



Cassini's Grand Finale: The Final Orbits

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The Cassini-Huygens mission, a joint collaboration between NASA, ESA and the Italian Space Agency, is approaching its last year of operations after nearly 12 years in orbit around Saturn. Cassini will send back its final bits of unique data on September 15th, 2017 as it plunges into Saturn's atmosphere, vaporizing and satisfying planetary protection requirements.

Before that time Cassini will continue its legacy of exploration and discovery with 12 close flybys of Titan in 2016 and 2017 that will return new science data as well as sculpt the inclinations and periods of the final orbits. Even though all of our close icy satellite flybys, including those of Enceladus, are now completed, numerous Voyager-class flybys (<100,000 km) of Mimas and Enceladus remain as well as some of our best flybys of the tiny ring moons. Cassini will also continue to study seasonal and temporal changes in the system as northern summer solstice approaches.

In November 2016 Cassini will transition to a series of orbits with peripases just outside Saturn's F ring. These 20 orbits will include close flybys of some tiny ring moons and excellent views of the F ring and outer A ring. The 126th and final close flyby of Titan will propel Cassini across Saturn's main rings and into its final orbits.

Cassini's Grand Finale, starting in April 2017, is comprised of 22 orbits at an inclination of 63 degrees. Cassini will repeatedly dive between the innermost rings and the upper atmosphere of the planet providing insights into fundamental questions unattainable during the rest of the mission. Cassini will be the first spacecraft to explore this region.

These close orbits provide the highest resolution observations of both the rings and Saturn, and direct in situ sampling of the ring particles, composition, plasma, Saturn's exosphere and the innermost radiation belts. Saturn's gravitational field will be measured to unprecedented accuracy, providing information on the interior structure of the planet, winds in the outer layers of Saturn's atmosphere, and the mass distribution in the rings. Probing the magnetic field will give insight into the nature of the magnetic dynamo, telling us: why the magnetic field is weak; why it exhibits little, if any, axial tilt; and the true rotation rate of the planet. The ion and neutral mass spectrometer will sniff the exosphere and upper atmosphere for molecules that escape the atmosphere itself and water-based molecules originating from the rings. The cosmic dust analyzer will sample the composition of particles from different parts of the main rings. Until the execution of these final orbits, the answers to such new questions will remain mysteries.

Expected results from Cassini's final orbits will be discussed.

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