

Researchers track moons embedded in Saturn's rings

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For the first time, astronomers have identified and tracked individual moons that are not in empty space, but nestled within a disk of debris orbiting a planet. The ability to watch as the embedded moons' orbits evolve over time could give scientists valuable new clues about how planets form and grow around stars in young solar systems.

Using images obtained by NASA's Cassini mission, astronomers led by Cornell research associate Matthew Tiscareno followed several of what are likely to be dozens of small moons orbiting within the outer edge of Saturn's A ring -- the outermost of the planet's large, dense rings -- from 2005 to 2009. They found that the moons' orbits evolved slightly over time, hinting that their paths may be influenced by interactions with the disk material surrounding them.

If disk-moon interactions are responsible for the changes, the system would provide a unique analogue to the processes believed to be at work in circumstellar disks, protoplanetary disks and solar system formation in the distant universe --- and a parallel to the dynamics behind the creation of our own solar system.

The findings appear in the July 8 issue of *Astrophysical Journal Letters*.

Although the embedded moons, which are between 1 and several kilometers in diameter, are too small to be imaged directly by Cassini's cameras, they are distinguishable by unique propellerlike structures they create in the ring material around them.

Tiscareno and colleagues have previously observed swarms of smaller propeller moons in a closer-in part of the A ring now known as the propeller belt, but those structures are too clustered to be tracked individually. In this case, the much larger moons orbit farther from the planet, on the outer side of the ring. The largest, created by a moon nicknamed Blériot after a French aviator, is several thousand kilometers long, or half the distance across the continental United States.

Cassini caught sight of Blériot more than 100 times, allowing the researchers to map its path in detail.

"You would expect any object that's just orbiting Saturn on its own should stay in a constant path," Tiscareno said. "What we actually see is that the orbits are changing."

The most likely explanation, he said, is that the moons are actually interacting with

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the disk: exchanging angular momentum with the ring particles around them either through gravity or by direct collisions.

Still, other explanations, like resonant interactions with more distant moons, have not been ruled out as causes.

Working out the contributing factors is the next task. Meanwhile, Tiscareno said, "a big part of our plans is to keep tracking these objects as long as the spacecraft is orbiting."

The Cassini mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology, manages the mission for NASA's Science Mission Directorate.

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