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Theoretical Investigations and Simulation of Electromagnetic Ion Cyclotron Waves in the Earth's Magnetosphere Through Magnetospheric Multiscale Mission

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Abstract : Wave-particle interactions are considered to be the paramount in the transmission of energy in collisionless space plasmas, where electromagnetic fields confined the charged particles movement. One of the distinct features of energy transfer in collisionless plasma is wave-particle interaction which is ubiquitous in space plasmas. The three essential populations of the inner magnetosphere are cold plasmaspheric plasmas, ring-currents, and radiation belts high energy particles. The transition region amid such populations initiates wave-particle interactions among distinct plasmas and the wave mode perceived in the magnetosphere is the electromagnetic ion cyclotron (EMIC) wave. These waves can interact with numerous particle species resonantly, accompanied by plasma particle heating is still in debate. In this work we paid particular attention to how EMIC waves impact plasma species, specifically how they affect the heating of electrons and ions during storm and substorm in the Magnetosphere. Using Magnetospheric Multiscale (MMS) mission and electromagnetic hybrid simulation, this project will investigate the energy transfer mechanism (e.g., Landau interactions, bounce resonance interaction, cyclotron resonance interaction, etc.) between EMIC waves and cold-warm plasma populations. Other features such as the production of EMIC waves and the importance of cold plasma particles in EMIC wave-particle interactions will also be worth exploring. Wave particle interactions, electromagnetic hybrid simulation, electromagnetic ion cyclotron (EMIC) waves, Magnetospheric Multiscale (MMS) mission, space plasmas, inner magnetosphere

Keywords : MMS, magnetosphere, wave particle interraction, non-maxwellian distribution
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