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# Saturn's rings may be from the whirl of a passing icy rock

**Origin of rings is elusive**
NASA/JPL/Space Science Institute

By **Emily Benson**

Put a spin on it. Saturn's rings might have formed when it ate a rotating icy rock that passed too close. This scenario could explain why Saturn's rings are made of different stuff from those of other gas giants.

Existing theories assume that rings form when objects such as asteroids or comets are pulverised by the gravity of a planet like Saturn. But they fail to explain why Saturn's rings are mostly water ice, while other gas giants' are rocky, says Ryuki Hyodo at Kobe University in Japan.

"The origin of Saturn's rings remains elusive," he says.

Earlier models estimated how much mass a planet might capture from a passing celestial object based on physical properties such as the size of the planet and the smaller body, and the distance between the two.

But Hyodo and his colleagues also considered the way the passing object whirls through space: whether its tumbling lines up with the direction in which it travels around the planet, or if it is doing backflips.

That distinction is important, the team found. Passing bodies that rotate in the same direction as their path around the planet are more easily broken up, and their fragments more efficiently sucked into orbit.

That is because the planet's gravity pulls harder on the closer side of the small object, tugging it around in the same direction as it is travelling. If the planet's gravity has to work against the object's spin, it will be unable to sweep in as much material as when they are aligned.

## Shape-shifting spheres

Those uneven gravitational forces could pull and deform a passing object like a piece of taffy.

To see what Saturn and Uranus might do to passing objects spinning in different ways, the team simulated how individual bits of a round object move based on properties such as mass and density. They modelled more complex bodies than have been tried before: rather than just a homogeneous ball, they included more realistic objects with a hard, rocky core surrounded by an icy mantle.

In some Saturn scenarios, only the outer layer of frozen water was swept up by the planet, creating proto-rings that could have evolved into the icy bands visible today.

The Uranus simulations, however, tended to produce rockier rings. Because Uranus is denser than Saturn, it can seize more of the deeper, rockier part of a passing body than Saturn before the fragments collide with the planet instead of forming rings.

## Pristine rings

The study is a step forward, says Matthew Tiscareno at the SETI Institute in Mountain View, California, but a question of timing remains.

Saturn and the other giant planets would have been most likely to encounter passing bodies like the ones Hyodo and his team simulated about 4000 million years ago, Tiscareno says.

Since then, most of those objects have smashed into planets or been ejected from the solar system.

But the clean water ice of Saturn's ring system suggests that it may be much younger, since interplanetary dust should pollute it over time.

"Even if you can get it in the first place, how does it survive for 4 billion years and still look pristine?" Tiscareno asks.

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