SATURN

Nanoparticle rain from rings

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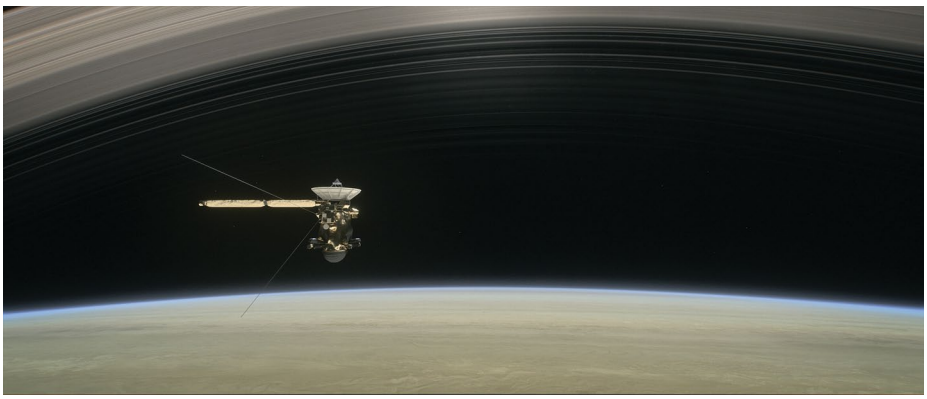

Credit: NASA/JPL-Caltech

Cassini, during the months that preceded its spectacular end, performed a series of proximal orbits that explored in situ the space between Saturn's innermost ring and the planet's upper atmosphere for the first time (pictured). Two papers, led by Mark Perry and Luke Moore, characterize the inflow of nanoparticles from the ring onto Saturn's atmosphere. Such 'rain', recently discovered by Cassini, exhibits unexpectedly high hydrocarbon abundances, particularly with respect to water (the main component of Saturn's rings).

The two papers provide a complementary view of the phenomenon using Ion and Neutral Mass Spectrometer instrument data. Perry et al. focus on the altitude and latitude dependence of the flux of neutral particles, whereas Moore et al. use the ion data to constrain models of Saturn's ionosphere. The results confirm the identification of the ring as the source of the nanoparticles, which are ubiquitous and participate in mass redistribution through the rings significantly more than expected. Their very high total mass flux ($\sim 10^4$ kg s^{-1}, three orders of magnitude higher than model predictions), however, would deplete the whole ring system of hydrocarbons in less than 1 Myr, suggesting that this flux is strongly time-dependent. The hydrocarbons then interact through charge exchange with the H^+ and H_3^+ present in the upper ionosphere, creating an environment dominated by heavy ions and making the whole ionospheric chemistry more complex than anticipated. Understanding the consequences of such results will keep scientists very busy long after Cassini's demise.

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