Odd bodies, rapid spins keep cosmic rings close

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Maryame El Moutamid, part of an international scientific team, has found that gravity – rather than shepherding moons – retains rings around small cosmic bodies. Credit: Jason Koski/Cornell Brand Communications

Forget those shepherding moons. Gravity and the odd shapes of asteroid Chariklo and dwarf planet Haumea—small objects deep in our solar system—can be credited for forming and maintaining their own rings, according new research in *Nature Astronomy*.

"Rings appear around Saturn, Jupiter, Neptune and Uranus, but scientists found rings around Chariklo and Haumea within the last few years. Chariklo and Haumea were the first small objects known to have rings, and we think that rings throughout the solar system are more common than we thought," said Maryame El Moutamid, research associate in the Cornell Center for Astrophysics and Planetary Science and an author of the new paper. "In the case of small bodies Chariklo and Haumea, gravity shepherds the rings. The rings are confined by the gravity because of the shape irregularity of their bodies."

Until now, scientific literature generally assumed that the gravitational torques from shepherd moons around planets kept the rings in shape and prevented them from spreading and disappearing. Instead, this research shows that a topographic anomaly on the object, such as a mountain, may play a similar gravitational role as a "moon" to hold the rings together.

In addition to gravity, rapidly spinning cosmic bodies that create specific resonance also keep rings from expanding, dissipating and disappearing.

Chariklo is a small, rocky asteroid between Saturn and Uranus. It is about 188 miles in diameter and takes 63 years to orbit the sun. It is the largest object in an asteroid class known as Centaurs, according to NASA.

Meanwhile, Haumea, a trans-Neptunian object (it crosses Neptune's orbit), about the size of Pluto, looks like a flattened ball with a 385-mile diameter. It is found in the Kuiper Belt, a region beyond the orbit of Neptune. Haumea was discovered in December 2004 and takes about 285 years to orbit the Sun.

With Saturn, the rings are shepherded by tiny moons to keep them in place. But for Chariklo, its odd, rocky shape—which includes a large

"mountain—keeps the rings in place just beyond the border of the Roche limit—an invisible area where cosmic objects can get pulled into the cosmic body via gravity.

"In the case of Chariklo, the irregularities confine the rings. In the case of Haumea, the body's big flatness does the job," said El Moutamid, who is also a member of Cornell's Carl Sagan Institute.

Astronomer Bruno Sicardy of the Observatoire de Paris led the research in a project called Lucky Star. Other authors of the paper, "Ring Dynamics Around Non-axisymmetric Bodies," are by Stéfan Renner, Françoise Roques and Josselin Desmars, Observatoire de Paris; Rodrigo Leiva, Southwest Research Institute, Boulder, Colorado; and Pablo Santos-Sanz, Instituto de Astrofısica de Andalućıa, Spain. Funding was provided by the European Research Council.

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