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Compositional mapping of Saturn's E-ring during Cassini's flyby of Rhea

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The Cassini spacecraft was launched in 2004 towards the Saturnian system to address major scientific questions about the planet, its magnetosphere, rings and icy moons. We have performed compositional mapping of Saturn's E-ring during the Cassini's flyby (R4) of Rhea, the second largest moon of Saturn, on 9th March 2013. The icy or rocky dust particles from the surface of moons without atmosphere are ejected from their surfaces by meteoroid bombardment. The ejected particles from the moon's surface can be detected during a spacecraft flyby. In our campaign we try to identify the footprints of Rhea's surface in the composition of E ring using Cosmic Dust Analyzer (CDA) during the closest approach of Cassini's Rhea flyby. The flyby speed was 9.3km/s and the closest approach was at 997km from Rhea's surface.

The Cosmic Dust Analyzer (CDA), onboard Cassini spacecraft, characterizes the micron and sub-micron dust particles at Saturn [1]. One of the tasks of CDA is to determine the chemical composition of icy and mineral dust particles at Saturn. A Time of Flight (TOF) mass spectrometer within the CDA generates mass spectra of positive ions (cations) of impinging dust particles onto the rhodium (Rh) target plate.

We sampled dust grains during the entire flyby and divided the flyby into three intervals: (A) $\sim$ -32 minutes before entering Rhea's hill sphere (B) $\sim \pm 15$ minutes from the closest approach within Rhea's hill sphere and (C) $\sim$ +28 minutes after leaving Rhea's hill sphere. A Boxcar Analysis (BCA) is performed for compositional mapping of E-ring along the spacecraft trajectory [4]. Most of the TOF mass spectra are identified as one of the three compositional types: (i) almost pure water (ii) organic rich and (iii) salt rich [2][3]. Although we could not identify compositional information from Rhea, we have a compositional profile of the E ring. The CDA will carryout very similar measurements during Dione flyby in 2015.

References

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