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A Literature Survey on High Energy Physics

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Abstract- Research in modern science based on primordial particles those constitute the observable world. It is highly interesting to cover the vast field of materialistic world which lead to the scientists to investigate the building stone of the object that occurs naturally. Without proper knowledge of constituents of observable objects research on high energy physics will never yield satisfactory result. The aim of this paper is to intricate the right direction of investigation.

Index Terms-Primordial,QGP State, hyper fine particles, big bang,super novae.

I. INTRODUCTION

High Energy Physics is a vast field of investigations , especially in the area of nuclear reactions relating to both light and heavy ions collision , light elements scattering , generation- penetration and spreading of Cosmic particles, interactions of atomic and sub-atomic particles and antiparticles. The most important point to remember is that relativistic effect on mass, momentum and speed of the hyperfine or subatomic particles are to be considered very precisely because of encountering smallest contribution too. Early researches in the field had obstructed their journey because of lack of sophisticated instruments which can yield sufficiently accurate contributions towards the observables. Lacking is also found in the assumptions made by the researchers thereby creating diversities from realities which affect the new researchers to think over a problem freshly. In fact, due to supervision problems of the faculties a huge amount of fund of the country is being utilized improperly yielding large volumes of un-wealthy papers in the name of research. The foundation stone should be laid down strictly after theoretical research and judgment verifying the justification of implementation of a research plant so that the number of plants are in action would become less important. R &D project must have a vitality for an underdeveloped country but we should not and never encourage misuse of fund.

Multiparticle production in high energy nuclear collisions is still a complete mystery. In most cases, the primary sources remain unexplored while from the understanding of the dynamics of production of secondary conclusion are drawn which may be wrong. Of the various types of particles produce, mesons, especially the pions constitute the major part secondary. In some nucleus-nucleus interactions two important features of generation of pions and kaons are of great importance. Kaons are also very important because of their strangeness content which is related to the physics of the assumed QGP (quark –gluon-plasma) signatures. Relativistic nucleus-nucleus collisions are believed to offer the unique opportunity to produce hadronic matters at an elevated temperature. The ultra-relativistic heavy-ion collisions are studied by Alternating Gradient Synchrotron (AGS), Relativistic Heavy Ion Collider (RHIC) and the CERN Super Proton Synchrotron (SPS) at the extreme conditions. The formation of QGP state of matter, absolutely an exotic state, is based on some speculation in high energy nucleus-nucleus collisions. In QGP state individual hadrons dissolve into a gas of de confined quarks and gluons in strongly compressed and hot matter.

Early research in primordial nucleosynthesis may give an idea of formation of heavy object from tiny particles through synthesis.

The investigations on primordial and stellar nucleo-synthesis of elements are gaining the momentum day- by-day, although the journey had started since the dawn of history. Astronomers have long been acquainted with certain rather peculiar looking celestial objects which had come to be called “spiral nebulae”.

Until about a quarter of a century ago, the spiral nebulae were more or less generally believed to be located among the stars of our Milky way system and were brought to be possible the example of stars giving birth to their own planetary systems according to the classical picture of Kant and Laplace.

After the great discovery made by Edwin P. Hubble, an astronomer at Mount Wilson Observatory, the concept of celestial structure is completely changed. Later on many scientists made a series of investigations on celestial objects. The main problems of studying the synthesis process of elements of the universe involved the primordial conditions and so researchers in this field of study are primarily tried to explore the basic theories of the creation of universe. Among those ‘The theory of Beginning’, ‘The Big Squeeze’, ‘The Big Bang theory’ etc are notable.

The great scientist Fred Hoyle at his young age believed the concept of 'Big Bang'. But unfortunately before his death he expressed his opinion against the Big Bang theory. He felt that, in one fine morning material particles had been originated out of nothing.-- this is impossible. Still, this contra-opinion could not stop the investigations in this field. Some people believed that at the early stage of the universe, it was full of cosmic clouds and due to stepwise condensation processes today's universe is formed. This concept is also lack of primitiveness. Once we initialize an arbitrary condition of the universe, subsequent development will not impose any problem in the path way of evolution.

The major problem of cosmogony i.e. the theory of the origin of the universe, have perplexed the man-mind ever since the dawn of knowledge. Among the ancients, the origin of the world was necessarily associated with a creative act by some deity, who separated light from darkness, raised and fixed the heavens high above the surface of the earth. They fashioned all other features that characterized the highly limited world picture of early man.

As time rolled by and people gradually accumulated knowledge about the various phenomena taking place in the world that formed their environment, the theories of cosmogony took a more scientific shape. The names of Buffon, Kant and Laplace characterize the scientific era when the first attempts were made to understand the origin of the universe exclusively as the result of natural causes. The theories of that time which were limited essentially to the origin of our solar system, later underwent a process of multiple evolution; culminating in a reasonably complete and consistent theory of planetary formation recently developed by Carle Von Weizacker and Gerard P. Kuiper .

In the meanwhile the progress of observational astronomy opened entirely new horizon of knowledge of the universe and reduced the old riddle of the birth of planets to a minor incident within a much broader picture of the evolution of the universe. The most striking problem of today's cosmogony is to explain the origin and evolution of the giant stellar families, known as galaxies, which remained scattered throughout the whole space of the conceptual universe. In fact infinite vastness of the universe imposes more and more problems to our thinking and expectations. The key factor for understanding of this large-scale cosmic evolution was provided about a quarter century ago by a discovery of American astronomer Edwin P. Hubble. Hubble found that the galaxies populating the space of the universe are in a state of rapid expansion. This implies that once upon a time all the matter of universe must have been uniformly squeezed into a continuous mass of hot gas. The close correlation between the observed phenomena of expansion and certain mathematical consequences of Einstein's general theory of relativity, was first recognized by an imaginating Belgian scientist, Abbe George Edward Lemaitre, who formulated an ambitious program for explaining the highly complex structure of the universe known to us today as the result of successive stages of differentiation which must have taken place as a concomitant of the expansion of the originally homogeneous primordial material. If and when such a program is carried through in all details, we shall have a complete system of cosmogony that will satisfy the principal aim of science by reducing the observed complexity of natural phenomena to the smallest possible number of initial assumptions. Although such a program is far from completion as of today, considerable progress has been made on various parts of it and the end seems to be already in sight.

Many scientists believe that the present state of the universe resulted from a continuous evolutionary processes, which started in a highly compressed homogeneous material a few billion years ago --- the hypothesis of "beginning". Others prefer to consider the universe as existing in about the same state throughout eternity --- the hypothesis of a "steady state universe". Russian astronomer Vorontzoff Velyaminov was apparently forced by the philosophy of dielectic materialism to accept the later hypothesis. British astronomer Fred Hoyle attempted to explain the alleged steady state of the universe by introducing a hypothesis of continuous creation of matter in intergalactic space.

So many other theories, relating to the early stage of the universe are proposed by numerous scientists, which do not provide us a complete and accepted model. Now whatever may be the theories, thing is that universe needs to birth material particles or elements. It seems reasonable to assume that various atomic species were formed during the very early period of expansion when all the matter in the universe was still uniformly squeezed to extremely high density and subjected to very high temperatures, providing favorable conditions for all kinds of nuclear transformations. Since the relative amounts of different atomic species produced during this "universal cooking era", must have been determined by physical conditions then prevailing our knowledge of the relative abundances of chemical elements and their isotopes in nature, should enable us to reconstruct the picture of the early stages of expansion. Thus the table of relative abundances of atomic species may be thought of as the oldest document pertaining to history of our universe.

Relative abundances of elements have been exhaustively studied by many great geo-physists and astrophysists and today we have a large amount of material on that subject. The bulk of the data comes from chemical analysis of the earth's crust and of the meteorites which presumably represent the fragments of a former planet that once moved between the orbits of Mars and Jupiter. These data were supported, by spectral analysis of the sun, the stars and of the diffuse material scattered through interstellar space. The most important result of these studies is the fact that the chemical constitution of the universe is surprisingly uniform.

It is observed that about 55% of cosmic matter is hydrogen and about 44% helium; the remaining 1% accounts for all heavier elements, in the same proportions as we find them on earth. Considering the general figures for cosmic abundance, our earth represents a remarkable exception, almost lacking in Hydrogen and Helium which are the main constituents of matter in the universe.

The scarcity of Hydrogen and Helium and other rare gases on our earth is purely a local effect, the result of the circumstances under which the birth of the earth took place.The formation of our planetary system started by the process of aggregation of interplanetary dust, resulting in what may be called primordial planetary cores. This dust floating in the inter stellar gas of mixed hydrogen and Helium, has about the same constitution as the dust clouds raised by a bulldozer working on a mountain road and its aggregation produced the rocky bodies of our earth, of Mars, Venus and other minor planets. Gaseous material filling interstellar space did not participate in this process until the original rocky bodies had grown large and massive enough to capture these gases by gravitational force. In order to be able to capture interstellar gas, a planetary core had to grow to be several times as heavy as our earth, nor Mars, nor Venus grew large enough because of their less gravitation and the supply of dust in their neighborhood was exhausted. Thus they remain rocky planets as we see them today. The primordial cores of Jupiter, Saturn and other major planets, however exceeded the critical mass limit and surrounded themselves with heavy atmospheres of Hydrogen Helium. Thus according to the studies of Harrison Brown, the rocky core of Jupiter, being similar to our earth but about six times as heavy amounts to about only 2% of the total mass of the planet. The central core is covered by layers of frozen water, ammonia and methane which together account for another 8%. The remaining 90% of the giant body of Jupiter consists of a highly compressed mixture of Hydrogen and Helium which almost reaches the density of water near the hidden surface of the central core. This internal structure of Jupiter also reveals the fact that nucleo-synthesis was inevitable for growing of a heavenly body.

Based on the classical work of the Norwegian geo-chemist V.M. Goldschmidt, the cosmic abundances of atomic species is represented in fig.-I. These data are also supplemented by more recent data obtained by Harrision Brown from the analysis of meteorites. We see that cosmic abundances drop very rapidly with increasing atomic weight. Such elements as Silver and Molybdenum, located halfway up of the periodic system, are resent in the amount of only about one part in several billions. The striking feature of the natural abundance curve is that after reaching the elements with an atomic weight of about 100, the curve levels out, indicating nearly equal abundances for all elements in the upper half of the periodic system. This surprising shape of the empirical curve, its original exponential rapid fall followed by horizontal contribution, obviously contains an important hint about the conditions under which the atoms originated. Any theory which claims to give a consistent picture of the nuclear cooking process must also be able to account for this abundance curve.

II. CONCLUSION

The present paper represents a literature survey on the formation of primordial objects which comes out of nucleosynthesis and ultimately directs the investigators to shape up their works on high energy physics.

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