Investigation of the frequency structure of the fast magnetosonic mode

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This talk will focus on 3 topics concerning fast magnetosonic waves: 1) statistical study of the high frequency resolution structure of this mode, 2) search for an explanation of dispersive quasi-periodic modulation of this mode, and 3) an understanding of frequency drift associated with proton injections. The Van Allen Probes EMFISIS suite and the HOPE plasma instrument are used in this study.

1) We present a survey of high resolution frequency peaks of this mode normalized by the proton cyclotron frequency f_{cp} and inter-compare burst spectrum between the 2 spacecraft as a function of separation. Histograms of the normalized frequency of peaks are centered around $n\,f_{cp}$, below n=25. They systematically drift below $n\,f_{cp}$ as the lower hybrid frequency is approached, which we do not understand. Moving toward lower radii inside the plasmasphere, the clustering around $n\,f_{cp}$ gradually disappears into a continuum. Case studies of the spectra of these waves have found the emissions to be composed of 1) harmonics, usually with spacing near the local f_{cp}, 2) broad band hiss-like structure, or 3) a superposition of the two spectral types. No statistical studies of the frequency structure of these waves have been made.

2) Quasi-periodic fast magnetosonic waves characterized by rising tones, for which high resolution views show that of each rising tone is composed of banded structures spaced near the local f_{cp}. This type of the quasi-period emissions characterized by rising tones cannot be explained in terms of a strong compression in the background magnetic field or plasma density. It has been argued that the dispersive features of these rising tones could be due to cyclic inward proton diffusion in energy. As this diffusion occurs, linear theory predicts that the frequency will rise. We discuss our plans to search the HOPE dataset for ion diffusion during these modulated fast magnetosonic mode events.

3) The lower harmonics of fast magnetosonic waves are frequently observed with rise frequencies of about 1 f_{cp} over a 20 minute interval during the passage of a proton front. We use the Comprehensive Inner Magnetosphere-Ionosphere Model to study the propagation of these injection fronts in which the front moves from dusk toward noon and to learn if enhanced growth rates at the plasmasphere track the leading edge of these fronts, consistent with observations.