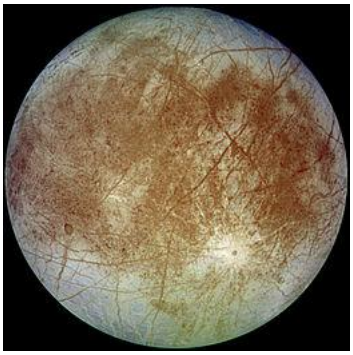
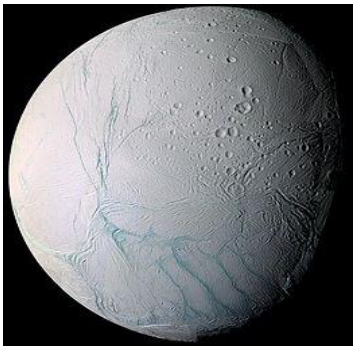
The Quest for Extraterrestrial Lives

By Sokseiha MUY

"Are we alone in the universe?" This question has haunted human mind since the dawn of the civilizations. The immensity and the darkness of the night sky have long been a great source of wonder, enigmas, fear, and inspiration. To answer to this question, ancient people invented all sorts of myths that we can find profusely in every civilization. Today, the fascination of the "***Terra incognita***" doesn't lessen. With the modern and sophisticated instruments, scientists scrutinize the sky in search of the answer. Many astonishing discoveries have been made, but we are just at the beginning of this exciting adventure…





On the top, the photo of Europa in almost approximate natural color taken by *Galileo*. On the bottom, the photo in false color of Enceladus taken by *Cassini*.

In other to sustain life, a planet must meet 3 basics conditions. First, it must be a telluric planet or an earth-like planet i.e. a planet which has a solid crust. Moreover, 4 essential chemical elements must be present on the planet: Oxygen, carbon, nitrogen, and water since they are basic ingredients of the organic chemistry which is believed to the be origin of the first form of life on our planet. Finally, it must be located in the habitable zone namely a zone which is not too far nor too close to the star so that water can exist in liquid state. However, scientists believe that in some planets outside the habitable zone, liquid water can still exist thank to the heat generated by **radioactivity** in the planet core and the **tidal force** exerted by the other planets in the proximity. Two examples of such planets which have attracted great attention of the scientific community are Europa, one of the Jupiter**'s** satellites and Enceladus, one of the Saturn's satellites.

The surface of Europa is covered by a thick layer of ice. This icy surface has caught the attention of scientists by the presence of many continuously moving cracks which seem to float on a liquid, probably water. This observation has suggested the existence of an ocean under its surface in which simple organisms such as bacteria or microbes or even more complex forms of lives can develop especially near the **hydrothermal sources** as those observed on the Earth's ocean floors. On the other hand, Enceladus began to interest scientific community in 2005 when the *Cassini* space probe photographed a jet of ice from its south pole. Another specific characteristic of Enceladus is the intense volcanic activity on its surface due to the huge tidal force exerted by Saturn. This volcanic activity is believed to generate enough heat to keep water in liquid state and therefore to sustain a possible form of life.

With the extraordinary conceptual and technological breakthroughs, men look deeper and deeper into the sky, far beyond the solar system in search of others habitable planets. The discovery of the 1st **exoplanet** in 1992 has stimulated astronomers around the world to launch in the quest of other exoplanets. Until now, many new exoplanets have been discovered and some of them seem to meet the required conditions to sustain life.

Detecting the extra solar planets is a real technological challenge. Because of their weak luminosity, in general they are completely masked by the dazzling brightness of the stars around which they orbit. Specific design of the telescope and spacecraft is needed to overcome this difficulty. For instance, *Kepler* telescope which was launched by the NASA in 2009 is entirely devoted to the detection of exoplanets using **photometry** technique. Up to now, 919 exoplanets have been discovered and there is no doubt that this number will continue to grow up in the following years thank to the advent of new and more powerful instruments.

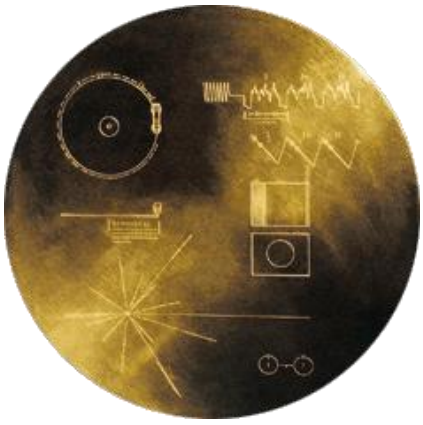
Artist's impression of the *Kepler* telescope.

The Arecibo Radio Observatory in Puerto Rico, which is part of the SETI project.

Besides these programs of direct detection of exoplanets, other researches for the extraterrestrial life have also been carried in the past 50 years. For instance, The program *Search for Extra-Terrestrial Intelligence* (SETI) initiated by the American astronomer Frank Drake in the 1960's, aims at detecting radio signals send by other extraterrestrial intelligence that have reached an advance civilization and a level of technology that enables them to send or receive radio signals.

The detection method consists in analyzing the electromagnetic spectrum captured by the antennas and distinguishing the eventual signals from the random noise. The scientists working in this project have also composed the Interstellar Radio Messages (IRMs) and transmitted it into the outer space in hope that one day an extraterrestrial intelligence will detect and be able to decode them

Another space program which was partially devoted to the search for extraterrestrial intelligence was the program *Voyager 1 and 2*. These two spacecrafts were launched in 1977 and were intended to study Jupiter and Saturn. They also transported with them two discs called "Voyager Golden Records" containing various images and sounds such as thunder, bird songs, spoken greeting in fifty five languages (among which thai and vietnamese languages but no khmer language, unfortunately), music etc. in other to illustrate the extraordinary diversity of our planet. On the golden disc was engraved, in symbolic language, the origin of the spacecraft and the way to play the record. The spacecrafts also contain a



Cover of the Golden Record that was embarked on the *Voyager* spacecrafts.

small quantity of pure uranium, a radioactive element, which should enable the eventual extraterrestrial intelligence in the distant future who receives it to determine the age of the record.

In brief, we are now closer than ever to the ultimate answer to our millennium question. The quest for extraterrestrial live, the Holy Grail for every astronomer, has been launched and we have the exceptional chance to live one of the most exciting epochs of the space exploration. The eventual discoveries of extraterrestrial lives will be a giant step for mankind, even bigger than that of Armstrong on the moon.

Glossary

Terra Incognita : Latin expression which literally means "unknown land", used to define places which are not mapped or explored in detail.
Radioactivity : The process by which a nucleus of an unstable atom spontaneously decays into lighter element(s) by emitting alpha and beta particles as well as gamma ray.
Tidal force : Effect of the force of gravity and is responsible for the tides**.**
Hydrothermal sources : Sources of hot water which are commonly found on the ocean floors where tectonic plates are moving apart.
Exoplanet : Planet which is situated outside the solar system.
Photometry : Measurement of the flux or intensity of an astronomical object's (stars, planets, …) electromagnetic radiation.

To go further

For those of you who are willing to find out more detail about different topics evoked in the article, please refer to the following website:

1. http://www.science-et-vie.com/2011/03/11/un-ocean-cache-sous-la-banquise-dencelade/. A page in French which gives more detail about the particularity of Enceladus and the reason why we expect that liquid water may exist on this planet.
2. http://voyager.jpl.nasa.gov/index.html. A website which gives a lot of information on the *Voyager* spacecraft, including interesting history about its mission as well as the Golden Record mentioned in the above article.
3. http://kepler.nasa.gov/. A very complete website on the *Kepler* project whose objective is the detection of exoplanets. A lot of beautiful images and plenty of useful information (although sometimes a little bit technical).

In addition to the above website, one can also read articles in wikipedia which are accessible without too much knowledge on the field.