Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PCG040-P13 Room: Convention Hall Time: May 27 17:15-18:45

Cassini ion observation and modeling of the Saturnian inner magnetosphere

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The Cassini mission has discovered a plume with mostly water which is evolved from Saturnian moon Enceladus (Porco et al., 2006) and this water creates an extended torus around Saturn. The inner magnetosphere consists of a dense and cold plasma in the shape of a disk (Moncuquet et al., 2005; Persoon et al., 2005; Wahlund et al., 2005; Sittler et al., 2006) created by ionization of the water rich torus. From the Radio and Plasma Wave Science (RPWS) observations onboard Cassini, it is revealed that the charged dust in the E-ring interacts with the dense surrounding plasma disk of Saturn, i.e. dust-plasma interaction, and two ion populations were inferred; one co-rotating with the planetary magnetosphere and another moving with near Keplerian speed around Saturn (Wahlund et al., 2009).
In order to map the spatial extent of the dust-plasma interaction effects we have analyzed the RPWS Langmuir Probe derived ion velocities in the Saturnian inner magnetosphere. The results confirms that the bulk of the ions in the plasma disk is sub-co-rotating out to about 7 $R_S$and tend to approach co-rotation at further distances from Saturn.
We have also carried out the modeling of plasma and dust in this region. We used MHD equations for ion, electron and dust. The results show that the ions have velocity smaller than co-rotation velocity by dust drag.