Project Details

ROSES ID: NNH09ZDA001N
Selection Year: 2010
Program Element: Focused Science Topic

Topic: Determine the Behavior of the Plasmasphere and its Influence on the Ionosphere and Magnetosphere

Project Title:
MHD Modeling of the Plasmasphere

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Summary:
The plasmasphere affects the propagation of pressure pulses, the timescale for magnetospheric reconfiguration, and the growth and propagation of electromagnetic ion cyclotron waves and whistler waves. Through its effect on these waves, it strongly affects the distribution of radiation belt electrons.

We propose to study the dynamics of the magnetosphere with a comprehensive model for the plasmasphere and the magnetosphere based on a global multi-fluid MHD simulation code. The major thrust of our investigation will be in the two areas: the dynamics of wave and impulse propagation in the magnetosphere under changing solar wind and ionospheric conditions and the development and evolution of plasmaspheric structure and its effects on the global magnetosphere-ionosphere system.

The key science questions to be addressed are:

1. How does the plasmasphere evolve, and how do the physical assumptions of the model affect the evolution?

2. How do plasmaspheric plumes develop and evolve?

3. What is the effect of the plasmasphere on ULF waves?

4. What is the effect of the plasmasphere on the propagation of interplanetary shock compressions through the magnetosphere?

The LFM global MHD code will be extended to carry an arbitrary number of ionic species which will, in addition to the usual plasma stresses, will react to gravity and the corotation centrifugal force. The global MHD code will be linked to the NCAR thermosphere-ionosphere model to provide realistic conductivities and wind driven stresses.

Publication References:

Summary: no summary

Reference:
Pembroke, Asher; Toffoletto, Frank; Sazykin, Stanislav; Wiltberger, Michael; Lyon, John; Merkin, Viacheslav; Schmitt, Peter; (2012), Initial results from a dynamic coupled magnetosphere-ionosphere-ring current model, Journal of Geophysical Research, Volume 117, Issue A2, doi: 10.1029/2011JA016979