MAX PLANCK SOCIETY

Press Release

News SP / 2006 (27) March 14th, 2006

Ice Volcanoes on Saturn's Moon Enceladus

International team of researchers discovers ice volcanoes on Saturn's moon Enceladus

Scientists from the Max Planck Institute for Nuclear Physics and the University of Potsdam have found ice volcanoes - or what could be called "ice geysers" - on the surface of Saturn's moon Enceladus. They made the discovery using a combination of computer simulations and measurements from the dust detector on the space probe CASSINI. The ice volcanoes are located at geologically young, warm structures in the icy moon's southern polar region. The ice particles probably are created from steam deep in crevices. Volcanic activity is now known to exist in three bodies in our solar system: Enceladus, Earth, and Jupiter's moon Io (Science, March 10, 2006).

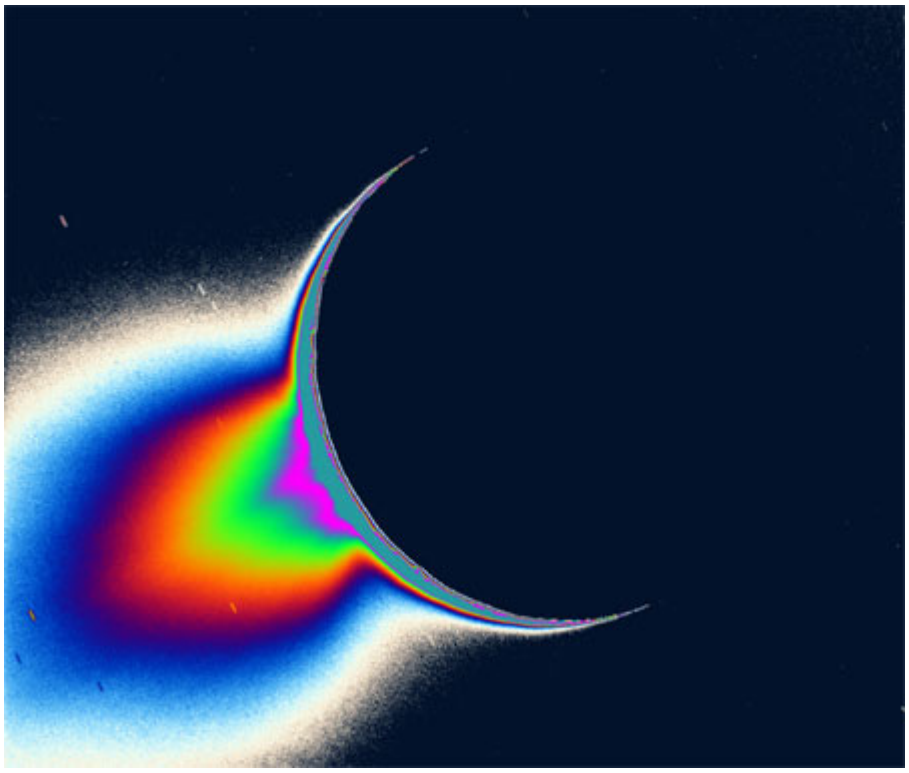

Fig.1: *An artificially coloured image of Saturn's moon Enceladus. Clearly visible over the southern polar region are dust fountains, caused by ice volcanic activity (lower left corner).*

Image: NASA/JPL/Space Science Institute

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ISSN 0170-4656

Saturn's E ring, the largest ring around any planet in our solar system, is not only remarkable for its huge size. What is also astounding is that current optical measurements show it to be made of ice particles of nearly equal size - a radius of 0.3 to 2 micrometres. The icy moon Enceladus was, however, expected to feed the ring with significantly larger pieces. The ring's mass distribution must thus somehow be tied up with the dynamics of the particles. Until now, however, scientists did not know how. Directly measuring ice particles near Enceladus promised to deliver a better understanding of the E Ring's complex nature.

On July 14, 2005, the CASSINI space probe came within 175 kilometres of Enceladus, which is suspected of being the source of Saturn's E Ring. This made it possible to measure dust distribution deep inside the area of Enceladus' gravitational pull. The scientists could thus investigate how the moon refreshed the ring with dust particles.

Until now, it was assumed that new ice particles were created by interplanetary micrometeorites, or ring particles themselves, bombarding the moon's surface. In this model, most of the fresh particles form a nearly isotopic dust cloud around the moon. In the other model, faster particles feed the ring. Indeed, the dust detector on the space probe GALILEO had already discovered dust clouds surrounding Jupiter's Galilean moons.

Measurements from the High Rate Detector (HRD) of CASSINI's "Cosmic Dust Analyser" (CDA), taken by scientists from the Max Planck Institute for Nuclear Physics in Heidelberg and the University of Chicago are however not consistent with this assumption. Observations showed that the maximum rate of impact was reached *before* the probe moved to its closest point to Enceladus. This can only be explained if there exists a strong anisotropic - that is, directionally dependent - dust distribution on the moon.

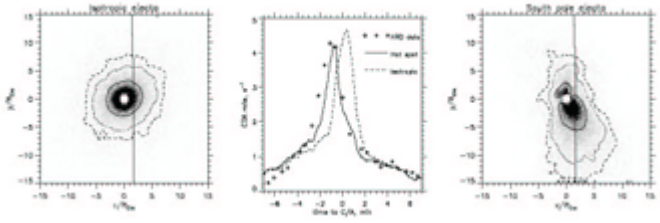

Fig.2: *A comparison of the rate of impact from CASSINI's HRD sensor and numerical simulation of the dust clouds around Enceladus. Right: the modelled dust distribution if there is an ice volcano in its southern polar region. Left: the dust distribution without volcanic activity.*

Image: University of Potsdam/Max Planck Institute for Nuclear Physics

The dust detector was not the only instrument which came to show unexpected discoveries. Photographs of Enceladus' southern polar region clearly showed geologically young structures. Infrared images also indicated a warmer area - a "hot spot" - in that southern region. This led scientists from the University of Potsdam to model dust distribution on the moon under the assumption that there is an additional, tightly confined, dust source on its surface. The models indicated a contained dust source in the southern polar region. This turned out to be consistent with the probe's measurements.

This convincing match between models and HRD measurements (see image 2) led the Cassini camera team to look for, and find, volcanic activity. Enceladus is thus the second moon in our solar system where volcanic activity has been discovered

[EC]

Original work:

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Cassini Dust Measurements at Enceladus and Implications for the Origin of the E Ring
Science, March 10, 2006

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