APPLYING IONOSPHERIC PLASMA RESONANCE SCALING LAWS TO INTERPRET ACTIVE AND PASSIVE PLANETARY MAGNETOSPHERIC RADIO SPECTRA

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ABSTRACT

The Radio Plasma Imager (RPI) on the Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) satellite stimulates a spectrum of plasma resonances and wave cutoffs in the magnetosphere similar to those stimulated by ionospheric topside sounders. Scaling laws developed for the ionospheric resonances are shown to apply to the RPI-stimulated magnetospheric resonances and aid in the spectral interpretation. The results are relevant to a controversy that has developed concerning the applicability of the ionospheric scaling laws to planetary magnetospheres.

INTERPRETATION OF PLANETARY MAGNETOSPHERIC RADIO SPECTRA

This paper addresses a controversy [1,2] concerning the application of scaling laws, developed to describe ionospheric topside-sounder-stimulated plasma resonances, to the interpretation of active and passive radio spectra in planetary magnetospheres. At issue is the application of scaling laws [3] developed to describe a sequence of these resonances, designated as Dn resonances, to the interpretation of plasma resonances stimulated by a relaxation sounder in Jupiter's Io plasma torus [4] and to banded magnetospheric radio emissions [5]. A resolution of this controversy is important for three reasons: (1) to test the claim [6] that the Dn resonant frequencies represent a signature of a fundamental new mode of plasma oscillations, (2) to obtain the proper interpretation of, and possible relationship between, the sounder-stimulated plasma resonances and natural magnetospheric emissions and (3) to provide a reliable determination of the magnetospheric electron density from (2) above.

Here we will demonstrate that the Radio Plasma Imager (RPI) on the Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) satellite stimulates Dn resonances in the magnetosphere when fpe/fce > 2. We will also demonstrate the importance of using all three of the RPI mutually orthogonal dipole receiving antennas for identifying them and that they can correspond to natural emissions. The Dn identification is based on the scaling laws discussed earlier and on the accurate (within a few percent) determination of fpe and fce from other resonant and wave cutoff features.

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