Plasma environment of Jupiter's topside ionosphere viewed from the Faraday fringe analysis for Jupiter's radio spectra

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So far the polar ionospheric plasma density of Jupiter has not been known particularly at the topside region higher than 6000km above the cloud tops, where most of non-thermal radio waves, such as decametric and hectometric radiations (DAM and HOM), are believed to be generated and propagate. This is because the plasma condition in the regions has not been directly explored by spacecrafts and is too tenuous to detect with the radio occultation method using TM signal of spacecrafts such as Pioneer, Voyager and Galileo (Fjeldo et al., 1975, 1976, Eshleman et al., 1979, Hinson et al., 1997). However, plasma environment of the regions is expected by the other indirect methods; ray tracing analyses for Io-related DAM (Misawa, 2004) and lightning-induced whistler mode waves (Wang et al., 1998) suggest that plasma of the topside ionosphere / high latitude region of the inner plasmasphere is in quite tenuous condition.

For the purpose of confirming the plasma condition of the topside ionosphere, we have investigated spectra of Jupiter's radio emissions observed with Cassini/RPWS to derive Faraday fringes. We have proceed the analysis especially for Io-related DAM events since radio source locations of the events are considered to be in some limited areas and wave propagation paths for which plasma conditions are derived are easily determined. The Faraday fringes observed near Jupiter are expected to consist of two components; one is generated in the topside ionosphere where DAM waves are originated and propagate, and another one is generated in the Io plasma torus (IPT). In order to estimate contribution of the latter component, we have assumed a plasma density model of IPT which is proposed by University of Colorado and modulate it to an appropriate value for the Faraday fringe analysis period based on the optical observation of IPT (Nozawa, 2002). As a preliminary analysis for the data observed around the Cassini Jupiter swing-by in Dec. 2000 shows that nearly 80% of the Faraday fringe is generated in the ionosphere and expected plasma density in the ionosphere is estimated to be approximately 10 elec./cmˆ3. This result will give a tight constraint for the generation and propagation processes of Jupiter's non-thermal radio waves.