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In situ dust measurements by the Cassini Cosmic Dust Analyzer in 2014 and beyond

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Abstract

Today, the German-lead Cosmic Dust Analyser (CDA) is operated continuously for 11 years in orbit around Saturn. Many discoveries like the Saturn nanodust streams or the large extended E-ring were achieved. CDA provided unique results regarding Enceladus, his plume and the liquid water below the icy crust. In 2014 and 2015 CDA focuses on extended inclination and equatorial scans of the ring particle densities. Furthermore, scans are performed of the Pallene and Helene regions. Special attention is also given to the search of the dust cloud around Dione and to the Titan region. Long integration times are needed in order to characterize the flux and composition of exogenous dust (including interstellar dust) or possible retrograde dust particles. Finally, dedicated observation campaigns focus on the coupling of nanodust streams to Saturn's magnetosphere and the search of possible periodicities in the stream data. Saturn's rotation frequency was identified in the impact rate of nanodust particles at a Saturn distance of 40 Saturn radii.

A special geometry in 2014-065 lead to an occultation of the dust stream by the moon Titan and its atmosphere when Titan crossed the line-of-sight between Saturn and Cassini. Here, CDA pointed towards Saturn for the measurement of stream particles. Around closest approach when Cassini was behind Titan, the flux of stream particles went down to zero (Fig. 1). This „dust occultation“ is a new method to analyse the properties of the stream particles (speed, composition, mass) or the properties of Titans atmosphere (density). Furthermore, the particle trajectories can be constrained for a better analysis of their origin.

In the final three years CDA performs exogenous and interstellar dust campaigns, studies of the composition and origin of Saturn's main rings by unique ring ejecta measurements, long-duration nano-dust stream observations, high-resolution maps of small moon orbit crossings, studies of the dust cloud around Dione and studies of the E-ring interaction with the large moon Titan.

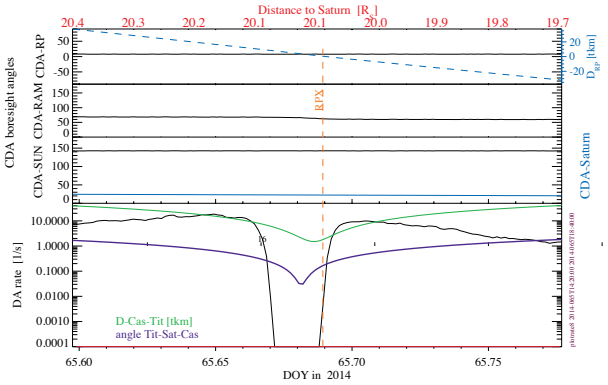

Fig. 1 *Angles between the CDA boresight and various objects/directions (Sun, RingPlane, DustRAM, Sun, Saturn, top diagrams) and the dust impact rate (bottom). The flux of stream particles stopped behind the moon Titan around 2014-065T16:40.*