On Quiet Decays of Radiation Belts Electrons

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ABSTRACT

In this presentation, we address the questions on how to model the dynamics of the radiation belts during quiet geomagnetic times. We consider a broad hierarchy of models, from equilibrium (steady) model representation, to reduced Fokker-Planck, then, full Fokker-Planck formulations. We show briefly how we can sometimes find analytically the solution and what we learn from it, simplify important phenomena such as pitch angle diffusion, to the profit of lowering the computational cost while still keeping admissible accuracy, or, inversely, model pitch angle diffusion at high temporal and spatial resolution from satellite data-driven wave properties.

We the apply these models to the geomagnetic storm of March 1st 2013 and compute how fast the slot region forms gradually between the two radiation belts during long and quiet storm recovery, contributing to depopulate the close-Earth magnetosphere of the large amount of electrons injected by the storm. This scattering phenomenon by pitch angle diffusion is caused by wave-particle interactions from whistler hiss waves and is essential to the energy structure of the belts and slot region. We focus in this talk on discussing the remarkable tri-dimensional (L, energy, and pitch angle) structure of the radiation belts and exhibit its main characteristic based on both the numerical results and global observations from the Van Allen Probes using the Magnetic Electron and Ion Spectrometer (MagEIS) flux measurements of the belts.

While the previous description is well adapted to describe the dynamics in and above the slot region during a few tens of days between two storms, we question its generalization to deeper inner belt dynamics over longer timescales (of a few months). Among the various other effects that are required for this problem, wave –particle interactions from lightning-generated waves and VLF navy transmitters are thought to be important. The last part of the presentation is then devoted to the modeling of these effects.