

Research model suggests moons of some planets developed from rings

November 30 2012, by Bob Yirka



This is an image of the planet Uranus taken by the spacecraft Voyager 2 in 1986.
Image: NASA

(Phys.org)—French researchers Sébastien Charnoz and Aurélien Crida have proposed in a paper published in the journal *Science* that moons that orbit some of the planets in our solar system came about due to accretion from material in rings that used to surround the planets, rather than as entities that took shape while their host planets were forming.

Space researchers have long proposed that moons circulating planets generally came to exist in one of three ways: as entities that formed on

their own as their host was developing, as [clumps](#) that coalesced from material shed from a planet struck by some other body, or by being captured as they passed by. In this new research, Charnoz and Crida propose a fourth possibility – that the moons were formed from material in rings that surrounded their host planet.

In attempting to explain how moons orbiting planets such as Uranus, Neptune and [Pluto](#), came about, the researchers created mathematical models that could predict moon formation from material surrounding a planet. Their models suggest that when material in a ring reaches a certain critical point at some distance from the host, called the Roche radius, the gravity from the host planet is offset by the [gravitational pull](#) that each piece exerts on others in the ring. Because of this, material in the ring begins to coalesce with some pieces eventually accreting enough material to form a moon. They add that the speed at which material in the ring orbits the host may account for the number of moons that form. Slow moving material might result in the formation of several small moons, while fast moving material may result in just one, as might have been the case with Earth and its single moon. Their model explains, they suggest, why all of the moons orbiting planets (except for Jupiter) in our solar system grow in size as they [orbit](#) farther from the host planet. Jupiter they say, is an exception, with its moons likely originating in tandem with the planet birth itself.

The researchers concede that their models can't explain how the rings themselves came to exist, but suggest it's possible that they came about due to collisions with other bodies moving through space.

More information: Formation of Regular Satellites from Ancient Massive Rings in the Solar System, *Science*, 30 November 2012: Vol. 338 no. 6111 pp. 1196-1199
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ABSTRACT

When a planetary tidal disk—like Saturn's rings—spreads beyond the Roche radius (inside which planetary tides prevent aggregation), satellites form and migrate away. Here, we show that most regular satellites in the solar system probably formed in this way. According to our analytical model, when the spreading is slow, a retinue of satellites appear with masses increasing with distance to the Roche radius, in excellent agreement with Saturn's, Uranus', and Neptune's satellite systems. This suggests that Uranus and Neptune used to have massive rings that disappeared to give birth to most of their regular satellites. When the spreading is fast, only one large satellite forms, as was the case for Pluto and Earth. This conceptually bridges the gap between terrestrial and giant planet systems.

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