



演 講

Nonlinear Wave-particle Interactions in Earth's Inner Magnetosphere

Speaker : **Prof. Yoshiharu Omura**

Research Institute for Sustainable Humanosphere, Kyoto University, JAPAN

Time : 107 年 4 月 27 日 星期五 14:00

Place : 健雄館(科四館) S4-811 教室

摘 要 / Abstract :

In recent years, a series of spacecraft, Cluster, THEMIS, Van Allen Probes, and ERG have been launched into the Earth's inner magnetosphere, and they have functions to record wave forms with high time resolutions, enabling us to understand coherent structures in waves such as whistler mode chorus, hiss, and electromagnetic ion cyclotron (EMIC) emissions frequently observed in the radiation belts. Successful reproductions of these waves by particle simulations have resulted in significant progress in theory on their generation mechanisms and associated acceleration and precipitations of energetic particles. We give a brief account of the nonlinear theory of the generation mechanism of chorus emissions. We describe the nonlinear dynamics of resonant electrons, and the formation of the electromagnetic electron "hole" that results in resonant currents generating rising-tone emissions. We have theoretically derived threshold and optimum wave amplitudes for the nonlinear wave growth of rising-tone emissions. The profiles of these wave amplitudes as functions of frequencies agree well with those from observations and simulations. In contrast, falling-tone emissions are generated through the formation of electron "hills." We also describe the mechanism of nonlinear wave damping due to quasi-oblique propagation, which results in the formation of a gap at half the electron cyclotron frequency. The nonlinear wave growth theory of chorus emissions can be applied to the generation mechanism of electromagnetic ion cyclotron emissions. Hybrid code simulations have confirmed that coherent rising-tone emissions are generated by energetic protons at frequencies below the proton cyclotron frequency through formation of electromagnetic ion holes. Electromagnetic ion cyclotron waves can also interact with relativistic electrons. Both chorus emissions and electromagnetic ion cyclotron rising-tone emissions play important roles in controlling radiation-belt particle dynamics. Coherent structures recently found in the plasmaspheric hiss emissions are also interpreted by the nonlinear wave growth theory. Good agreement between the observation and the theory confirms local generation of the hiss emissions in the equatorial region just inside the plasmopause.

※歡迎聽講※

~請聽講者提早入座~