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CASSINI-CDA's Hunt for Exogenous Dust Particles around Saturn

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We present a progress report on the analysis of the CASSINI-CDA (Cosmic Dust Analyzer) data set to constrain the in-fall of exogenous dust into the Saturn's system.

Finding such exogenous particles and constraining their mass-influx is of importance to support a variety of investigations performed by in the Saturn's system. For example, formation and compositional evolution scenarii of the main rings rely on a detailed understanding of erosion mechanisms, resulting in regolith growth on individual grains and compositional mixing through ballistic transport of ejectas. Also, quantifying the amount of exogenous oxygen and water being delivered in the inner Saturn system is also of importance for detailed studies of the atmospheric composition of Saturn and Titan. In addition, studies of surface composition of icy satellites will benefit from an estimate of 'contaminant' deposition brought by dust particles from outside Saturn's System. Last but not least, the measurements of Cassini CDA provide a direct insight on various zodiacal dust populations at Saturn's heliocentric distance, so far poorly constrained by previous observations.

We screen the CASSINI-CDA dust detector data set obtained in the past 7 years for particles whose impact detection characteristics would suggest an exogenous signature. Dust particles not gravitationally bound to Saturn fall into two broad categories: particles of interplanetary (IDPs) or interstellar (ISDs) origin. As far as IDPs are concerned, multiple sources are possible, including collisional products of Kuiper Belt objects drifting toward the inner solar system under Poynting-Robertson drag influence, or Jupiter family comets. To support data analysis, we use different methods relying on three CDA sub-systems: the induced charge on the entrance grid, the impact detection subsystem and the chemical target. Each method has different sensitivity for minimum velocity estimates and impact direction. We model our results by fitting different plausible interstellar and interplanetary dust populations expected at Saturn's orbit distance and derive the corresponding fluxes.