Lecture of the Week Series

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Beginning today, AICS Research, Inc. is launching a new service: a Lecture of the Week, and you're welcome to subscribe to a weekly announcement newsletter if you wish. The talks will center primarily around evolutionary biology, in all of its aspects: cosmology, astronomy, planetology, geology, astrobiology, ecology, behavior, phylogenetics and evolutionary biology itself, and are presented at a professional level, that of one scientist talking to another.

For the past 30 months AICS Research has been recording the highest quality conferences in these fields and now has 200 excellent presentations in its vault.

The webpage for the lectures is:

http://aics−research.com/lotw/

Instructions on subscribing to the weekly notice are given on the page.

Because of the recent, quite extraordinary news regarding the discovery of water geysers on Enceladus, a small moon of Saturn, the inaugural lecture will be given by Reta Beebe, an archivist of the Cassini mission that discovered this phenomenon. Reta's talk was given last March, before the discovery, but as you will see, while the discovery is surprising, it wasn't unexpected either.

An introduction to Reta's talk is presented below.

Wirt Atmar

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March 13, 2006

Looking for Life in All The Wrong Places

Cassini and Huygens at the Saturn System
Reta Beebe, New Mexico State University
54 min. (requires QCShow Player)

In our search for a second genesis of life in the solar system, Mars has been the perennial favorite for more than a century. But life appears to require liquid water, and Mars has been a dry and desolate, at least on its surface, for 3 billion years or more, and thus its prospects are fading.

Our hopes for discovering life in this solar system began unexpectedly turning to the moons of the outer planets 25 years ago, following the twin Voyager missions. The gas giant planets are composed primarily of hydrogen and helium, and are thus they're made of the stuff of the primordial universe. But these low atomic weight gases also make them rich in water. The problem? They're cold. Indeed many of the moons of these planets are so cold that water ice becomes the geologic rock of the planetary body.

But a few of the moons are hot. The mechanism? Tidal heating. As Reta Beebe explains in this talk, several of the larger inner moons of both planets are synchronously locked forever with a twin, orbiting at exactly half its speed. This is true for the Jovian moons, Io, Europa and Ganymede and for the two Saturnian twins, Enceladus and Dione and Mimas and Tethys. For every trip around Jupiter that Ganymede makes, Europa makes two trips and Io makes exactly four. These resonances will occur forever. Their orbits are gravitationally bound to one another. But because their orbits are not exactly circular, tidal heating occurs, sufficient to the point that the surface of Io is nearly molten and Europa and Ganymede appear to have liquid water oceans under thick and thicker crusts of ice.

The tidal heating in these moons provides precisely the two things that we suspect that life requires: energy and liquid water. Following the Voyager missions in the early 1980's, attention turned to Europa as possibly the second best hope for finding life in the solar system, but Europa also lies in a terrible neighborhood: Jupiter's radiation belt. The radiation levels are so high at Europa that the most radiation−hardened spacecraft could only spend a month or so orbiting Europa before it was fried. No complex biochemical molecule, much less life, could exist on its surface. If life exists, it will have to have been protected by Europa's ice cap, deep in its interior ocean.

Enceladus, in contrast, resides in a much more benign environment, and it now appears that it may be warmer in its interior than Europa. Just this week, a new report by Carolyn Porco et al. in Science reports that geysers of liquid water appear to breaking through Enceladus' much thinner ice crust and are venting into space.

"We realize that this is a radical conclusion, that we may have evidence for liquid water within a body so small and so cold. However, if we are right, we have significantly broadened the diversity of solar system environments where we might possibly have conditions suitable for living organisms," Porco said.

The discovery of liquid water in Enceladus so near the surface was unexpected, but it wasn't a complete shock either. The four− or six−year Cassini mission currently orbiting Saturn represents only our second trip to Saturn in 25 years, but this discovery of water at Enceladus is likely to foster a quick return to the moon, but the next time now with instruments more suited for biological exploration.

If there is life in Enceladus' oceans, it should be very easy to detect. We can sample that water from space, using a low−orbiting spacecraft flying over Enceladus' south pole.

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