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Energetic ion observations on Rhea

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Abstract

Cassini flew by Saturn's moon Rhea four times between 2005 and today. During two of these flybys MIMI/LEMMS energetic particle detector onboard Cassini detected significant reduction of energetic ion fluxes (20 keV - 300 keV) in vicinity of Rhea, which is probably caused by plasma absorption by the moon. The profile of the flux dropout shows differences in the different energy channels of LEMMS, primarily due to finite gyroradius effects. Other factors that contribute to the shape of the depletion profile are the properties of the background magnetospheric magnetic and electric fields, the structure of Rhea's interaction region, the ion composition and the response function of the different LEMMS channels.

We will use a test-particle approach, taking into account all these factors, in order to simulate the observed depletion profiles. We will explore whether non-dipolar effects and field time variations are important in shaping the ion profile, and will also examine if LEMMS responds primarily to protons (as assumed until today) or to heavier ions. We will use several numerical techniques (e.g. fourth order Gauss Runge-Kutta and Boris particle tracking methods) and evaluate which method is the best (in terms of accuracy and computational resources) that will allow us to have good "particle statistics" and more reliable results.

The same approach could be used to trace energetic charged particles and simulate observations at other Saturnian moons, such as Enceladus, Dione and Titan.