EPSC Abstracts,
Vol. 4, EPSC2009-617, 2009
European Planetary Science Congress,

Jovian radio wave propagation through the Io plasma torus

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Abstract

We report on the Jovian radio wave propagation through the Io torus plasma. We select cases of Jovian hectometric (HOM) emission which are subject to attenuation effect. The morphology of such phenomena is characterized by the use of RPWS experiment observations recorded during the Cassini Jupiter flyby. This attenuation is shown to depend on the Jovian magnetic field where clear modulations appear at two central meridian longitudes around ~180° and ~50°, corresponding respectively to the position of the magnetic field axis in the Northern and Southern hemispheres. A detailed analysis of the dynamic spectra leads us to confirm (previous work by Lecacheux, JGR, 85, 1980) the presence of refraction effect caused by the Io plasma torus. The Jovian radio wave presents different spectral features when it propagates through the Io plasma torus. We note in particular three main cases: a total emission extinction, a partial decrease of the radiation and an enhancement of the intensity before and after the attenuation of HOM emission. The origins of such spectral effects depend on: the source location (in the Northern or Southern hemisphere), the observer position (e.g. Cassini spacecraft) with regard to the magnetic equator of the planet, and the electronic density in the Io torus. We discuss our results and compare them to previous studies based on data recorded by Voyager, Galileo and Cassini spacecraft.