The Venus Transit 2004

... Extended InfoSheet D8

Printable Page: html PDF

Does life exist on Venus and on the other worlds of the solar system?

Is there life on the planets and moons of the solar system? Is there life on Venus? Human beings have never quite accepted the idea that life exists only the Earth. From the earliest times when humans populated the heavens with gods, goddesses and supernatural beings, and until the spectacular space exploration activities of the 20th Century, many have felt compelled to consider the question: Is there Life on Other Planets?

Ideas of earlier ages

In the 17th and 18th century - during the Age of Enlightenment - there was no doubt about it. Common people, scientists and especially philosophers believed that extraterrestrial life - intelligent life! - existed on other worlds: planets, moons, the Sun and the stars. In his satirical novel "Micromegas", Voltaire told how men from Sirius discovered our planet Earth.

Since astronomers' observations show that the stars, the planets and the moons of our solar system are not supernatural bodies but are real bodies like the Earth, they ask: Are these planets habitable worlds with intelligent life forms? This question has been discussed passionately. A very popular idea was that life on other worlds of the solar system would have characteristics attributed to them by astrologers. For example, people who live on Mars (the planet of war) should be strong, quarrelsome and enjoy war. People from the planet Venus should be very pretty and enjoy love and art.

Venus and Mars

Venus and Mars were prime candidates as an abode for intelligent life in the solar system because in telescopes they showed some similarities to the Earth: an atmosphere with clouds, seasons (on Mars) and faint dark variable features which could be continents. Fascinating surface features on Mars included red deserts and shining white polar caps which changed with the seasons. For Venus it was significant that the planet was only slightly smaller than the Earth and was densely covered with clouds.

Until the end of the 1950s many scientists believed that the Venusian clouds were made of water vapour, and since the planet orbited the Sun closer than the Earth, the surface conditions on Venus could be tropical. The surface could be covered with jungles, oceans or deserts. Life could be similar to the type of life which existed on the Earth during the Carboniferous and Permian periods.

The nature of life

But what is the nature of life and where could it exist in the solar system? According to scinetific research, there are **two major distinguishing characteristics of life: reproduction and evolution**.

Actually, at this moment we know only one place in the solar system where life has definitively developed and can exist: our blue planet Earth. By studying the Earth we have gained some appreciation of the kind of environments that are conducive to life.

We now know that **liquid water is a key prerequisite for life** and that its abundance on the Earth has been a key factor in the evolution of life. It is therefore reasonable to look at other worlds in the solar system where liquid water could exist because its presence signals the possibility of life. In this connection we have to ask where in the solar system are the atmospheric conditions right (and that means similar to the Earth).

Planetary studies

Our planetary system contains one star, nine planets, more than seventy satellites, thousands of asteroids and billions of comets. After fifty years of planetary studies with space probes and specialised telescopes we know the physical properties of these bodies very well and can make the following summary:

- Mercury, the innermost planet, has no atmosphere because it is too hot and its gravity is too weak. The slight traces of atmosphere come from the solar wind.
- Pluto, the outermost planet, generally has no atmosphere because its gravity is too weak. Only when it comes within Neptune's orbit in its 250-year journey around the Sun do the frozen gases of methane sublime and create a temporary atmosphere.
- Most of the satellites have no atmosphere because their gravitational fields are too weak.
- Venus has no liquids because it is too hot (up to 482° C) and the pressure is too high (about 90 atmospheres)
- Mars has no liquids on the surface because its atmospheric pressure is too low. In the past it had liquid water and it is possible that some liquid water can be set free during melting processes caused by volcanic eruptions which have yet to be observed with instruments.
- Jupiter, Saturn, Uranus and Neptune are too cold and their atmospheric pressures are too high for liquid water.
- Jupiter's satellite Europa may have liquid water under its crust because Jupiter's tidal action could cause volcanic activity and the resulting warming could maintain an ocean.
- Saturn's moon Titan may have liquid methane on its surface.

So where should we look ?

The best places to look for life in the solar system are Mars, Europa and Titan. But iss Venus really uninhabitable? This may be true for the surface but not for the Venusian sky. At the end of 2002, the German astrobiologist *Dirk Schultze-Makuch*, who is working at the University of Texas in El Paso, argued that the Venusian clouds could definitely be an abode for life. The temperature at a height of 50 km above the surface of Venus is only between 30 and 80 degrees and the pressure is similar to sea level pressure on Earth.,/p>

Reanalysis of data recorded by the *Venera* and *Pioneer* space probes showed a mysterious phenomenon which may indicate traces of Venusian life in the shape of micro-organisms. For example, ultraviolet images of the Venusian atmosphere show strange dark spots caused by something which seems to filter out the solar ultraviolet radiation. Another anomaly is the unexpected low concentration of carbon monoxide measured by the space probes. It poses the question: what happens to gas produced by lightning?

On the same missions the probes detected hydrogen sulphide. This chemical should have been transformed long ago into sulphur dioxide - or else something is continuously producing new hydrogen sulphide. Schulze-Marbach believes that this process is caused by micro-organisms which consume sulphur dioxide and carbon monoxide (an explanation for the low concentration of these gases) and which secrete carbon dioxide or hydrogen sulphide. Moreover, it is possible that the microbes use sunlight for this process and that would also explain the dark spots.

And what about the lack of water?

The fact that essential water exists at only a very low concentration is no obstacle to the existence of biological cells in Venus' atmosphere. In recent years, investigations of geysers, oil wells and volcanoes have shown that life can exist even in those extreme environments in the shape of heat-resistant bacteria. Scientists have know for a long time that micro-organisms can be raised aloft by storms or volcanic eruptions and can serve as condensation nuclei for clouds. But they categorically excluded the possibility that germs can survive at this height or reproduce themselves. They identified three reasons: a temperature of minus 56 degrees, the damaging hard ultraviolet radiation and the absence of food.

Recently this theory has been challendged by the water ice specialist Birgit Sattler. She works at the University of Innsbruck, and sampled water droplets at a height of over 3000 metres on Sonnenblick

mountain near Salzburg. On investigating them, she made the sensational finding that about 1500 vigorous bacteria of different forms and size were swimming in each millilitre of the fluid. And the number microbes rose steadily each week at a speed characteristic of vegetable plankton.

Unlike clouds on the Earth, the dense clouds on Venus have a long life. The droplets that form - a possible home of the microbes - are larger than those in the Earth's atmosphere and they last for periods of several months. On the Earth, the droplets fall to the ground as rain after only a few days.

Go to the corresponding Brief InfoSheet

Back to the List of Extended InfoSheets.

last modified: 2004/02/16