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ARE WE ALONE IN THE UNIVERSE? A SEARCH FOR EXTRATERRESTRIAL LIFE

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Abstract

The question “Are We Alone in the Universe?” is as old as humanity itself and as important as the origin of life. Almost all religions believe in multiple worlds and life in them. Cosmologists and astrobiologists have no doubt that life, even intelligent beings are present in many exoplanets in this vast Universe. Direct searches by sending missions with sophisticated instruments, by analyzing reflecting light and indirect searches by detecting radio signals are being conducted. Discoveries so far are encouraging. Soon we will find life in the planets of Universe other than ours; it is a matter of time only.

Key word : Universe, Extraterrestrial life, Exoplanets, SETI, Multiverse

Fifty years ago, a young astronomer interested in interstellar voyeurism, turned a radio telescope on neighbor stars to see what he can see. He is Frank Drake (then 29) of National Radio Astronomy Observatory in Green Bank, USA, focused his radio telescope on two nearby stars to find out any transmissions from possibly in residence there. The result of the search was negative, but Drake’s project began a new search in human history – Search for Extraterrestrial Intelligence or **SETI**¹.

Search for extraterrestrial intelligent life may be project of 50 years only, but the belief of existence of extraterrestrial life is much older. **Extraterrestrial**² term has two words – extra (= “beyond” or “not of”) and terrestrial (= “belonging to Earth”). Simply, extraterrestrial life means the life that does not originate from Earth. Up to now it is unknown whether any life of extraterrestrial origin exists or ever existed in the past. But considering the incredibly vast size of the Universe, it would be improbable for life not to exist somewhere other than Earth.

The development and testing the theories about extraterrestrial life is new branch of science called **Exobiology**³ or **Astrobiology**.

Ideas of Extraterrestrial Life

Ancient Beliefs

Greek writers Thales (7th century B.C.) and Anaximander (6th century B.C.) were the first thinkers for a Universe with many other planets and therefore, possible extraterrestrial life in them. Epicurus (3rd century B.C.) wrote “there will be nothing to hinder an infinite Universe” that ought to have an infinity of populated worlds. However, idea of **geocentric**⁴ Universe (Aristotle and Ptolemy) denied a plurality of world, hence did not favor extraterrestrial life.

In Hindu belief, life has endless repeated cycles through rebirths. There are many material worlds to fulfill the desires of living entities, which teach the soul about purpose of life. And then, there are many spiritual worlds, where purified souls live with ultimate reality. Saints, devotees and thinkers of material are guided by spiritual worlds.

According to Quran, God is the Lord of all the worlds, which indicate multiple Universes, extraterrestrial and even extra-dimensional life.

With the spread of Christianity throughout West, geocentric idea became widely accepted. Though the church never issued any answer on the question of extraterrestrial life, the idea was aberrant.

Medieval beliefs

In 13th century A.D., Tempier, the Bishop of Paris argued that God is omnipotent and could have created more than one world. He also speculated that aliens existed. In the meantime, Copernican **heliocentric**⁵ cosmology made it clear that Earth is merely a planet amongst vast number of celestial bodies in the Universe. This evoked the extraterrestrial idea as one mainstream of science and philosophy. In 16th century A.D., Italian philosopher Giordano Bruno preached for an infinite Universe in which all stars have their own planetary system. Bruno's thought was contradictory to dogmas of Catholic belief; he was condemned by Roman Catholic Church and was burned alive at the stake in Rome in 1600 A.D.

As scientific discoveries progressed, the possibility of extraterrestrials became widespread speculation. With the discovery of Uranus, many 18th-19th century astronomers were convinced that our solar system and other would be populated by alien life. Those astronomers include Immanuel Kant and Benjamin Franklin.

Modern Beliefs

In the second half of 20th century, the space age began and potential visits of aliens were evoked by a number of UFO reports during 1950s. Enormous popularity of flying saucers in USA and other parts of the world led to coin the term **UFO**⁶ – the Unidentified Flying Objects. Idea that UFOs are Chariots of Gods from other world has made the fiction stories of Eric von Daniken bestsellers throughout the world.

During the past four decades, various claims have been made for evidence of extraterrestrial life. A NEW Scientist article published in 2006 looks at 10 of the most hot discoveries (Box 1), which the magazine described as hints rather than proofs.

Box – 1 : 10 most hot discoveries favoring life beyond Earth

1. In 1976, NASA's⁷ Viking Landers performed biochemical tests on soil of Mars. The tests were positive for chemical signatures indicative of life.
2. In 1977, Ohio State University radio telescope detected an unusual pulse of radiation from near **constellation**⁸ Sagittarius. The 37-second-long signal is famous as "Wow" signal. the nearest star in that direction is 220 million light years away. Intelligent aliens with very powerful transmitter might have created it.
3. In 1996, NASA announced that a small meteorite discovered in Antarctica in 1984 contained organic molecule. Electron microscope revealed signs of **nanobacteria**⁹ in the sample.
4. In 2001, "Drake equation" (developed in 1961) reestimated that number of life-bearing planets in the Universe should be hundreds of thousands. Each of those planets lies in the habitable distance from its respective Sun, where water is liquid and photosynthesis is possible. The nearest Earth-like planet should be within a few light years away.
5. In 2001, researchers of NASA suggested that the red tinge of Jupiter's moon Europa is due to alien **microbes**¹⁰. The surface of Europa is mostly ice (-170° Celsius), it reflects infrared radiation. Some bacteria living in extreme conditions of Earth fit the data.
6. In 2002, Russian astrobiologists discovered a bacteria *Deinococcus radiourans* that can tolerate several thousand times the radiation dose that would kill a man. Surface of Mars is exposed to such amount of radiation. Probably, ancestors of these microbes inhabitants of Mars are brought to earth by a meteorite.
7. In 1992, astrobiologists of Texas University reanalyzed the data of NASA's and Russia's space mission of 1970s on Venus. Solar radiation and lightning produces enough carbon monoxide but it is rare; probably something is using it. Presence of carbonyl sulphide is also a signature of life, because it can be produced only by the microbes.
8. In 1993, scientists of Galileo Space probe detected traces of sulphur on Europa, the moon of Jupiter. They suggested that the sulphur traces look similar to the waste-products of bacteria.
9. In 2004, European Space Agency claimed evidence of methane in the atmosphere of Mars. Methane in our Earth mostly produced by bacteria or other life forms.
10. In 2004, astronomers of SETI project detected a mysterious signal from a spot between the constellation Pisces and Aries. At that spot, there is no star or planet. The signal is widely thought to be transmitted by intelligent aliens wishing to be noticed by others.

Humans took thousand of years to explore our own planet, hundreds of years to comprehend our neighboring planets, but now new planets are discovered almost every week. To date, 450 **exoplanets**¹¹ or **extrasolar planets** (planets not belonging to our solar system) have been identified which are orbiting stars other than our Sun. most of those exoplanets are gas giants like Jupiter and Saturn. But among them 20 planets already have been found rocky with conditions suitable to harbour life. So, modern belief is that extraterrestrial life including intelligent being is very probable. But what we need is to develop reliable technical strategy and to look in the right places.

Today's Search for Extraterrestrial Life

The search for life elsewhere is nothing but a search for ourselves. It will answer many fundamental questions, not only in Physics, Chemistry and Biology but also in Philosophy, Psychology and Religion. The question whether we are alone in the Universe still remain unanswered; there is no concrete scientific evidence yet supporting one possible outcome. But that does not mean we should stop searching. There are many approaches and results of searching extraterrestrial life – direct and indirect; within and beyond our solar system.

Direct Search within Our Solar System

- Direct search for evidence of life within our solar system includes studies on the surface of Mars. Reports of those studies support limited evidence that microbial life might possibly exist or have existed on Mars.
- Possible liquid water under the surface of Europa, a moon of Jupiter may contain life. A mission to Europa is proposed.
- Recent photographs of Mars from Mars Global Surveyor show evidence of flows of liquid on the frigid surface of the planet.
- The Messenger Mission to Mercury has revealed a large amount of water in its exosphere.
- Scientists have speculated on presence of microbes in the cloud layers of Venus, 50 km above its surface. The climate is hospitable there and chemical disequilibrium also supports existence of life.
- Titan – the largest moon of Saturn is known to have significant atmosphere. Cassini-Huygens Mission demonstrated the presence of liquid hydrocarbon lakes. Analysis of data is consistent with presence of organisms which are consuming hydrogen and ethane, and producing methane.

If microbial extraterrestrial life is found in a body of our solar system, it must be proved that such life was not contaminated from Earth in recent or distant past. In case of contamination, life in that body cannot be designated as extraterrestrial.

Direct Search beyond Our Solar System

Planets not belonging to our solar system are called **Extrasolar planets** or **Exoplanets**. Several such planets are discovered, which have Earth-like qualities. In

2007, European Southern Observatory, Chile have found the first Earth-like planet within the habitable zone of the star Gliese 581 – 20.5 light years away from the Earth. The planet is named Gliese 581c. it is known to have carbon dioxide and methane in its atmosphere. Among other habitable extrasolar planets are Gliese 581d and OGLE-2005-BLG-390Lb. present radio detection methods are inadequate for detailed study of extrasolar planets. Future telescopes may be able to image such planets with key information like presence of free oxygen in their atmosphere or presence of life forms.

Searching for extrasolar planets is a new kind of mission for direct search of extraterrestrial life. French Space Agency has launched COROT Mission in 2006. it is first of its kind and presently looking for extrasolar planets. In 2009, NASA has launched Kepler Mission, which is essentially a big digital camera with .95 meter aperture and 95 megapixel detector. Kepler is now busy in surveying more than 100,000 stars for planets and sending the existence of Earth-like planets.

Indirect Search

An indirect search for extraterrestrial life is conducting by SETI through astronomical search for radio signals broadcasted by intelligent aliens. Of course, there is no guarantee that an intelligent alien species will intentionally transmit information into deep space. So, some scientists are of opinion to take a proactive approach. In stead of simply listening signals from others, it would be worthy strategy to send regular signals into space. Such signal is ready; “Calling all aliens, this is Earth. Are you receiving me?”

Challenges for detecting Extraterrestrial Life

Almost all scientists believe that there is good reason to think extraterrestrial life and even intelligent life exist. It is also consensus that detection of extraterrestrial life technically feasible. Still date, the main problem is lack of technology. We have to develop proper telescope, proper radio signal and proper strategies to analyze signature of life in other planet.

But beside technological challenge, scientists engaged in search for extraterrestrial life must keep in mind that it may be very different from life here at our Earth. We always take granted that life-bearing Earth-like planets should have atmosphere rich in free oxygen, should have liquid water, should have carbon-based organic molecules which are framework of life on Earth. Biological evolution is so inherently unpredictable that even if life originated on a planet identical to Earth at the same time, life on that planet would certainly be every different from Earth’s life. May be they have separate genetic material than DNA, separate energy molecule than ATP, even separate method of photosynthesis for **autotrophs**¹². So, modern Earth may be the one of hundreds of templates we could use in searching extraterrestrial life.

The problem is even complicated with the postulation of modern cosmology that parallel Universes may exist. Multiple other Universes may have emerged from same primordial vacuum that gave rise to ours. So our Universe may be one of many

Universes within a wider expanse called **Multiverse**¹³. In those unknown Universes, laws of Physics might be different from ours; so matter in them is not same as ours. Assuming they exist, many other Universes may contain intricate structures and perhaps even some forms of life. With the possible existence of multiple model of life, our search for extraterrestrial life is even challenging.

How We will Respond to Extraterrestrial beings

Though almost all direct and indirect search for extraterrestrial life is negative, we are eager to know what would be the impact of extraterrestrial beings on our Earth. Some scientists warned that contact with aliens would not be happy one; the result may be what Native Americans faced when Columbus landed in America. But almost all popular science fiction movies like *E. T.*, *Close Encounter of the Third Kind*, *Koi Mil Gaya* have shown us very friendly aliens. Scientists are not so emotional, rather cautious; they have their protocols to face the extraterrestrial being. And whatever may be the impact, it is inevitable that in near future we will face alien civilizations.

It was not so easy for earlier explorers to explore the depths of oceans or to map the far side of the moon. Likewise, it will not be easy to find life on the planets of other stars. Frank Drake, now 80, is directing the Carl Sagan Center for the Study of Life in the Universe at SETI Institute. He is living with his special emotion, with which he started his search 50 years ago that soon we will be enriched with new knowledge of other worlds, species and cultures. It is a matter of time only, says Drake in an online interview. And it will have a tremendous impact because almost any civilization we find will be much older than our own. They will have much more experience. Much more knowledge, technical and scientific, and that will benefit us greatly. And we will learn ways to have a higher quality of life on Earth which would otherwise take us perhaps hundreds of years of expensive research to learn, to identify ourselves.

The curtain is going up and countless new worlds are ready with their stories to tell.

Notes :

- ¹ SETI = Search for extraterrestrial intelligence, a non-profit institute in California, USA
- ² Extraterrestrial = not belonging to our Earth
- ³ Exobiology = a branch of biology concerned with search for life outside earth (= astrobiology)
- ⁴ Geocentric = based on the Earth as the center
- ⁵ Heliocentric = based on the Sun as the center
- ⁶ UFO = Unidentified Flying Object, the term originated from several reports of flying saucers
- ⁷ NASA = National Aeronautics and Space Administration, USA

- ⁸ Constellation = an assemblage of stars
- ⁹ Nanobacteria = smallest bacteria, less than smallest possible cell (0.2 μm)
- ¹⁰ Microbes = microscopic forms of life
- ¹¹ Exoplanets = Planets not belonging to our solar system
- ¹² Autotrophs = Organisms able to produce own food, like green plants
- ¹³ Multiverse = A hypothetical space that holds many Universes

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