Structure of the universe

Decades of researches conducted on universe have shown underlying multi verse theories about its coming to be. Universe is entirety everything that exists i. e., matter, planets, stars, space and galaxies. One of the theories that explain the existence of the universe is the big bang theory.

Big bang theory stipulates that the universe was formed after the occurrence of a gigantic explosion. The stars and all the galaxies present today evolved from the matter and energy that was catapulted from that blast. American astronomer Edwin Powell Hubble was the brains behind the big bang theory. He made attempts to show how the earth expanded from a common source. (Charles H. Lineweaver, Tamara M. Davis, 2005)

Big bang theory generated the big crunch theory which clarifies that gravity that exists in the universe. He suggested that the closed boundaries of the universe will one day pull the dispersed materials together and reassemble the universe back into the original and dense structure it initially was.

Understanding the black hole evolutionally cycle makes it easy to comprehend the structure of the universe. The end life of any massive star results to formation of a black hole. Stars have deposits of fuel inside them, any large star undergoing combustion eventually wears of and finally explodes to form a supernova. The remnants of the burnt star crumbles to a dense object called a neutron star. Neutron star ends up becoming the black hole which is responsible for the production of gravitation force, a force strong enough to rupture atomic structure. The black holes’ mass is directly proportion to the mass of the millions of the suns which are located at the center of the galaxies.

The universe has also been cited to have come to be through the classical theory, also referred to as the atomic structure. The theory brings out the extreme subatomic world in the universe. The atoms in the atomic structure are said to be made up of fundamental particles such as electrons, protons and neutrons. The nucleus encompasses balls of protons and neutrons that are packed tightly and the electrons that twirl around the electron shells at a maintained distance from the nucleus and at separate energy levels. There is a vast blankness between the electron shells and the nucleus. (Gary Hinshaw , Robert Naeye , 2008)

In 1964, Gell-Mann and Zweig George came up with a proposition that nuclear particles consisted of smaller but essential particles known as the quarks. A neutron has one up quark and two down quarks while a proton consist of two up quarks and one down quark. Between the protons and neutrons, there exists a transfer medium called the gluon which is a strong force carrier. Under extreme pressures and temperatures, nuclear particles easily break down into quark-gluon plasma, QGP. On splitting, the atoms release energy similar to energy released by an atomic bomb. The transition of a star from an atomic structure to a nuclear particle structure forms a supernova. After supernova, the remaining protons and neutrons collapse into a large dense core. The strong gravitation force forces both protons and neutrons to combine into neutrons. This is why the black hole’s inner core is made up of neutrons. The black hole evolution intensifies its absorption of energy and matter. The growth reaches a critical point where the temperature and pressure cause the nuclear particles to break into quarks. The effect of this breakdown is the turning off of the gravity switch. More

than 97% of the mass is lost during the breakdown and converted into incredible quantity of energy which sets off a chain reaction that produces the quark-gluon plasma. The plasma produced ends up splitting the black hole apart and results in the big bang.

The universe has no end; it stretches to great distances and it is occupied by many big black holes. Any black hole will always reach a specific mass before exploding into a big bang that hurls energy and matter into far distances. The same material is reabsorbed by other black holes after a time. This process is continuous.

With exception of the knowledge we currently have regarding the origin and the structure of the universe, a mare gaze in the sky depicts a cosmic black canvas that has no end. The view is constrained due to aesthetic reasons such as; light speed, the dimensions of the galaxy, number of atoms in the sun, the aging process of the universe among others. The observable universe as per the big bang theory comprises of all the observable features of the human eye. The distance to the far end of the universe is roughly the same, hence the notion that the universe is spherical. The universe is viewed in form of visible and observable universe. Visible universe includes the signals that are emitted after the recombination while the observable universe includes the signals that have always been there since the beginning of the big bang traditional cosmology. As per the Cosmic Microwave Background Radiation (CMBR), particles emitting it show that the radius of the visible earth is approximately 14. 2 billion parsecs or 45. 7 billion light years and the distance to the edge of the observable universe shows that the radius of the universe is 14. 5 billion parsecs. The universe is

approximately 13. 375 billion years; however, the space has undergone a spontaneous expansion to a pont, where observable objects that were initially much closer have now been drifted further away. (Peebles, P. J. E., Schramm, 1994)

It is important to understand the origin of the universe before embarking on the insights of the structure of the universe. The long tour regarding the origin of the universe starts with our understanding of the earth. The earth is on the list of the objects comprised in the solar system. The sun takes the central part, and is also the largest object in the solar system. Of all the nine planets, Mercury is the nearest to the sun followed by; Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto is the farthest from the sun, and at the edge of the solar system. All the nine objects orbits around the sun. The moon is the nearest significant object to the earth and is four hundred thousand kilometers away. The distance between the earth and the sun is approximately one hundred and fifty million kilometers as compared to the distance between the sun and Pluto which is roughly six billion kilometers. Beyond the Pluto, is a vast empty space followed by proximal centauri star which is roughly forty trillion kilometers away from the sun. This incredible distance is measured by astronomers in terms of the light year.

Light year is the distance travelled by the light in a period of one year when moving at its speed of three hundred thousand kilometers per second. This is time taken by the light to travel from the sun to the earth. From the sun to proxima centauri, the distance taken by the light is over four light years. Sun and proxima centauri are two of the numerous stars that belong to Milky Way Galaxy. Astronomers' researches have shown that, when the Milky Way

galaxy is viewed from above, the central region is spherical with a number of spirals like arms which are the stars. The sun is found near the edge of one of these arms. The sun is estimated to lie about twenty eight thousand light years from the center of the galaxy. Around the center of the galaxy, is a halo of old stars which extends in all directions for roughly fifty thousand light years. (Peebles Schramm, Turner, Kron, 1991)

The Milky Way contains over one hundred billion stars. These starts are separated from each other by many thousands of light years, but they remain attracted to each other and confined to the galaxy due to the force of gravity. Moving beyond the galaxy to the neighborhood of the Milky Way, a hundred and seventy thousand light years away is a small galaxy known as the large magellanic cloud. The observable universe shows that besides these two galaxies, there are probably a hundred billion more galaxies with different shapes and sizes. Galaxies exist as separate entities throughout the universe, but they attract each other through the gravity force, hence grouping them into clusters. MilkyWay galaxy belongs to a cluster referred to as the local group. Andromeda galaxy is the largest galaxy. Clusters of galaxies are grouped into super clusters with the local group of galaxies belonging to the local super cluster. Virgo cluster is a cluster of galaxies found at the center of local super cluster. Currently, distant but visible objects like quasars can be observed. Quasars emit so much energy, but the sources of this energy have never been established.

The study of the universe is known as cosmology. Cosmologist’s primary mandate is to understand how the universe has developed into its present state and predict how it is likely to behave in the future. Objects in the solar

system have varying distances, light from distant galaxies take light billions of years to reach our solar system. Photographs taken of these galaxies are definitely the pictures of how they looked like in the past, but not at the present. Light emitted from these galaxies continues to move away from each other, hence implying that the universe has been expanding for at least ten billion years. Cosmology involves the formation of hypothesis or theories meant to make a phenomenon that can be tested with observations. The prevailing theory concerning the origin and evolution of the universe, the big bang theory, has its cosmological concepts organized as follows; (Osterbrock, Gwinn,& Brashear, 1993). The main concepts of the Big bang theory are brought forth in the first section with scarce regard to actual observations. The second section brings out the classic tests of the theory that's makes it compelling to be the acceptable description of our universe. The third section shows the limitations and a detailed account of the big bang theory model.

From 12 to 14 billion years ago, the universe was few millimeters across but over the time, it has expanded from the its previous hot and dense state to the current cooler and vast cosmos inhabited by all the living things.

The big bang theory can be explained in two perspectives; the general relativity and the cosmological principle. In 1916, Einstein came up with a General Theory of Relativity in which he proposed it as the new theory of gravity. The theory was laid on the backbone of the 1680s Isaac Newton's theory of gravity. Isaac stated that gravity was only valid on bodies at the rest or those moving very slowly, but Einstein proved that the theory of gravity is valid for bodies at rest and at motion. The key concept embedded

in General relatiivity theory is that gravity can no longer be illustrated by the gravitational field, but rather by the distortion of time and space itself. (Freedman, Wendy L, 1992)

John Wheeler, a physicist stated that matter tells the space how to curve and space tells matter how to move. This notion explained peculiarities lying behind the orbit of mercury and the bending of light by the sun. The introduction of the general relativity saw the start of further inventions by scientists. Einstein has also been praised for being behind the application of the new gravitational dynamics to the universe as a whole. Cosmological principle was based on the assumption that the matter in the universe is homogenous and isotropic when averaged over very large scales. This assumption has continuously been tested throughout the exercise of observing the galaxy distribution. In addition, the cosmic microwave background radiation, which is the remains of the heat after the big bang explosion, exists uniformly over the whole sky. This has proved the projected theory that stated that the gas that emitted the cosmic microwave background radiation was evenly distributed right.

When the Foundations of the big bang cosmology are based on the assumption that the universe is homogenous and isotropic, the corresponding distortion of space-time due to gravitational field shows that the universe exists in any one of the following forms; the universe can either be positively curved just as the surface of the ball and finite in its extent, and it can be negatively curved just as a saddle and infinite in its extent, or flat and infinite in its extent. To clarify on these predictions, matter must be taken into consideration due to its vital role in cosmology. (Alan Guth,

1998)The density of the matter is directly proportional to the geometry of the universe. If the matter density is less, the universe can appear infinite and open, if the density is greater, and the universe is finite and closed. If the density equals its critical density, the universe is infinite and flat.

Despite the fact that the universe has been expanding, facts show that the expansion has not been uniform over the years. This has been so due to the fact that the gravitational pull has been in effect and questions that range in many scholars' mind concerning the fate of the universe is whether the pull will be strong enough to finally reverse the expansion of the universe to a point where it collapses back to its original form. Expansion of the universe, abundance of the light elements and the cosmic microwave background radiation has been the three main measurable signatures that have supported the predictions of the big bang model. The Hubble constant proved Einstein's general relativity correct after stating that the expansion of the universe deferred with distance. Edwin Hubble observed that galaxies were moving away from us with a speed that was proportioned to their distance from us. They are moving faster than the speed of the light. This expansion rate accelerates due to the dark energy. These notions can be compared to raisin bread. A nearby raisin moves a little, while a raisin further away move relatively further. (Scott Watson, 2000.)

The test of the light elements is based on nucleosynthesis. This term refers to formation of heavy elements, such as atomic nuclei that has many protons and neutrons all from the fusion of lighter elements. As per the big bang predictions, the universe was dense and hot originally, but one second after the big bang, the temperature of the universe intensified greatly and was full

of protons, neutrons, electrons, anti-electrons, photons and neutrinos. The cooling of the universe led to the decay of neutrons to protons or the merging of protons to make an isotope of hydrogen. Minutes later, the isotope formed helium and traces of lithium. This explains how light elements were formed through big bang nucleosynthesis. (Andrei, Linde. 1994)

The Cosmic microwave background radiation is another fact explaining the big bang theory. After the big bang, the universe that was extremely hot has now been expanding causing the gas within to cool. This resulted into the universe being filled up with radiation. Existence of the CMB radiation was predicted by Ralph Alpher, George Gamow and Robert Herman in 1948 in their work of on Big Bang Nucleosynthesis.

Although the big bang theory explains clearly the Expansion of the universe, abundance of the light elements and the cosmic microwave background radiation, the theory has three main problems. Wilkinson Microwave Anisotropy Probe determined that the geometry of the universe is nearly flat, but the big bang cosmology shows that the curvature will continue to grow with time. The cosmic microwave background temperature tell that the distant regions of the space must have been in contact at one given point, but by the assumption of Big Bang expansion, the regions could never have been in contact because the distant of the regions of space are far apart from each other. Lastly, big bang cosmology predicts that a very large number of heavy magnetic poles must have been produced during the expansion but they have never been observed up to date. (Alan Guth , Paul Steinhardt, 1984).

Christians and Muslims believe that the universe was empty until God created all other objects within the solar system.