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Modelling of the energetic ion observations in the vicinity of Rhea and Dione

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During several flybys of CASSINI by the saturnian moons Rhea and Dione energetic particle detector MIMI/LEMMS confirmed significant reduction of energetic ion fluxes (20 keV [U+2010] 300 keV) in vicinity of these moons, which is mainly caused by plasma absorption by the moons.

In order to simulate the observed depletion profiles we developed an energetic particle tracer, which is able to simulate the charged particle trajectories considering different models of the saturnian magnetosphere. Currently we are using the fourth order Gauss Runge-Kutta calculation method and our background magnetospheric model is based on dipole magnetic field, co-rotation electric fields and can include the effects of the current sheet or other non-dipolar effects.

Using this energetic particle tracer we explore which of these magnetospheric characteristics are more important in shaping the ion profiles. We also examine if LEMMS responds primarily to protons (as assumed until today) or to heavier ions, using the calibration experiments data, observations of the energy flux spectrum by CHEMS instrument (on board of CASSINI as well) and different simulation results.

Here we will present results of our modeling and discuss other scientific problems, where the charged particle tracer can be applied: simulation of the ion observations on Enceladus and Titan, and simulation of the charged particles motion in the inner magnetosphere of Saturn (preparation for the CASSINI “Proximal Orbits”), where we will study different diffusion effects, influence of dust and scattering collisions and possible particles input mechanisms to the magnetosphere of Saturn. As the primary energetic particle detector that will be used to monitor the innermost belts during the proximal orbits is LEMMS, understanding through the current work its complex responses to different ion species is essential for interpreting the planned observations inside Saturn’s D-ring.