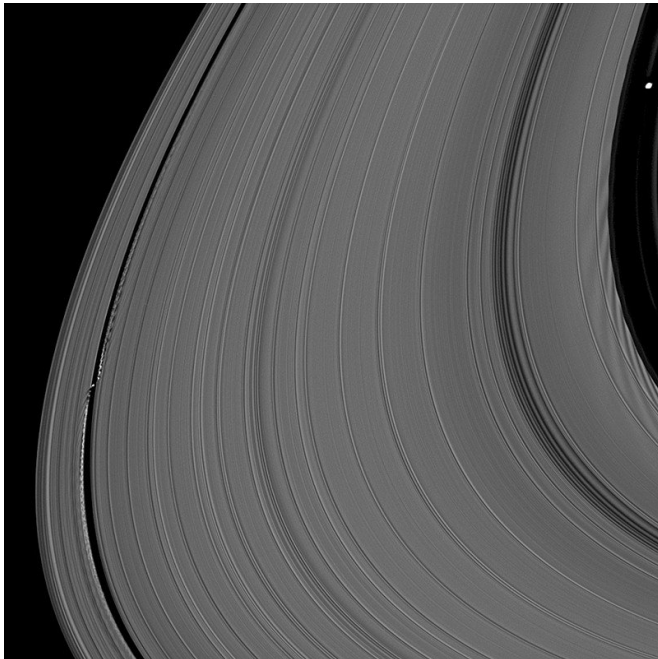


To keep Saturn's A ring contained, its moons stand united

17 October 2017, by Blaine Friedlander



A team of Saturn moon keeps Saturn's A ring from spreading. This image from NASA's Cassini mission clearly show the ring's density waves created by the small moons. The waves look like the grooves in a vinyl record. Credit: NASA

For three decades, astronomers thought that only Saturn's moon Janus confined the planet's A ring - the largest and farthest of the visible rings. But after poring over NASA's Cassini mission data, Cornell astronomers now conclude that the teamwork of seven moons keeps this ring corralled.

Without forces to hold the A [ring](#) in check, the ring would keep spreading out and ultimately disappear. "Cassini provided detail on the mass of Saturn's moons and the physical characteristics of the rings, so mathematically speaking, we concluded that the moon Janus alone cannot keep the rings from spreading out," said Radwan

Tajeddine, a research associate in astronomy and lead author of the new research. "What Confines the Rings of Saturn?" is planned for publication Oct. 18 in the *Astrophysical Journal*. Tajeddine also will present this research in a poster at the American Astronomical Society's Division of Planetary Science meeting Oct. 17 in Provo, Utah.

The scientists discovered that confinement of the A ring is shared among the moons Pan, Atlas, Prometheus, Pandora, Epimetheus, Mimas and Janus. "All of these moons work as a group to contain the ring. Together they are strong. United they stand," said Tajeddine.

Cassini, which crashed into Saturn Sept. 15 at the mission's end, provided valuable data and detailed images of the planet's rings. The A ring looks similar to a vinyl record; it has ["density waves"](#) that resemble a record's grooves that are created by what astronomers call moon resonances. These resonance markers enabled scientists to deduce that the moons' gravitational influence help to slow and reduce the spreading ring's momentum.

There are hundreds of density waves spread over the A ring that are generated by different [moon](#) resonances. Tajeddine compares it to tug of war with many knots along the gravitational rope. All of these gravitational pushes by these moons slow the ring down and pull momentum from it. So much momentum is lost by the time the ring gets to Janus that the forces create the edge of the A ring.

Senior author Joe Burns, Ph.D. '66, the Irving Porter Church Professor of Engineering and professor of astronomy said: "This was exactly the sort of information we had hoped the Cassini mission would provide, and by doing so it has allowed us to solve this puzzle."

Tajeddine said scientists are still not sure how the rings formed, but the mechanism of their confinement is finally understood. "That's the

novelty of this idea. No one imagined that rings were held by shared responsibility," he said.

"The density waves created by moons are beautiful to look at, but they actually participate in confining the ring," said Tajeddine. "Janus has been getting all of the credit for stopping the A ring, which has been unfair to the other moons."

Provided by Cornell University

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