

A dusty road connecting Saturn and its rings - preliminary results from Cassini Cosmic Dust Analyser during the Grand Finale Mission

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The Cosmic Dust Analyzer observations during the Cassini Grand Finale Orbits were designed for the in situ characterization of Saturn's rings' composition and to study their interactions with the host planet. It is found that the gap between the inner most D ring and Saturn is almost free of larger, micron-sized dust grains but rich in nanodust particles (radius smaller than 100 nm) that only become detectable by CDA because of the high spacecraft speed of 30 km/s.

Regarding the grain composition, while the majority of CDA mass spectra have been identified during this phase are too faint to be individually calibrated, two types of mass spectra has been identified for stronger events - water ice and silicate types. The observed silicate-to-ice grain ratio is much higher than that of the rings inferred from the remote sensing methods, possibly implying that the ring erosion by the impactor ejecta process could simultaneously "clean" the non-icy component left from the ring progenitor and interplanetary exogenous mass infall. As for the dynamics, the observation confirms the transport of charged nanodust from the main rings along certain magnetic field lines to the planet, i.e. the previously proposed and observed "Ring Rain" effect. The measured nanograin flux profile shows similarity to the H3+ infrared emission pattern, suggesting the infall of nanograin as a pathway of ring-planet interaction associated with both exogenous (e.g., impactor ejecta) and endogenous (ionospheric plasma charging) processes.