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HRD dust results from Saturn rings creossings

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The HRD is part of the CDA instrument on the Cassini mission and its overall objective is to obtain quantitative measurements of particle flux and mass distribution throughout the Saturn ring system, when the counting rate was expected to be very high to saturate the Dust Analyzer of the CDA instrument. The particle mass range covered by the HRD ranges from 10-12 to about 10-7 g for differential and cumulative flux measurements and $>$10-7 g for cumulative flux measurements. The HRD is capable of handling counting rates up to 104 impacts per second with very little dead time. The time resolution of the HRD is programmable and ranges from 1 s down to 0.1 s in the encounter mode [1]. HRD also has an internal flight calibrator mode, which is used to verify the performance of its electronics.

Cassini spacecraft entered Saturn orbit July 1, 2004 and started a long investigations of Saturn and its ring system. There were multiple E ring crossings and every time the spacecraft cross the ring, the HRD has detected dust particle elevated activity. Particularly intensive were the flybys during February 17, March 9, May 2 and July 14, 2005. During these periods the HRD registered particles larger than 2 microns with more than 4 counters. In the case of the July 14th flyby, the period of elevated activity lasted from about 10 minutes before the closest approach to about 10 minutes after the closest approach. The highest intensity, however, up to 10 particles per second larger than 2 μm, was centered not at the closest flyby distance as it was expected, but approximately one minute before the closest approach, when the Cassini spacecraft was flying over the south pole of the Enceladus satellite. These results, together with the results from other Cassini instruments established that a specific site on the south pole is the source of the ice particles [2]. There is another mechanism of producing dust

particles from the surface of satellites. When the icy satellite surfaces are being bombarded with a micrometeoroid beam or particle beam from the E-ring itself, particle ejecta are produced with velocities high enough to get them into high altitudes. Some of these particles are getting in the orbit of Enceladus with high velocity to overcome the satellite gravity, or are swept by the solar wind, and eventually provide constant particle source for the E-ring [2].

References: [1] R. Srama et al., Space Science Reviews 114, 465 (2004), [2] F. Spahn et al., submitted to Science, (2006)