Observations of Interactions between EMIC and Magnetosonic Wave Modes at Heavy Ion Boundaries

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Pc1 pearl pulsations are a subset of electromagnetic ion cyclotron (EMIC) waves modulated periodically in time. While otherwise retaining the left-hand polarization and field-aligned propagation behavior expected of EMIC waves, they have been shown to possess different spectral characteristics than unstructured EMIC waves in addition to the modulation. Of particular note is the independence of excitation and modulation frequencies from L, implying a non-local source for these parameters. Ground observations have typically assumed the excitation frequency/modulation period relationship to be dependent on the equatorial magnetospheric plasma where EMIC waves are thought to be generated. Our statistical observations over nearly three years of Van Allen probe data have shown that pearl pulsations typically manifest as a constant excitation frequency band modulated at a constant rate over a finite range in L.

One possible method of transport of this information across Lshells would be through a perpendicularly-propagating wave mode such as the magnetosonic mode. We show case studies using both the MMS and Van Allen Probes missions of wave events transitioning between magnetosonic and time-modulated EMIC wave properties at heavy ion temperature and density gradients. The time modulation periods characteristic of Pc1 pearl pulsations align with the beating one might expect from the observed closely-spaced magnetosonic harmonic frequencies generated at larger L. The change in plasma parameters at observed heavy ion boundaries results in a change in the wave dispersion surface which might allow a conversion of wave energy between the two modes through local unstable ion populations.