

Science Update May 25 2021: Life, Cuttlefish, Gravity

Life. It is now statistically (and logically) certain that life exists in many places in the universe. Even after it was discovered that planets orbiting other stars (exoplanets) are extremely common, there was still some thought that the Earth is unusual because of its large amount of liquid water, which is required for life as we know it. New computer modeling out of the University of Copenhagen, however, has confirmed the theory that planets form by a process of accretion of particles of dust and ice. That means that water is an inherent part of the composition of planets, rather than a rare result of some cosmic accident. All that is needed to have liquid water on a planet's surface, then, is for it to be in the necessary temperature zone near its star.

In related news, a recent report out of Caltech and JPL analyzing Mars's atmosphere and rock history has determined that the red planet was covered in a deep ocean 4 billion years ago and that, significantly, that water did not simply evaporate into space as previously thought. Instead, much, and perhaps most, of it remains trapped in minerals in the planet's crust. Its continued presence markedly raises the possibility of life beneath the Martian surface.

In still another recent study, investigators have confirmed the presence of water and organic materials essential for life on the surface of asteroid Itokawa, the rock that was sampled by the Japanese Hayabusa spacecraft in 2010. This news is of course on top of the multiple previous reports of the likelihood of life on several moons of Jupiter and Saturn as well as Mars and in the atmosphere of Venus.

Finally, considering the question statistically, there are thought to be 100 billion exoplanets in our galaxy and 2 trillion galaxies in the universe. That means there are about 10 to the 23rd power number of planets (and that doesn't count their moons) in the universe. Given all the indications of the likelihood of life on other astronomical bodies, the notion that Earth is the only place in the universe where there is life must be accepted as an impossibility.

Cuttlefish. Being a cephalopod, and therefore a close relative of the octopus, cuttlefish are among the most intelligent invertebrates. Recent research out of the Marine Biological Laboratory at Woods Hole has shown that cuttlefish are able to pass the "marshmallow test," which requires giving up an immediate reward because they have learned that

a better reward will appear if they wait. The animals were able to wait for up to 130 seconds, which is as long as chimpanzees, crows and parrots. In a separate experiment, the cuttlefish that could wait the longest were found to be more intelligent in other ways. Cuttlefish have, in fact, among the largest brain-to-body size of all invertebrates. Even though they are molluscs therefore, they are understandably outraged when compared with clams, who have no brains at all.

Gravity. The problem of creating a universal theory of physics has focused on trying to fit gravity with the other known forces in the universe which would allow it to be integrated with the quantum mechanics that does a good job describing everything else. Newton's law of gravity works at large and ordinary scales (e.g. interactions of astronomical objects, or apples falling to the ground) but, because gravity is so extraordinarily weak compared with the other forces (electromagnetism and the strong and weak forces) it has been impossible to even measure it at tiny distances; it cannot be separated out from the effect of the earth's gravity or electromagnetic attraction between objects. Now, however, researchers from the Institute for Quantum Optics and Quantum Information (IQOQI) of the Austrian Academy of Sciences have for the first time measured gravitational interaction between two objects each less than a tenth of a gram in mass. The strength of their attraction (which is about one third the weight of a human red blood cell) turned out to be just as predicted by Newton's law. The researchers will next attempt to measure even smaller interactions with the hope of discovering quantum gravitational effects for the first time.

Lance Dodes