Cassini caught in Hyperion's particle beam

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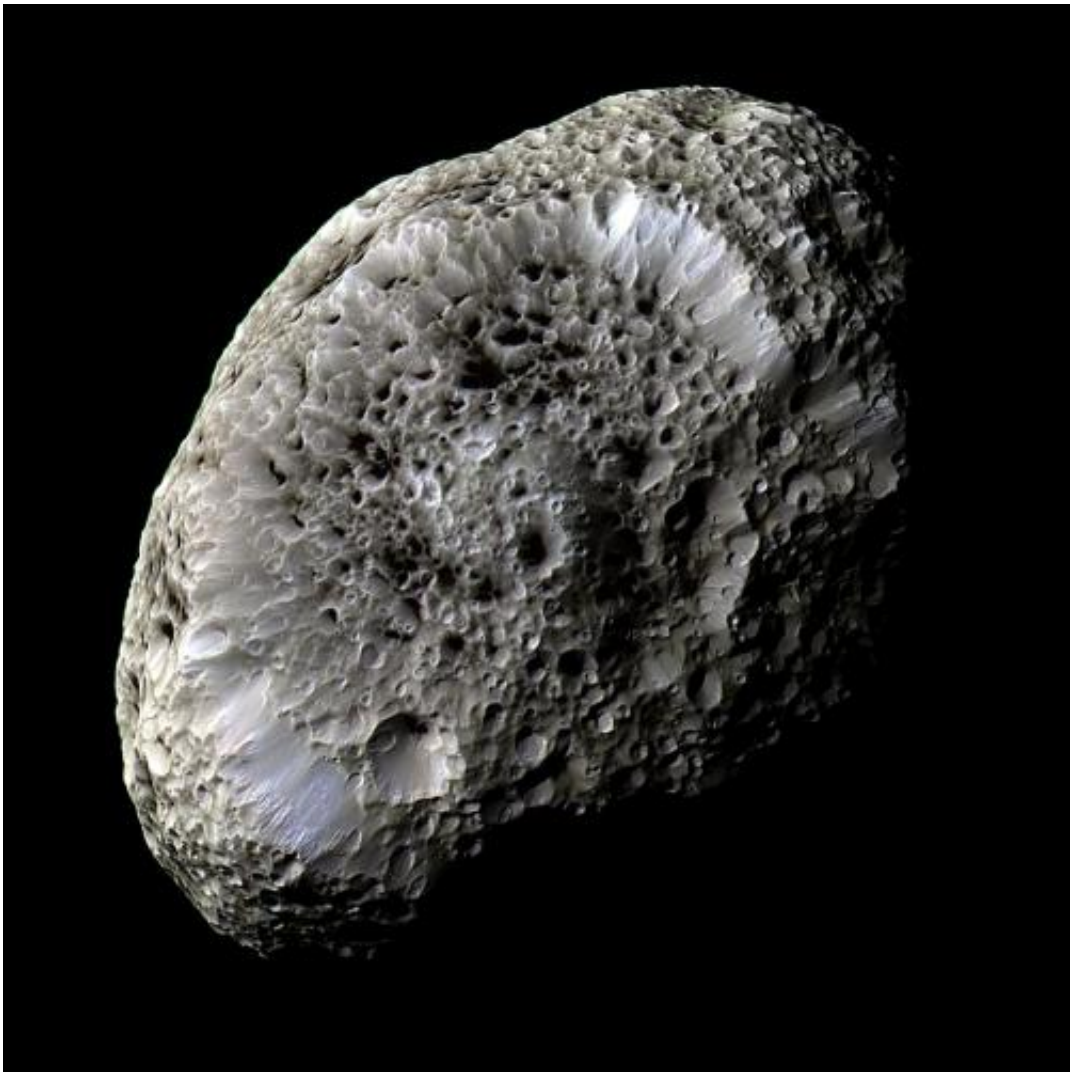

This stunning false-color view of Saturn's moon Hyperion reveals crisp details across the strange, tumbling moon's surface. Differences in color could represent differences in the composition of surface materials. The view was obtained during Cassini's close flyby on Sept. 26, 2005. Hyperion has a notably reddish tint when viewed in natural color. The red color was toned down in this false-color view, and the other hues were enhanced, in order to make more subtle

color variations across Hyperion's surface more apparent. Credit: NASA/JPL/Space Science Institute

Static electricity is known to play an important role on Earth's airless, dusty moon, but evidence of static charge building up on other objects in the solar system has been elusive until now. A new analysis of data from NASA's Cassini mission has revealed that, during a 2005 flyby of Saturn's moon Hyperion, the spacecraft was briefly bathed in a beam of electrons coming from the moon's electrostatically charged surface.

The finding represents the first confirmed detection of a charged surface on an object other than our moon, although it is predicted to occur on many different bodies, including asteroids and comets.

The new analysis was led by Tom Nordheim, a doctoral candidate at Mullard Space Science Laboratory (MSSL), University College London, and was published recently in the journal *Geophysical Research Letters*.

Hyperion is porous and icy, with a bizarre, sponge-like appearance. Its surface is continuously bombarded by ultraviolet light from the sun and exposed to a rain of charged particles—electrons and ions—within the invisible bubble generated by Saturn's magnetic field, called the magnetosphere. The researchers think Hyperion's exposure to this hostile space environment is the source of the particle beam that struck Cassini.

Measurements made by several of Cassini's instruments during a close encounter with Hyperion on September 26, 2005, indicate that something unexpected took place in the charged particle environment around the spacecraft. Among those instruments, the Cassini Plasma Spectrometer (CAPS) detected that the spacecraft was magnetically connected to the surface of Hyperion for a brief period, allowing

electrons to escape from the moon toward the robotic probe.

Most people are familiar with the electrostatic charge buildup that occurs when a balloon is rubbed against hair or a sweater. Objects in space can also become electrostatically charged by exposure to solar ultraviolet light and incoming charged particles. The Cassini data show that a similar process can take place on Hyperion.

The finding is surprising, as the small but odd-looking moon was thought to be a simple inert object, which would not undergo any strong interactions with the Saturnian magnetosphere. Nevertheless, the team's analysis indicates that Cassini remotely detected a strongly negative voltage on Hyperion. "It was rather like Cassini receiving a 200-volt electric shock from Hyperion, even though they were over 2,000 kilometers [1,200 miles] apart at the time," said Nordheim.

Scientists had previously suggested that surface features observed on the asteroid Eros and several of Saturn's moons are due to the motion of charged dust across their surfaces. On small objects with low gravity, dust grains might even be able to overcome the force of gravity and escape into space.

Although mission controllers have detected no signs that the Hyperion electron beam caused damage to Cassini, strong electric charging effects could prove to be a hazard to future robotic and human explorers at planetary objects without atmospheres, including Earth's moon, where they could create the potential for powerful electrostatic discharges.

"Our observations show that this is also an important effect at outer planet moons and that we need to take this into account when studying how these moons interact with their environment," said Geraint Jones of MSSL, a member of the Cassini CAPS team who helped supervise the study.

Cassini's CAPS instrument was powered off in 2012, when the instrument began to draw excess current. The team is based at Southwest Research Institute, San Antonio. Part of the CAPS instrument that made the detection discussed in this research—the CAPS electron spectrometer—was built by MSSL.

Nordheim and colleagues also utilized data from three other Cassini instruments in their analysis: the Radio and Plasma Wave Science instrument, the Magnetospheric Imaging Instrument and the magnetometer.

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