302nd Regular Open Seminar（2023/10/18）

Title：　Wave-particle interactions between electromagnetic cyclotron waves and energetic electrons in the inner magnetosphere

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Related RISH mission：Mission 3 Sustainable Space Environments for Humankind

Abstract：

The Earth's inner magnetosphere is the region where the dipole magnetic field is dominant and includes plasmasphere, ring current, and radiation belts. Since charged particles perform collisionless motions in this area, wave-particle interaction is the significant process causing electron acceleration/deceleration and pitch angle scattering. The electron motions also affect the excitation, propagation, and damping of waves. Various plasma waves generate and propagate in the inner magnetosphere. With helix structures in both electric field and magnetic field, electromagnetic cyclotron waves, such as whistler-mode waves and electromagnetic ion cyclotron (EMIC) waves, can easily interact with gyrating electrons. Therefore, the wave-particle interaction between electromagnetic cyclotron waves and electrons is very active and plays a crucial role in magnetosphere dynamics.

This presentation will first introduce the features of electromagnetic cyclotron waves in the inner magnetosphere and the physical energy transportation between the waves and electrons. Then, I will talk about the generation and loss processes of energetic electrons (energy > tens of keV and can be up to a few MeV) by showing numerical simulation results. In particular, nonlinear processes regarding various resonances in wave-particle interactions between oblique chorus emissions and energetic electrons will be discussed (Figure 1).

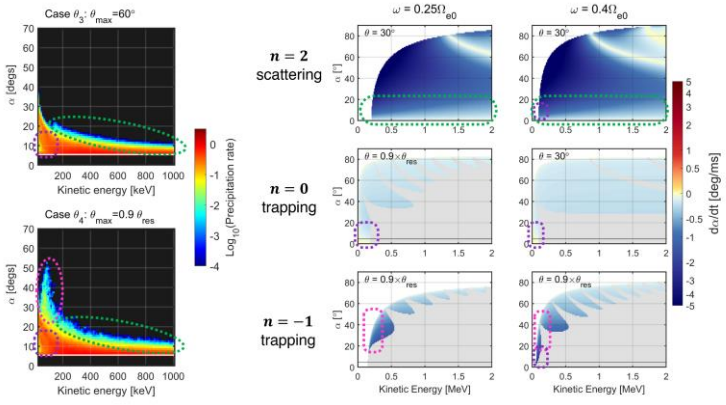

Figure 1：Energetic electron losses caused by various resonances in chorus wave-particle interactions. (left) Simulated electron loss. (right) Theoretical pitch angle changing rates.