Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PEM031-08 Room: Exibition hall 7 subroom 1 Time: May 24 10:45-11:05

Relativistic electron acceleration in Geospace

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Relativistic electrons are trapped and accelerated in the Van Allen radiation belts. The electron flux is highly variable associated with magnetic disturbances, and often increases largely associated with high-speed solar wind stream. There are two different mechanisms that cause large flux enhancement of relativistic electrons. The radial diffusion driven by MHD fluctuations induces adiabatic acceleration of energetic electrons. Cyclotron resonant wave-particle interaction of whistler mode waves causes the internal acceleration via cross-energy couplings. Whistler mode waves are act as a mediating agent by absorbing a fraction of the power of low-energy electrons, which results in wave growth, and then its transfer to relativistic electron accelerations. Thermal plasma population of plasmasphere also controls electron acceleration by wave-particle interaction. In order to investigate which mechanism is actually essential for large flux enhancement of relativistic electrons, there are several satellite missions for geospace exploration during next solar maximum. In Japan, the geospace exploration mission ERG (Energizaion and Radiation in Geospace) has been planned, which consists of small satellite program, ground-network observations as well as modeling/integrated studies.

Keywords: relativistic electrons, Van Allen radiation belts, particle acceleration