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Effects acting on energetic particles in Saturn's magnetosphere

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Abstract

Energetic charged particles can undergo a number of different effects in Saturn's magnetosphere. Some of these processes are well known, as the loss of ions due to charge exchange within the extended Neutral Torus. On average, these losses have to be compensated by source processes, but the mechanism and magnitude of them is poorly understood. Especially the origin of protons below 1 MeV within the radiation belts remains an open question.
Since more than six years, the MIMI/LEMMS instrument onboard the Cassini spacecraft provides a wealth of knowledge about charged particles between several 10 keV and several 10 MeV. From this data, mission averaged proton profiles at constant adiabatic invariants are derived within the radiation belts ($L < 5R_S$) and the middle magnetosphere ($L > 5R_S$). We extended the radial diffusion equation by multiple source and loss terms in order to include all the relevant physics. Numerical solutions of this equation are able to reproduce the observed profiles. Due to the large number of effects, the equation includes parameters that are free as long as only a small range in energy and L is considered. Therefore, we aim to describe the whole range that is covered by LEMMS with the same set of parameters, which then can immediately be used to quantify the different effects they are representing.