
Statistical Observations of Proton-Band Electromagnetic Ion Cyclotron Waves in the Outer Magnetosphere: Full Wavevector Determination

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Abstract

Electromagnetic Ion Cyclotron (EMIC) waves mediate energy transfer from the solar wind to the magnetosphere, relativistic electron precipitation, or thermalization of the ring

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current population. We use 8 years of Magnetospheric Multiscale (MMS) mission observations in the dayside magnetosphere to detect proton-band EMIC waves in the Earth's dayside magnetosphere, and find that they are present roughly 15% of the time. Their normalized frequency presents a dawn-dusk asymmetry, with waves in the dawn flank magnetosphere having larger frequency than in the dusk, subsolar, and dawn near subsolar region. It is shown that the observations are unstable to the ion cyclotron instability. We obtain the wave polarization and wavevector by comparing Single Value Decomposition and Ampere methods. We observe that for most waves the perpendicular wavenumber is larger than the inverse of the proton gyroradius, while the parallel wavenumber is smaller than the inverse of the ion gyroradius. Left-hand polarized waves are associated with small wave normal angles, while linearly polarized waves are associated with large wave normal angles.