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Ultralow Frequency Waves In Saturn's Magnetosphere: More Than Ion Cyclotron Waves

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Electromagnetic waves near the oxygen/water group cyclotron frequency are an ubiquitous feature of Saturn's inner magnetosphere. These left-circularly polarized, transverse waves are generated by the anisotropic velocity distribution of recently produced ions, and reflect the ion production rate. The properties and distribution of these emissions have been previous studies and related to the distribution of neutrals in the system (Leisner et al., 2006; Crary et al., 2013; Meeks et al., 2016.)

In addition to these waves, other, related mode have been observed by the Cassini spacecraft. The waves near the W^+ (water group) cyclotron frequency sometimes have a compressional component and/or accompanying emission the first (2f) harmonic (implying the waves are oblique rather than parallel propagating. Neither of these properties is predicted by the classic theory of wave growth from a ring-beam distribution. In addition, ion cyclotron waves are also observed near the gyrofrequency of a 32 AMU ion, suggesting production of O_2^+. While observed, O_2^+ is a very low abundance species outside of 4 Saturn radii, and in the regions where these waves are present. Finally, strong but linearly polarized waves are sometimes observed near the orbit of Enceladus. The association between these waves and W^+ ion cyclotron waves is unclear.

We will present the measurements of these ULF waves, their frequency of occurrence with respect to position and time, and discuss their implications for plasma production in Saturn's magnetosphere.