

First ring system around asteroid: Chariklo found to have two rings

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Observations at many sites in South America, including ESO's La Silla Observatory, have made the surprise discovery that the remote asteroid Chariklo is surrounded by two dense and narrow rings. This is the smallest object by far found to have rings and only the fifth body in the Solar System -- after the much larger planets Jupiter, Saturn, Uranus and Neptune -- to have this feature. The origin of these rings remains a mystery, but they may be the result of a collision that created a disc of debris. This artist's impression shows how the rings might look from close to the surface of Chariklo. Credit: ESO/L. Calçada/Nick Risinger (skysurvey.org)

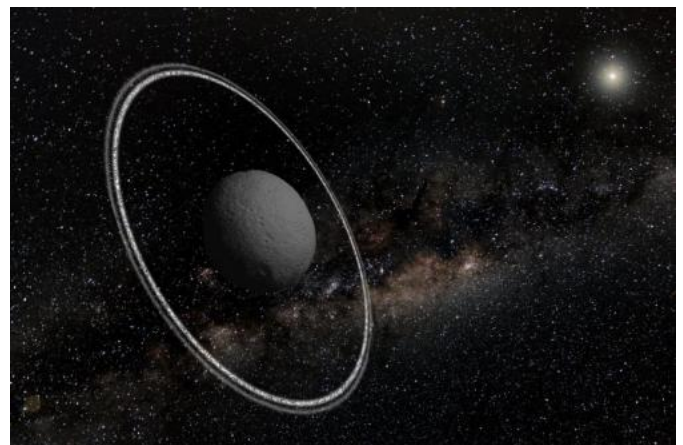
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The rings of Saturn are one of the most spectacular sights in the sky, and less prominent rings have also been found around the other giant planets. Despite many careful searches, no rings had been found around smaller objects orbiting the Sun in the Solar System. Now observations of the

distant minor planet (10199) Chariklo as it passed in front of a star have shown that this object too is surrounded by two fine rings.

"We weren't looking for a ring and didn't think small bodies like Chariklo had them at all, so the discovery—and the amazing amount of detail we saw in the system—came as a complete surprise!" says Felipe Braga-Ribas (Observatório Nacional/MCTI, Rio de Janeiro, Brazil) who planned the observation campaign and is lead author on the new paper.

Chariklo is the largest member of a class known as the Centaurs and it orbits between Saturn and Uranus in the outer Solar System. Predictions had shown that it would pass in front of the star UCAC4 248-108672 on 3 June 2013, as seen from South America. Astronomers using telescopes at seven different locations, including the 1.54-metre Danish and TRAPPIST telescopes at ESO's La Silla Observatory in Chile, were able to watch the star apparently vanish for a few seconds as its light was blocked by Chariklo—an occultation.



Chariklo is a comet-like miniature planet located between Saturn and Uranus. It has a diameter of 250 km and new observations show that there are two rings of ice particles and pebbles. This is the first time such a small celestial body with rings has been observed. Credit: Lucie Maquet

But they found much more than they were expecting. A few seconds before, and again a few seconds after the main occultation there were two further very short dips in the star's apparent brightness. Something around Chariklo was blocking the light! By comparing what was seen from different sites the team could reconstruct not only the shape and size of the object itself but also the shape, width, orientation and other properties of the newly discovered rings.

The team found that the ring system consists of two sharply confined rings only seven and three kilometres wide, separated by a clear gap of nine kilometres—around a small 250-kilometre diameter object orbiting beyond Saturn.

"For me, it was quite amazing to realise that we were able not only to detect a ring system, but also pinpoint that it consists of two clearly distinct rings," adds Uffe Gråe Jørgensen (Niels Bohr Institute, University of Copenhagen, Denmark), one of the team. "I try to imagine how it would be to stand on the surface of this icy object—small enough that a fast sports car could reach escape velocity and drive off into space—and stare up at a 20-kilometre wide [ring system](#) 1000 times closer than the Moon."



The special camera is Irish, and the software programs were specially developed over five years at the Niels Bohr Institute by three astronomers and two Ph.D. students. It takes 40 images per second and the resolution is just as fantastic as if it was out in space. It is

now sitting on the Danish telescope at the La Silla Observatory in Chile. The main purpose of the camera is to observe exoplanets, which are planets orbiting a star other than the Sun, but the sensitive camera has also shown its strength for making extremely precise observations of other objects. Credit: Jesper Skottfelt, Niels Bohr Institute

Although many questions remain unanswered, astronomers think that this sort of ring is likely to be formed from debris left over after a collision. It must be confined into the two narrow rings by the presence of small putative satellites.

"So, as well as the rings, it's likely that Chariklo has at least one small moon still waiting to be discovered," adds Felipe Braga Ribas.

The rings may prove to be a phenomenon that might in turn later lead to the formation of a small moon. Such a sequence of events, on a much larger scale, may explain the birth of our own Moon in the early days of the Solar System, as well as the origin of many other satellites around planets and asteroids.

The leaders of this project are provisionally calling the rings by the nicknames Oiapoque and Chuí, two rivers near the northern and southern extremes of Brazil.

More information: Paper: [dx.doi.org/10.1038/nature13155](https://doi.org/10.1038/nature13155)

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