The Detection and Consequences of Coherent Electromagnetic Plasma Waves: Prediction of Rapid L = 2-3 Electron Slot Formation

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Low frequency (LF) ~22 Hz to 200 Hz plasmaspheric hiss was studied using a year of Polar plasma wave data occurring during solar cycle minimum. The waves are found to be most intense in the noon and early dusk sectors. When only the most intense LF (ILF) hiss was examined, they are found to be substorm dependent and most prominent in the noon sector. The noon sector ILF waves were also determined to be independent of solar wind ram pressure. The ILF hiss intensity is independent of magnetic latitude. ILF hiss is found to be highly coherent in nature. ILF hiss propagates at all angles relative to the ambient magnetic field. Circular, elliptical, and linear/highly elliptically polarized hiss have been detected, with elliptical polarization the dominant characteristic. A case of linear polarized ILF hiss that occurred deep in the plasmasphere during geomagnetic quiet was noted. The waveforms and polarizations of ILF hiss are similar to those of intense high frequency hiss. We propose the hypothesis that ~10–100 keV substorm injected electrons gradient drift to dayside minimum B pockets close to the magnetopause to generate LF chorus. The closeness of this chorus to low altitude entry points into the plasmasphere will minimize wave damping and allow intense noon sector ILF hiss. The coherency of ILF hiss leads the authors to predict energetic electron precipitation into the midlatitude ionosphere and the electron slot formation during substorms. Several means of testing the above hypotheses are discussed.

References