Phase space density analysis in Saturn's inner magnetosphere from Cassini observation

Hiroyasu Tadokoro[1]; Hiroaki Misawa[2]; Fuminori Tsuchiya[3]; Yuto Katoh[3]; Akira Morioka[1]; Yoshizumi Miyoshi[4]

[1] Planet. Plasma and Atmos. Res. Cent.,Tohoku Univ.; [2] PPARC, Tohoku Univ.; [3] Planet. Plasma Atmos. Res. Cent., Tohoku Univ.; [4] STEL, Nagoya Univ.

Radial profile of phase space density (PSD) gives a clue to determine internal or external source of energetic particles in magnetized planets. It is considered that energetic particles in Saturn's inner magnetosphere are lost due to the existence of rings and neutral gases. In order to investigate importance of these loss processes, we have investigated radial profile of energetic electrons (20 keV - a few MeV) in Saturn's inner magnetosphere (L=2-10 Rs) by performing phase space density analyses for the Saturn orbit insertion (SOI) of Cassini. The analyses show that there are following differences of characteristics of electron PSD between inbound and outbound in 6 - 8 Rs.

1. Electron PSD of outbound is greater than that of inbound in 6 - 8 Rs.
2. Electron PSD of inbound decreases with decreasing of radial distance.
3.Electron PSD of outbound has a local peak in 6 - 8 Rs.

The results of 1 and 2 are consistent with PSD analyses from the Voyager data of Armstrong et al., [1983] although they did not calculate PSD for the region more than 8 Rs. The local peak in 6 - 8 Rs is a newly confirmed result and corresponds to a dispersion-injection. In order to investigate the generation process of the observed PSD, we solve one dimensional Forkker-Planck equation. Here, we consider Coulomb-collisions, E-ring absorption, and satellite absorption as loss processes. From a result of the calculation, it is suggested that Coulomb-collisions are the dominant loss process in Saturn's inner magnetosphere. In this presentation, we will show the observed PSD and discuss importance of each loss process.

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