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The flow of material inward from Saturn's rings

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The first in situ measurements of Saturn's exosphere and upper atmosphere reveal a complex and varied flux of molecules and particles flowing into Saturn from its rings. Combining neutral and ion measurements from the Cassini Ion and Neutral Mass Spectrometer (INMS) with nanoparticle measurements from the Charge-Energy-Mass Spectrometer (CHEMS) and the Ion and Neutral Camera (INCA) instruments on the Magnetospheric Imaging Instrument (MIMI), we have taken the first steps toward a new understanding of the interactions between rings and the body that they orbit.

Some of the initial discoveries include the identification of CH4 as the primary influx species, the high influx of nanoparticles, the concentration of molecules and particles at the ring plane, and the variability in the molecular flux. We report on several avenues of research including comparison between the INMS and CHEMS data to the larger particles measured by the Cassini Dust Analyzer, the total mass flux based on INMS and CHEMS data, the diffusion ratios of molecules with different masses, the abundance of neutral molecules measured by INMS compared to the mixing ratios determined by photochemical equilibrium, and characteristics of the transport processes that deliver the molecules and particles from the rings to Saturn's upper atmosphere.