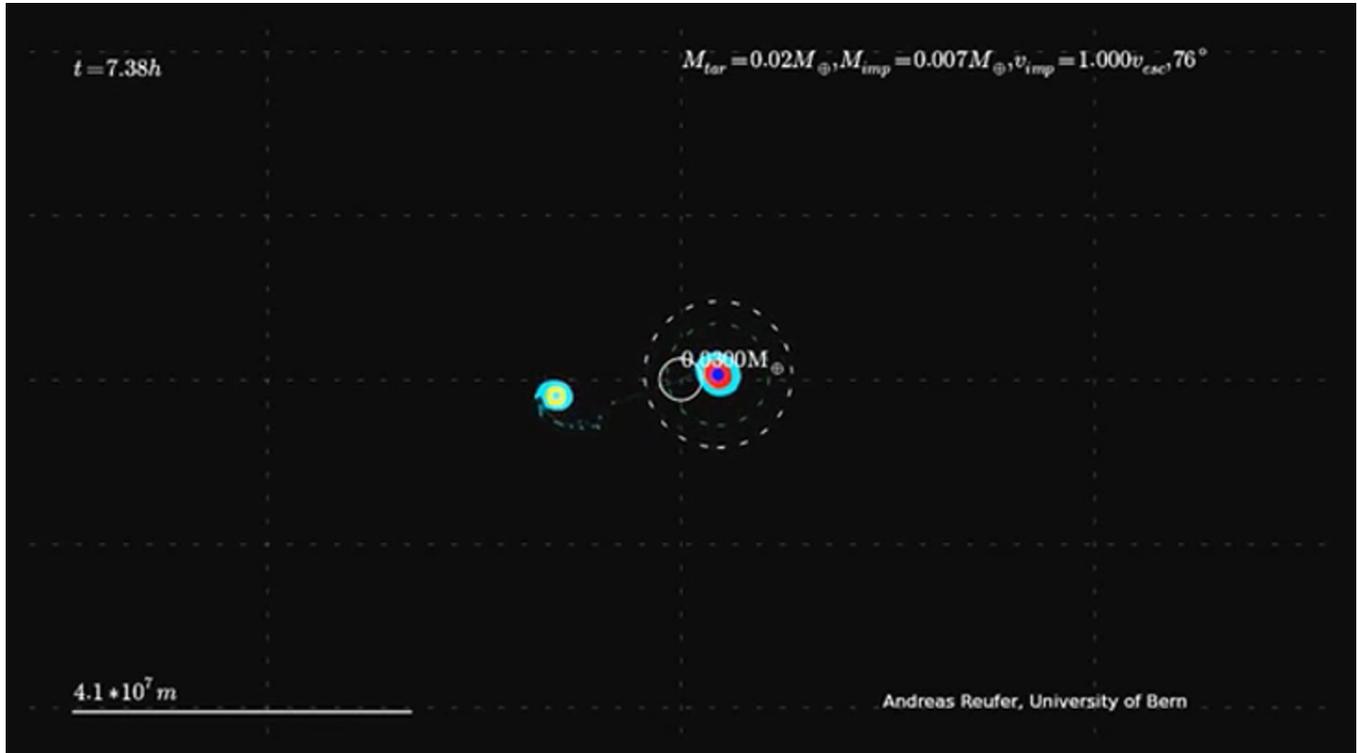


Moon-merge model could explain Saturnian system

Simulation suggests that the moons of Saturn were once more like Jupiter's.

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With widely ranging densities and locations, Saturn's six mid-size satellites are among the strangest in the outer Solar System. Measuring between 300 and 1,500 kilometres in diameter, the moons have varying characteristics: several are made almost entirely of frozen water; one, Enceladus, is rockier and geologically active; and some show evidence of submoons and rings. How did they get this way?

According to a model proposed by Erik Asphaug, a planetary scientist at the University of California, Santa Cruz, and his colleague Andreas Reufer of the University of Bern in Switzerland, Saturn and its satellites initially resembled a miniature version of the Jupiter system, with four large satellites similar in size to Jupiter's Galilean moons. Saturn's satellites then began to merge, eventually forming Titan, the planet's largest moon, says Asphaug, who presented the model on 17 October at the annual meeting of the American Astronomical Society's Division for Planetary Sciences in Reno, Nevada.

The mid-size satellites would have formed from the scraps left over from building Titan, with the mergers perhaps accounting for Titan's surprisingly elongated orbit. The merging may have been triggered by an instability in the Solar System about 3.8 billion years ago, when theorists think that the orbits of Uranus and Neptune were migrating. Because of Jupiter's bigger gravitational grip, its moons were relatively impervious to the disturbance, Asphaug speculates.

But Hal Levison, an astronomer who studies planetary dynamics at the Southwest Research Institute in Boulder, Colorado, says that the model is currently too simple to work. As the model is now configured, he says, the mid-size moons would inevitably accrete on to Titan rather than survive in isolation.

In the simulation shown above, the final merger of two of the Jupiter-like proto-moons is producing Titan, and flinging away water-rich material that later forms the icy mid-size satellites. The colours show the satellites' composition, with dark blue indicating an inner core of iron; pink and yellow representing a rocky mantle; and light blue denoting an outer coating of ice.