Life Elsewhere in the Universe

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Abstract

The earth is found to be the only life bearing planet within the solar system. The cause of not having life on other planets of the Sun may be attributed to the unsuitable physical and chemical conditions for sustaining life. By now, we have come to know the planetary systems of a few sun type single stars. Astrophysicists also suggest that when a star is born, it is nearly always accompanied by a planetary system. There are about 20 billion stars similar to our Sun in the milky way galaxy and a vast number of galaxies in the visible universe. This shows the large probability of planets similar to Earth in the universe, hence life might exist in some of these planets. The nearest star to Earth, other than the Sun, is Proxima Centauri, situated about 4.24 light-years away. Thus, it is impossible to physically examine the presence of life in planets of other stars of the universe. However, we have scope to extrapolate our experience skillfully to other parts of the universe with the knowledge of physics and chemistry to anticipate the existence of life beyond Earth. The radio waves are the only possible media of linkage with civilizations of other planets. In this regard Darke's equation speculates the number of civilizations we might communicate with. The equation makes use of many probability factors with rough approximation. While many of these factors have some scientific basis, the factor representing the fraction of life bearing planets out of life sustaining condition in planets varies from extremely rare (say =0.000001) to very common (say=1). In the absence of adequate knowledge on the evolution of life, the value of the probability factor could not be focused properly. This author has attempted to suggest a more reasonable value of the probability factor by making use of the traditional knowledge on evolution of life on earth.

Key Words: *Life in Universe, Material science, Spiritual Science,Traditional knowledge, Radio waves, Darke's equation, Probability factor.*

Introduction

The ever-curious mind has never forgotten to ask - are we alone in the entire universe? The idea of extra-terrestrial life has been seeded from very ancient times. The discovery of new continents by Christopher Columbus and Ferdinand Magellan showed that there are also other inhabited regions. Copernicus, an eminent astronomer, showed that the earth is similar to other celestial bodies and there is nothing special about it. Subsequently the concept of extra-terrestrial life became more acceptable.

Towards the end of nineteenth century, Camille Flammarion postulated that planets are inhabited by men, and the harsher conditions are on the planet the poorer must sensibility be there, thus, the inhabitants of the mercury and the Venus be less intellectual than us while the mars being inhabited earlier to the earth due to its early formation and rapid cooling must be more advanced in every respect. This logic has become a history.

Today it has been possible to explore into the enormity of the universe using the large telescopes. We know the largeness of our solar system; however, the vastness of the solar system is lost when we try to place it in the map of the Milky Way galaxy and perhaps it cannot be shown in the map of the universe. The sun is an ordinary star in the population of 100 billion to 400 billion stars in the Milky Way galaxy [1] and there are about 100 billion to 2 trillion galaxies in the visible universe [1]. Who knows the invisible extent of the universe? Living on the earth, it is practically impossible to physically explore into the existence of life particularly when the journey to the nearest star takes about a generation time. And further we have the only experience of the earthly-life. Under such circumstances, one could possibly extrapolate our experience skilfully to other parts of the universe with the knowledge of physics and chemistry to know the existence of life beyond Earth.

Discussion

The sun is a middle-aged star of about 4.65×10^9 years with a life expectancy of about 10^{10} years [2]. We know from theoretical physics, that the universe was created from a Big Bang about 13.787±0.02 billion years ago and it is now in the expanding state [3]. This infers, all celestial bodies in all parts of the universe having the same cosmic history, are made up of the same chemical elements and they obey the laws of physics and chemistry. Hence, the natural formation of complex organic compounds that led to the origin of the earth is common in the universe. The presence of some compounds (various organic molecules, volatiles, and even the building blocks of DNA) has been noticed in certain asteroids, comets, satellites (e.g. Titan, the satellite of the Saturn), interstellar clouds and in meteorites [4]. Samples collected from asteroid Bennu by NASA's OSIRIS-REx mission contain 14 of the 20 amino acids used to make proteins and all five nucleobases, the components of DNA and RNA [5]. To understand the natural formation of the complex organic compounds in the universe, the studies were focused on earth, the planet with which we are well conversant.

The formation of the earth is about 4.5 billion years [6]. It is obvious that the original atmosphere during formation of the earth must have been swept away by the violent solar wind and subsequently a fresh atmosphere would have formed by the

gases evolved from the earth's crust due to internal heating and the heat generated by the impact of numerous meteorites falling on the early earth [7]. Thus, the atmosphere generated in the early earth was mainly made up of hydrogen, nitrogen, methane, ammonia, water vapor and carbon dioxide [8]. The presently available oxygen and ozone (a molecule with three atoms of oxygen) was not available in the atmosphere of the early earth. Subsequently, photosynthesis in plants manufactured the oxygen that we breathe today. It is thought that the intense ultraviolet radiation hitting the surface of the earth in the absence of ozone layer in the atmosphere and frequent occurrence of storms as well as volcanos led to the formation of complex molecules. After about a million years of the formation of the earth when the earth cooled down sufficiently the oceans of the earth were formed by condensation of the water vapor in the atmosphere. The complex organic molecules formed then were dissolved in the relatively fresh water of the early oceans. John Haldane and Alexander Oparin suggested during 1930 that life was born from this 'Warm Dilute Soup' [9].

Studies from fossils (ancient sedimentary rocks) reveal that microscopic unicellular organisms similar to bacteria appeared about a billion years after the formation of the earth [10]. Again, the multicellular organisms appeared after the lapse of about two billion years since formation of the earth. Thus, life started from the inert to unicellular organism followed by the multi cellular organisms [10]. The different species that are found today are caused due to evolution discussed in the **`Theory of Evolution'** suggested by Charles Darwin.

Unlike the faith of some people, the scientists thought that life came up after successive development of preconditions and did not appear abruptly. The first phase was established when Stanley Miller and Harold Urey demonstrated through laboratory experiments that amino acids found in living organisms can be synthesized in a laboratory using the atmospheric mixture of early earth in the absence of oxygen [11]. By changing the experimental conditions, it was further possible to prepare twenty known biological amino-acids [11]. The second phase of development was achieved when only few atmospheric precursors such as formaldehyde or hydrogen cyanide acid are formed in the gas itself and the dissolution of this in water, more complex monomer molecules are formed [12]. In the third stage these monomers have been used in synthesizing polymers of biological interest. In the fourth stage the organic phase was separated from the aqueous phase. However, it is still not clear as to how life first came in the chemical evolution. **The formation of first life is least understood by the chemistry of living matter**. We also do not understand the physics and chemistry of homoeopathic drug-preparation and its working in human beings. The effect of celestial bodies on human beings is also beyond the scope of science. It is, as if, we have to

explore into still finer domains of matter with a new physics and chemistry to understand the above phenomena. There are many elementary particles beyond the so-called fundamental particles. Again, the light particles and field forming particles are now claimed as particles of matter in the micro-micro domain [13]. These particles are also mass bearing particles below the detection level of modern science [14]. The role of these new particles has not been interpreted properly in the physics and chemistry of matter due to zero rest mass in atomic mass units. In reality any micro structure has a micro-micro structure similar to the microstructure of a macro structure. In fact, a macro body has co-existing three-domain-structures (macro structure, microstructure and micro-micro structure) [13]. Modern science unknowingly proxies the role of micro-micro-structure in the mathematical model of atomic structure by making many unnatural hypotheses thereby empowering the micro particles (electrons) to exhibit the property of micro particles (electron) and further representing the functional role of less known micro-micro structure [15]. Thus, requiring unnatural wave particle duality of the electrons in the mathematical atomic model. The scope of exploring the natural atomic structure comprising fundamental & elementary particles carrying fractional electric charge and micro-micro-particles with photonic charge cannot be ruled out [15]. If such ultra-fine atomic structure is a reality of nature in finer domain then, science ignoring the ultra-fine structure of atoms would face limitations in understanding the operational dynamics governing the birth of life, aging of living matter and death of life. The action of homoeopathic drugs on living beings and the effect of celestial bodies on the wellbeing of human beings cannot be understood without improving the mathematical atomic model. We need to understand the micro-micro domain structure of atoms coexisting within the extra-nuclear electronic structure for understanding the above less-known phenomena. This can be visualized from the limitations of Dalton's atom (without the electronic structure) in explaining the functional behaviour of matter. It is high time to explore into the finer structure (micro-micro structure) of atoms and molecules for understanding how life appears in living matter. The improved atomic structure would also have scope to develop harmony between materials science and spiritual science.

Advances in space science enabled our search for life in other celestial bodies of the solar system. The exploration to the moon made in 1969 confirmed that there is no atmosphere there and the night temperature is much lower than that of the day. Due to the lack of atmosphere and the magnetosphere in the moon, the solar wind directly hits the surface and makes the natural satellite unsuitable for any life. Samples collected from the surface of the moon did not reveal the presence of any organic compounds. The failure to find life on the moon made people think about the feasibility of life on planets having favourable conditions. The planets Mercury and Venus do not have favourable life bearing conditions and also it has no existence of water, thus, existence

of life was denied there. Beyond the orbit of the earth and not far from the sun the physical conditions appear favourable for life. Thus, Mars appeared to be the most favourable target in search of extra-terrestrial life. The surface temperature of Mars varies about -153°C (243°F) at the poles to around 20°C (68°F) at the equator during the hottest part of the day. It is important to note that it has an atmosphere composed mainly of carbon dioxide and a small amount of nitrogen. In 1971 Mariner 9 probe orbited mars and collected a large number of photographs. It further gave evidence that large volcanoes are active even today. The photographs reveal the picture of vast river beds and their tributaries. This gives a feeling as though in the long past water was flowing freely on the surface of mars. This probably made NASA make two Viking missions to mars to understand how life started there. Viking 1 landed at Chryse Planitia while Viking 2 landed at Utopia Planitia on 20th July 1976 and 3rd September 1976 respectively. The space crafts were equipped well, even capable of detecting a germ of life. The photographs showed a beautiful landscape devoid of any form of life. Samples tested aboard by analytical instruments revealed that the soil is chemically active but biologically inert. This led to a conclusion that Mars may be devoid of life.

The search for life was then extended to Jupiter and Saturn. Jupiter and Saturn being away from the sun have low surface temperatures. The atmosphere of Jupiter contains mainly hydrogen and helium but it contains significant amounts of methane and ammonia. Some forms of life may be feasible at zones of favourable temperature. However, the forms of life may be like the jelly fish of the oceans of the earth.

After exploration of Voyager 1 and 2 more details of the titan became known. Titan has an atmospheric composition similar to that of the early earth and the atmospheric pressure is nearly the same as that of the earth. More importantly, hydrogen cyanide has been detected in the atmosphere of the titan [16]. Further, the colour of the satellite being reddish some anticipate its cause due to the presence of polymers prepared in nature from hydrogen cyanide [17]. Everything appears favourable except the surface temperature which is - 180°C. Though water would freeze at such low temperatures, liquid methane might lead to some different kind of life. Thus, it has some scope to reveal the truth of transition of inert to living matter.

The planets and satellites located away from the sun have lower temperatures. The chemical reactions involving complex chemical compounds still continue to occur at low temperature due to the activation energies derived from the solar and cosmic radiation. The comets are widely travelled in the solar system and therefore it is thought under favourable conditions life might have formed in comets which then might have transferred to the earth. This thought has a coherence with the belief of the 19th century

which states life formed elsewhere and propagated to the planetary systems from one to the other through micro organic spores. Though the chemistry of life bearing matter is understandable through formation of amino acids, the knowledge of the origin of life (i.e. the first appearance of life) is quite rudimentary and is not comprehensible through science. Perhaps the understanding of life and its consequences relating to birth and death requires interpretation of a different chemistry in finer domains than those dealt in conventional coordination chemistry. Understanding the life formation process is more important than looking for the favourable conditions to sustain life on a celestial body. There may be a very-very large number of earth-like life-sustaining bodies in the universe but life may not be there if these celestial bodies do not have the precondition for life forming.

Indirect Search for Life in the Universe

In view of obvious limitations, we may examine the feasibility of life elsewhere in the universe by assuming that life **somehow appears** in planet-like bodies having conditions similar to those of the earth. The first attempt was to search for life on other planets within the solar system. Failure in anticipation of life in a solar system other than our earth, made us make indirect searches elsewhere in the universe. The most favourable sites for the appearance of life are the planets in interstellar space. The basic elements of carbon chemistry are noticed in the interstellar medium [18]. Over 50 compounds including hydrogen cyanide have been detected in the interstellar dust [19]. The stars are known to have formed by gravitational collapse of the interstellar dust. However, some feel, the formation of stars does not destroy all organic compounds present in the interstellar dust. This is further coupled with the belief that the interstellar medium is the true origin of life in the universe. Thus, life must have developed in many planets of countless stars. The existence of planetary systems in other stars is being established through scientific exploration. More and more planetary systems in different stars are becoming known.

While trying to find the existence of life in the universe similar to the life on the earth, we need to search for planets having earthly conditions. Rational thinking tells us- to find planets with earthly conditions, one has to look for the sun like stars in the galaxy. The stars are grouped having similar brightness, temperature and mass. The sun is a G type average star, having independent existence i.e. without forming double or multiple star systems associating other stars. For independent stars such as the sun the radiation from the star is quite stable. On the other hand, the radiation from binary and multiple stars are of pulsating nature and they are unsuitable for supporting life on their planet. In view of this only the independent stars belonging to F, G and K groups (which are characteristically similar to the sun) have the scope of supporting life in their

planetary systems. It is natural to think that all stars have planetary systems like the solar system. By now, we have come to know the planetary systems of a few stars. Astrophysicists also suggest that when a star is born it is nearly always accompanied by a planetary system [20]. The population of such stars in our galaxy is about 100 billion to 400 billion. If everything goes fine, there might exist many living planets like our earth. Barnard's star has two planets with masses 1.1 and 0.8 times the mass of Jupiter. By now many stars like the sun are known to have a planetary system. It is impossible to observe the planets directly due to weak signals received from the planets, hence, it is a hopeless task to find life in these planets belonging to other stellar systems. The only way we can establish link is through radio signals if those civilizations are at least equal to that of ours if not more advanced than us. The subsequent discussions explore such a feasibility.

Drake's equation

The study of the universe reveals that there is nothing special about the earth, the sun or the milky way galaxy, because the earth is an ordinary planet in the solar system; the sun is an ordinary star in the Milky way galaxy which is again an ordinary galaxy in the universe. Thus, all celestial bodies have an average stand and therefore the law of average also operates for the evolution of life. By this consideration the evolution of life on earth is an ordinary event in the universe. Obviously, there must have been many civilizations in our galaxy itself. Such a thinking made Drake in early 1960's to develop an equation to roughly estimate the number (N) of advanced technological civilizations in our galaxy, which states:

$$N=R^{*}\times f_p\times n_e\times f_l\times f_i\times f_c\times L$$

where,

N = number of civilizations we might communicate with

R* = average rate of star formation

f_p = fraction of stars that have planets

n_e = average number of planets that could support life per star with planets

f_l = fraction of those planets where life actually develops

f_i = fraction of planets with life where intelligent life evolves

f_c= fraction of civilizations that develop detectable technology

L = the length of time those civilizations release detectable signals

The basic assumption made in the Drake's equation is that the civilizations evolved from and within the stellar systems and not by migration from one stellar

system to another. In Darke's equation, the value of factor f_l ranges between **very rare** (say f_l = 0.000001) to **common** (say f_l =1) giving the probable value of N. The range of f_l can be narrowed down by understanding the science behind evolution of life on Earth.

Search strategies

Under the above circumstances, how do we search and develop a link with presumably existing civilizations in the galaxy? The radio waves are the only possible media of linkage with other civilizations. If some astronomers in some other planetary system observe the solar system at television wave lengths, then the earth would appear more radiant than the sun. Following this logic, we would not have faced any difficulty in deducing that there are civilizations much older to us with intelligence equal to (if not more) in the galaxy by receiving extra-terrestrial radio signals. Here again, tracking such radio signals without knowing the exact wavelength of communication used by extra-terrestrial intelligence is not an easy job. Even if 1000 civilizations are at the moment communicating in our galaxy, finding the direction in which to point our aerial to hear any one of them is a difficult job [21].

Till today the radio search results are negative. In 1974 a message was sent by Arecibo radio telescope in the direction of the cluster M13, anticipating that we might get some feed-back from any other intelligent civilization. Some astrophysicists are hopeful for a possible contact in future.

Traditional knowledge helps in predicting more accurate value of f_l in Drake's Equation

One can make scientifically reasonable guess on values of probability factors R^*, f_p, n_e, f_i, f_c, L. However, it is not easy to guess the value of f_l particularly when the phenomenon is beyond science. Thus, the preconditions required for sustaining life on a planet are not the same as the preconditions required for evolution of life. The formation of living matter is associated with electron exchange reaction which falls under the scope of materials science. On the other hand, evolution of life in living matter comes under the scope of spiritual science, the science dealing with consciousness. However, recent interpretation reveals, consciousness is linked to the interactions of micro-micro particles (light particles and field forming particles) [22]. Though micro-micro particles are considered massless particles in atomic mass units but they have definite mass in a domain down photonic mass unit, the new domain down mass unit [14]. Therefore, spiritual science is otherwise a new material science dealing with matters of micro-micro domain. Hence, the evolution of life in living matter is associated with photon exchange

reactions. There is a natural exchange of photons among different celestial bodies. Any planet, say the earth, receives characteristic radiation from neighbouring celestial bodies depending on their state properties. Hence, a definite location on the surface of the earth receives a mixture composition of photons at different energy levels from background celestial bodies (background radiation). The earth also releases photons outwardly at different energy levels. These exchange radiation on the surface of the earth produce stress and strain on the surface matters as well as produce comforts and discomforts to living beings. The exchange radiation is a function of different parameters of celestial bodies and their angular orientation with respect to the surface of the earth. The exchange radiation causes only a low range of energy fluctuation that perhaps cannot evolve life. Hence, we may have to look for the higher degree of energy fluctuation to correlate with the evolution of life. Such a high degree of energy fluctuation through exchange of photons takes place on the surface of the earth during total solar eclipse and total lunar eclipse. Therefore, the effect of the eclipse may have a say on the evolution of life on Earth, however science is silent about it. On the other hand, the traditional knowledge on the effects of eclipse is encouraging. In traditional Indian (Vedic) knowledge, for example, Grahanas (eclipses) are considered times when cosmic energies shift drastically. Ancient Ayurvedic and Vedic texts sometimes suggest that new life forms, particularly subtle life forms (microbial or even energetic), are more active or born during eclipses because of the interplay between solar and lunar forces [23]. Therefore, one can expect the birth of life forms in living matter taking place through photon exchange reactions similar to the formation of living matter by electron exchange reaction.

Science is not comfortable in accepting traditional knowledge. This is not always true. It is interesting to note that about 40%-60% of pharmaceutical compositions and steroids have been successfully developed from traditional herbal-medicines [24]. Though the traditional medicines are less scientific but they are effective in their curative aspect. We also find the preparation of homeopathic drugs and their action on the human body is not understood in science but the drugs are effective in their action. In view of the above the traditional knowledge on evolution of life on earth may be taken into consideration particularly when science is silent on it.

In the early fifties of the 20th century Stanley Miller and Harold Urey conducted a series of experiments on a mixture of gases and liquids, based on the hypotheses of the composition of early Earth's atmosphere. The liquid mixture was brought to the boil in a flask and the vapor was subjected to the action of a pulsed electric discharge. Miller was able to prepare some of the basic molecules of life including amino acids and enzymes. Though these molecules of life are important in speculating earthly life, it does not explain how life appears in the organic compound.

We are yet to develop the science of life and death in organic structure. The basic understanding of life is beyond the scope of present physics and chemistry of matter. Study of life requires a unique combination of materials science and spiritual science. Often, we ignore traditional knowledge in scientific analysis. For example, the traditional knowledge on malfunctioning of the digestive system and growth of microorganisms in the controlled environment of the stomach during Solar eclipse and lunar eclipse is not considered to have any scientific significance. It may be stated here, that our understanding of atomic structure is from mathematical models hence the model might have deviated from reality [15]. Again, the atomic model has limitations in explaining the spectra of atoms other than the hydrogen atom. The spectra of all atoms are determined experimentally and the same is used for various scientific applications. It may so happen that the real atomic structure may have justification of the traditional knowledge. The traditional knowledge in many fronts has proved its stand. Traditional medicines have a long history of providing insights that lead towards the discovery of modern drugs, particularly for natural product-derived drugs. Approximately 60% of current medications are directly or indirectly derived from natural products, including plant-based drugs like Artemisinin (a potent antimalarial drug derived from the plant Artemisia annua, sweet wormwood) and Paclitaxel, also known as Taxol (a chemotherapy medication used to treat various cancers, including breast, ovarian, lung, and Kaposi's sarcoma). In view of the above, traditional knowledge may have value in different fronts which might help in augmenting our understanding of the real atomic structure. Traditionally it is known that bamboo cut in full Moon spoils faster, attracts more insects (like beetles, borers, termites) whereas bamboo cut in new Moon stay stronger, resist pests better which subsequently has been justified scientifically. Many parts of the plant collected during the eclipse period are also used as medicine. If the traditional knowledge has its worth then the scientific justification can only be provided by the learned main-stream scientists. It may not be correct to expect the scientific answer from the knowers of traditional knowledge.

The earth carrying lives is unique in the solar system. We also find, the apparent sizes of the sun and moon viewed from earth are nearly the same. This makes the feasibility of total solar eclipse and total lunar eclipse observed from earth. The size and distance of the sun from earth remain unchanged, if the size of the moon is larger in its normal position or with the prevailing size the moon is located near to earth then also the total solar eclipse forms but the total lunar eclipse is not feasible with the size of the earth remaining unchanged. On the other hand, the size of the moon and its distance from earth remaining unchanged if the size of the sun is larger or the sun-earth distance is less then total lunar eclipse would be feasible but not the total solar eclipse. Hence, the occurrence of total stellar eclipse and the total eclipse of its satellite for a planet becomes rare. Following the traditional knowledge life on a planet becomes feasible if

there is total stellar eclipse and total eclipse of satellites. Hence, one can guess the probability of evolution of life on a planet requires two primary conditions, 1) the planet at least have one satellite, 2) the size of star, the size of satellite and their distances from the planet should be such that the apparent sizes of star and satellite are same when viewed from the planet. The second condition is highly stringent thereby the probability factor becomes very-very low which may be less than the expected lower range in Darke's equation. In fact, life is extremely rare in the universe and the probability of communicating with Earth and with other civilizations is extremely low. However, there is nothing unique about our Earth and there is every scope of life elsewhere in the universe.

Conclusion

In trying to explore the existence of life elsewhere in the universe, it is necessary to understand how life appeared on Earth. Science explains how the living matter (the basic molecules supporting life including amino acids, and enzymes) are formed in harsh conditions of the early earth. However, science is unaware of how life appears in the living matter therefore considers it as beyond science. However, it is an active subject in spiritual science. Therefore, a complete harmony among material science and spiritual science can throw some light in understanding how life appears. This author considers the earth specific physical conditions including the total solar eclipse and total lunar eclipse as the preconditions for evolution of life on earth and the same physical conditions can be searched in the universe to ascertain the existence of earthly life on other celestial bodies.

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