ABSTRACTS (MASTER THESIS)

Test Particle Simulation of Relativistic Electron Microbursts Induced by EMIC Waves in the Earth's Radiation Belts

**(Graduate School of Engineering,
Laboratory of Computer Simulation for Humanospheric Sciences,
RISH, Kyoto University)**

Qinghua Zhao

We have performed test particle simulations to demonstrate that relativistic electron microbursts are induced by electromagnetic ion cyclotron (EMIC) triggered emissions. Pitch-angle scattering of relativistic electrons arising from the anomalous cyclotron resonance with left-hand polarized EMIC waves contributes to the sharp decrease of the relativistic electron flux in the outer radiation belt in the main phase of magnetic-storms. EMIC triggered emissions with frequencies typically increasing in time are generated in the equatorial region and propagate along the magnetic field line both northward and southward. First, by the simulation with simplified EMIC model, we check if electrons are scattered in pitch angles. We perform test particle simulations to reproduce the time histories of pitch angles, trajectories in the (θ-ξ) phase space, distribution of the resonant electrons assuming an EMIC wave with a varying frequency as observed by Cluster spacecraft. We find that the efficiency of pitch-angle scattering depends on the frequency sweep rate, the gradient of the magnetic field, and the wave amplitude. The most effective pitch-angle scattering takes place for the case of a rising-tone emission with an enhanced magnetic field gradient. Then we reproduce the EMIC triggered emission based on the chorus equations and wave equations. We trace a large number of electrons and record the numbers of electrons precipitated into the loss cone. Due to the short bounce time of the electrons compared to EMIC propagation time, the electrons after adiabatic bounce motion at the mirror points interact with another wave packet near the equator and are scattered into the loss cone. We find that EMIC triggered emissions are very effective in precipitating the relativistic electrons for a wide range of energy and pitch angles from the radiation belts, causing the relativistic microbursts.