Project Details

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Program Element: Focused Science Topic

Topic: Interaction Between the Magnetotail and the Inner Magnetosphere and its Impacts on the Radiation Belt Environment

Project Title:
Transport and trapping of energetic plasmasheet electrons in the inner magnetosphere

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Summary:
Energetic particles in the plasma sheet and near-Earth magnetotail can be transported sunward by large-scale magnetospheric convective processes, allowing some populations to be trapped inside the 'Alfven Layer' on close drift paths in the inner magnetosphere. These newly-trapped particles may contribute directly to the seed populations that are subsequently heated to ring current and radiation belt energies, and may also provide a source of free energy for the generation of electromagnetic waves that affect the dynamic variations of the outer radiation belts. In this effort, we propose a study of the dynamics of the Alfven layer and the characteristics and effects and contributions of energetic plasma sheet particles on trapped populations in the inner magnetosphere.

Specifically, the following questions are addressed: (1) What solar wind driving conditions and magnetospheric activity parameters dictate the position and morphology of the Alfven layer? (2) How do we characterize the transport-induced electron temperature anisotropies that provide the free energy for chorus and hiss wave activity in the inner magnetosphere? (3) What are the effects of transport, energization and trapping of plasma sheet source particles on the radiation belts, both in terms of direct adiabatic injection, and the the resulting effects of wave activity in the inner magnetosphere?

MHD/particle simulation, using both simplified solar wind conditions and case studies driven by observations from L1, will be combined with energetic particle and field observations from the inner magnetosphere and near-Earth tail to examine the physical processes involved in transporting, energizing, and trapping plasma sheet electrons in the outer zone radiation belts. The results will provide a deeper understanding of the mechanisms of coupling between the plasma sheet and inner magnetosphere, a model of the spectrum and dynamics of the seed populations that contribute to the ring current and radiation belts, and insight into the evolution and morphology of temperature anisotropies that can be used in models of inner magnetospheric wave activity.

Publication References:

no references