PLANETARY SCIENCE

Slow Leak Seen in Saturn's Rings

TUCSON, ARIZONA—Saturn's rings are slowly losing their lifeblood, and the Hubble Space Telescope has spotted the trail. At the meeting of the Division for Planetary Sciences held here last month, Thierry Fouchet of the Institute of Space Astrophysics (ISA) in Orsay, France, and his colleagues reported that they have detected water in the stratosphere of Saturn. The most likely source is the planet's icy rings, and the leakage implies that, in astronomical terms, the rings are a short-lived marvel.

News of the rings' mortality doesn't come as a great surprise. Astronomers had suspected that the rain of microscopic meteorites that pelts every body in the solar system was rapidly eroding the rings, and they already had some indirect evidence that ring debris is falling into the planet. But this first direct evidence of the infall could tell astronomers just how fast the rings are eroding, placing direct bounds on the life-span of Saturn's rings—and, by extension, the older, less showy rings of the other giant planets. "They seem to have the smoking gun," says ring specialist Jeffrey Cuzzi of NASA's Ames Research Center in Mountain View, California. "It's one step less indirect" than previous studies.

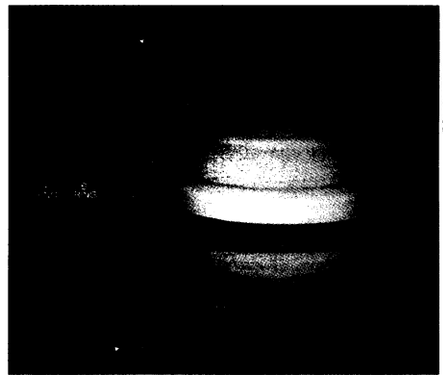
The region of Saturn's ring system most vulnerable to erosion, researchers thought, was the inner part of the tripartite ring system—wispy ring C and innermost B. Any icy submicrometer-size particles dislodged from the rings could gain an electric charge from the micrometeorite impacts, which would force the particles to travel along the planet's magnetic field lines. Farther out in the rings, the combination of magnetic forces and gravity would not let the particles wander far from the ring, so they would eventually reaccrete to it. From the C and innermost B rings, however, the magnetic lines would carry particles straight toward the planet.

If so, the best place to search for evidence that the rings are eroding would be in the upper atmosphere of Saturn. In 1984, John Connerney of NASA's Goddard Space Flight Center in Greenbelt, Maryland, and Hunter Waite of the Southwest Research Institute in San Antonio suggested that water from the rings could explain the dearth of electrons other researchers had noticed in the upper atmosphere's ionized region. The water would help soak up electrons by catalyzing their recombination with positive ions. The amount of water needed to explain the electron deficit implied ring erosion fast enough to limit the lifetime of a ring as dense as B to a few tens of millions of years, Connerney and Waite calculated.

Now Fouchet, Connerney, René Prangé of ISA, and their colleagues have gone after the ring water itself with the spectrographs aboard the Hubble Space Telescope. The group took far-ultraviolet spectra of Saturnian latitudes where water was expected to be falling from the rings and of latitudes where no extra water should be. Latitudes with magnetic connections to the rings showed at least twice as much water, providing in the group's words "convincing evidence of water precipitating from the rings along magnetic field lines."

Determining just how fast ring water is streaming into Saturn and thus how long the rings have been around will take more work on the spectra and some calculations of how fast the water is being removed from the stratosphere, says Connerney. A high flux would be the most direct evidence that Saturn's rings are short-lived and that it's only by luck that they are around for human beings to marvel at. The catastrophic event needed to make rings as massive as these—the shattering of a small moon by a comet or the disruption of a passing giant comet by Saturn's gravity—is likely to happen just once in the planet's lifetime, say dynamicists. If so, the dazzling rings of Saturn could be a rare sight indeed.

–Richard A. Kerr

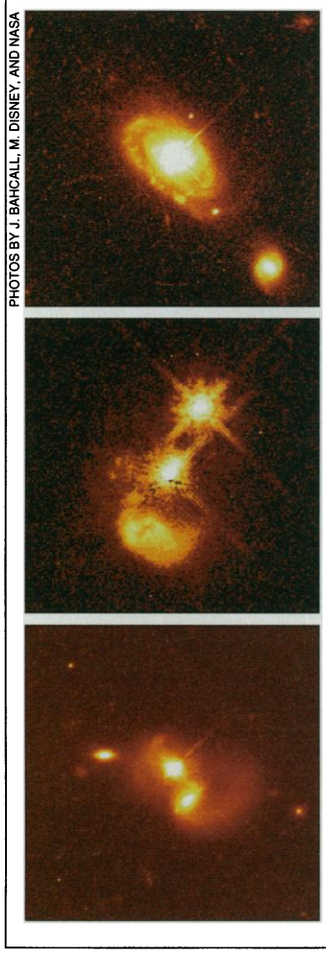


FOUCHET *ET AL.*/ISA

Trickle down. Ice particles dislodged from Saturn's inner rings can follow magnetic field lines into the planet.

ASTRONOMY

Hubble Gives a Quasar House Tour



PHOTOS BY J. BAHCALL, M. DISNEY, AND NASA

Quasars are hard to catch at home. These cosmic beacons, which produce more light than trillions of suns, dazzle earthbound telescopes and blot out a clear view of the distant galaxies in which they live. But the sharp-eyed Hubble Space Telescope has now caught the clearest glimpses yet of quasars in their home environments and found that they are not particular about their surroundings. Many of them live in irregular galaxies undergoing violent collisions or other turmoil (left, middle and bottom), but some quasars blaze from the centers of seemingly quiet, regular spiral galaxies (top) or undisturbed ellipticals.

Astronomers John Bahcall of the Institute for Advanced Study in Princeton, New Jersey, and Mike Disney of the University of Wales in Cardiff unveiled their latest images last week at NASA headquarters. The images, says Bahcall, are a "big step forward" in the effort to understand these beacons, which many astronomers think are powered by giant black holes. But the new images don't reveal any clear answers. Disney sees colliding galaxies—which are ordinarily fairly rare—in 11 of his 15 quasar images. Such a high frequency, he says, suggests that collisions play a critical role in quasar development, perhaps by shoving stars and gas into the maw of the black hole.

But Bahcall is not so sure. He says more than half of his 20 images show galaxies that hardly seem to notice their brilliant guests. It is possible that these quiet hosts have recently settled down after consuming a smaller galaxy, he says, but at this point, "there is no sweeping statement we can make."

–Gretchen Vogel