

# ACTIVE/PASSIVE INVESTIGATIONS OF MAGNETOSPHERIC EMISSIONS BASED ON IMAGE/RPI DATA

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## ABSTRACT

On passive radio-wave dynamic spectra, the magnetospheric electron density  $N_e$  is often determined by identifying the electron plasma frequency  $f_{pe}$  (proportional to  $N_e^{1/2}$ ) or, after the electron cyclotron frequency  $f_{ce}$  is determined from a magnetic-field model, the upper-hybrid frequency  $f_{uh} = (f_{pe}^2 + f_{ce}^2)^{1/2}$ . These frequencies are identified by assuming that they correspond to the upper or lower frequency limits of prominent magnetospheric emissions that are propagating in certain characteristic plasma wave modes. Here we report on the results of investigations of magnetospheric emissions using interleaved active and passive observations from the Radio Plasma Imager (RPI) on the IMAGE satellite (Imager for Magnetopause-to-Aurora Global Exploration). In particular, we discuss the accuracy of deducing  $N_e$  from: (1) the upper- and lower-frequency limits of an intense narrowband Z-mode emission identified as the upper-hybrid band, (2) the lower-frequency limit of the ordinary-mode emission known as continuum, and (3) the upper-frequency limit of whistler-mode emissions. In addition, we investigated the geographical distribution of, and the  $f_{pe}/f_{ce}$  values associated with, the banded magnetospheric emissions, commonly referred to as  $(n + 1/2)f_{ce}$  emissions. These values are necessary for understanding the generation mechanisms responsible for these emissions that have been observed in every planetary magnetosphere visited by properly-instrumented spacecraft. In the RPI investigations,  $f_{pe}$  and  $f_{ce}$  are determined to an accuracy  $\sim 1\%$  and  $0.1\%$ , respectively, from the sounder-stimulated plasma resonances and wave cutoffs. This accuracy, obtained from active operations, enables proper wave-mode identifications of natural emissions received during passive operations. It also enables commonly-accepted interpretations of the frequency limits of these emissions to be tested.