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Heating of the Ions by Electromagnetic Ion Cyclotron (EMIC) Waves Using Magnetospheric Multiscale (MMS) Satellite Observation

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Abstract : The magnetospheric multiscale (MMS) satellite observations in the inner magnetosphere were used to detect the proton band of the electromagnetic ion cyclotron (EMIC) waves on December 14, 2015, which have been significantly contributing to the dynamics of the magnetosphere. It has been examined that the intensity of EMIC waves gradually increases by decreasing the L shell. The waves are triggered by hot proton thermal anisotropy. The low-energy cold protons (ions) can be activated by the EMIC waves when the EMIC wave intensity is high. As a result, these previously invisible protons are now visible. As a result, the EMC waves also excite the helium ions. The EMIC waves, whose frequency in the magnetosphere of the Earth ranges from 0.001 Hz to 5 Hz, have drawn a lot of attention for their ability to carry energy. Since these waves act as a mechanism for the loss of energetic electrons from the Van Allen radiation belt to the atmosphere, therefore, it is necessary to understand how and where they can be produced, as well as the direction of waves along the magnetic field lines. This work examines how the excitation of EMIC waves is affected by the energy of hot proton temperature anisotropy, and It has a minimum resonance energy of 6.9 keV and a range of 7 to 26 keV. On the hot protons, however, the reverse effect can be seen for energies below the minimum resonance energy. It is demonstrated that throughout the energy range of 1 eV to 100 eV, the number density and temperature anisotropy of the protons likewise rise as the intensity of the EMIC waves increases. Key Points: 1. The analysis of EMIC waves produced by hot proton temperature anisotropy using MMS data. 2. The number density and temperature anisotropy of the cold protons increases owing to high-intensity EMIC waves. 3. The cold protons with an energy range of 1-100eV are energized by EMIC waves using the Magnetospheric Multiscale (MMS) satellite not been discussed before

Keywords : EMIC waves, temperature anisotropy of hot protons, energization of the cold proton, magnetospheric multiscale (MMS) satellite observations
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