



Cassini's Grand Finale: Highlights from a Voyage into Unique Territory

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After 13 years orbiting Saturn and exploring the Saturn system, the Cassini-Huygens mission ended in a science-rich blaze of glory on September 15, 2017. The Grand Finale and Ring Grazing orbits marked the final phase of Cassini's mission covering roughly ten months and ending the mission with the first time in-situ exploration of the region between the rings and planet. On its final orbit, Cassini plunged into Saturn's atmosphere, vaporizing and satisfying planetary protection requirements, while sending back its final bits of unique science data.

In late 2016, Cassini's trajectory transitioned to a series of 20 Ring Grazing orbits with peripases located within 10000 km of Saturn's F ring. These orbits provided the high-resolution views of Saturn's F ring and outer A ring, and prime viewing conditions for fine scale ring structures such as propellers. They also included the closest flybys of tiny ring moons, including Pan, Daphnis and Atlas. Plasma and dust composition measurements were also conducted in this region.

A final close flyby of Titan in late April 2017 propelled Cassini across Saturn's main rings and into its Grand Finale orbits. Comprised of 22 orbits, the spacecraft repeatedly dove between Saturn's innermost rings and upper atmosphere attempting to answer fundamental questions unattainable earlier in the mission. Saturn's gravitational field was measured to unprecedented accuracy, providing information from which constraints on the interior structure of the planet, winds in the deep atmosphere, and mass distribution in the rings could be derived. Probing the magnetic field provided insights into the physics of the magnetic dynamo, the structure of the internal magnetic field, and constraints on the location of the metallic hydrogen transition region.

The Grand Finale orbits provided the highest resolution observations ever of both Saturn's C and D rings and Saturn's atmospheric weather layer. Direct in-situ sampling of the ring particle composition and the innermost radiation belts was also achieved. The ion and neutral mass spectrometer sampled the exosphere and upper atmosphere for molecules entering and escaping from the atmosphere and water-based molecules originating from the rings. The cosmic dust analyzer directly sampled the composition of the ring particles from different regions of the main rings for the first time.

The last orbit turned the spacecraft into the first Saturn atmosphere probe with all of fields and particle instruments gathering data as long as the spacecraft remained stable. Approximately one additional scale height of atmosphere was probed prior to loss of the radio signal from the spacecraft.

During this talk, science highlights and new mysteries gleaned from the Ring Grazing and Grand Finale orbits will be discussed.

The research described in this paper was carried out in part at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration. Copyright 2018 California Institute of Technology. Government sponsorship is acknowledged.