curved and bent by mass and energy is described by the general relativity. Scientist does deal with the slice of the space-time known as commoving coordinates. The section that can be observed would be the backward light cone that delimits the cosmological horizon. The boundary between the observed and unobserved regions of the universe is been represented by the horizon. Density parameter Omega (Ω) is the important parameter that would be determining the future evolution of universe theory. Omega is the ratio of the average matter density to the critical value of that density. Depending upon the selection of 3 possibilities i.e. omega is equal to, less than, greater than 1. The shape of universe is decided which is flat, open, closed respectively.



Particles

Elementary particles are nothing but the ordinary matter and the force that acts on this matter. These particles are having unknown shapes and even we are not aware about it possessing any other fundamental particles. The existence of particles like quarks, leptons and their corresponding antimatter duals, as well as the force particles that mediate interactions like the photon, the W and Z bosons, and the gluon is supported by a standard model through the experimental confirmation. A quark held together by the strong force is called hadrons. It is further classified in the 2 types such as baryons made of three quarks and mesons made of one quark and one anti quark. The mass of universe was dominated by hadrons at the time when quarks bind together to form hadrons after 10^{-6} seconds of big bang, known as hadron epoch. Initially matter and anti matter were in the equilibrium condition due to the formation of hadron/anti hadron pair at very high temperature. The quantum of light and all other form electromagnetic radiation is known as photon. For the electromagnetic force it is force carrier. In quantum mechanics it is best explained and exhibits the wave-particle duality. Due to the zero rest mass its effect of forces are easily available under the macroscopic and microscopic level. After the 10 seconds of big bang the photon epoch started after leptons and anti leptons were annihilated at the end of lepton epoch. Concepts of multiverse have been given by many scientists. Some of the theory suggests that our universe has separated from the chain of main universes. But for that we need to find the other universes or the chain of the main universe and then should be able to prove the properties which do match with the chain of the universes, or the connection between the chain of universes and our universe. So again this would be hypotheses and nothing more than that. With all other theory it faces the same problem repeatedly.

As we discussed earlier there are theories proposing the multi universe concept but still it contains some loop holes and it fails to answer some of the question arising for the existence of multiverse

- If the multiverse exists then there must be a connection between the universe in which we live and the other universes, there should be some ways which should be existed that connect two universe or the ways in which we should be able to travel into the other universe having some different energy and time. For e.g. as we have worm hole for galaxies.

- As we believe our universe came into existence after the big bang and from then light is still moving continuously, then it might be possible the same with the other universe as well, so there would be the probability of intersecting the light of two different universes. But this has not been witnessed till date.
- If our universe is expanding continuously, if we don't know its exact size. Further, neither we can't even predict its size nor we even know its centre. Thus we don't know its boundaries and having said this we can't even imagine what would be there further its boundaries then how can we be sure of the existence of other universe.
- There is a concept of daughter universe in which it is stated, mathematics of this theory might suggest that all possible outcomes of a situation do occur, in their own separate universes. Means if we are at cross road and by taking the right turn we are in this universe than there is possibility of existing of other universe in the left side as well. This universe is called daughter universe, but if it would really exist then it is very sure that there might be some similarities between the two daughter universes. But we failed to discover it.
- There is a concept of bubble universe which states that other universes form because of eternal inflation, taking into consideration of this theory scientist has proposed that while the universe is continuously inflating and increasing its size, but some part of it would form a pocket and stop inflation, these parts would be isolated and bubble universe would form. But if the bubble universe is formed then it might be having some similarities with the original universe which also is not yet discovered.
- There is a concept of parallel universe in which scientist believe that there exists the exact same universe like our universe with same properties. But this too we haven't yet discovered.

Conclusion

We have observable universe up to the distance of 13.7 billion years, we can't predict the things beyond that. As the universe is continuously expanding, its centre and boundary cannot be determined. With the loop holes in every theory which explains the concept of multiverse, we can say that only the single universe exists as of now. We are lacking the strong evidence for the proposal of multiverse; it is our assumption and nothing more than that for now. As mention above in every theory there are some of the questions whose answers are mystery. The answers of basic question for the existence of multiverse are still unknown such as we have not witnessed any contact from the outside of universe. As its size is not fixed we can't say that the world beyond the universe is the different universe. We are yet to discover the way between two universe (if exists) like we do have a worm hole for the galaxies. We do not possess the data for the other universe like its properties, shape, its evolution and their galaxies etc, like we have for our own universe. According to the theories the matter inside our universe can be placed in the definite ways which means there is a possibilities of having the other galaxy as our milky way, at some other side of the universe. With the concept of parallel universe, it says there may be the same type of other universe like ours which possesses the same matter and properties like ours, and if it is true then to match our properties and evolution there should have been the same kind of other inflation like the big bang. But we are lacking with the

evidence. So there are chances for the existence of single universe only.

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