Project Details

ROSES ID: NNH11ZDA001N
Selection Year: 2012
Program Element: Focused Science Topic

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

Project Title:
Energetic particle acceleration and transport towards the inner magnetosphere via transient dipolarizations

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Summary:
The main objective of this proposal is to understand the physical connections between energetic particle populations observed in the vicinity of dipolarization fronts in the near-Earth plasma sheet and those observed in the dipole-dominated inner magnetosphere. Taking advantage of unprecedented multi-point observations by THEMIS, we propose to study the spectral properties, spatial distribution, occurrence rates and spatial and temporal scales of the injections. Typical observed spectra will be used as input parameters for particle-tracing under a transient electric field to calculate the particle paths and spectra in the inner magnetosphere under a variety of conditions and ascertain the importance of such injections. Case studies with three to five THEMIS spacecraft (as well as RBSP, when available) will be used for direct comparisons with the model results. This comparison will make it possible to adjust model parameters, leading to better understanding of the underlying physical processes and driver properties, such as the scale size and duration of the impulse. The proposed study will contribute towards the resolution of an outstanding science question in space physics:

How do the impulsive plasma energization and transport contribute to build up the inner magnetosphere energetic particle populations?

Specifically, we will address the following science questions:

i) What are the temporal, spatial and spectral properties of particles energized on dipolarization fronts?

ii) How do these particles penetrate into the inner magnetosphere? and

iii) How do the particle spectral properties change during transport toward and in the inner magnetosphere?

The proposed study will also result in a set of deliverables for the Focus Team: characteristic particle spectra during transient dipolarizations, spatial and temporal scales of flux changes, and predicted particle spectra and phase space density in the inner magnetosphere. These are valuable as initial conditions and parameters for a variety of models expected to be available to the Focus Team and for the interpretation of RBSP observations.

This proposal is directly relevant to NASA's Living With a Star Targeted Research and Technology Focused Science Topic (b): ``Interaction between the magnetotail and the inner magnetosphere and the impact of that interaction on the radiation belt environment''

Publication References:

Summary: no summary

Reference: Gabrielse, C.; Angelopoulos, V.; Runov, A.; Turner, D. L.; (2012), The effects of transient, localized electric fields on equatorial electron acceleration and transport toward the inner magnetosphere, Journal of Geophysical Research, Volume 117, Issue A10, doi: 10.1029/2012JA017873

Summary: no summary

Reference: Gabrielse, C.; Angelopoulos, V.; Runov, A.; Turner, D. L.; (2014), Statistical characteristics of particle injections throughout the equatorial magnetotail, Journal of Geophysical Research: Space Physics, Volume 119, Issue 4, pp. 2512-2535, doi: 10.1002/2013JA019638

Summary: no summary

Reference:
Turner, D. L.; Fennell, J. F.; Blake, J. B.; Clemmons, J. H.; Mauk, B. H.; Cohen, I. J.; Jaynes, A. N.; Craft, J. V.; Wilder, F. D.; Baker, D. N.; Reeves, G. D.; Gershman, D. J.; Avanov, L. A.; Dorelli, J. C.; Giles, B. L.; Pollock, C. J.; Schmid, D.; Nakamura, R.; Strangeway, R. J.; Russell, C. T.; Artemyev, A. V.; Runov, A.; Angelopoulos, V.; Spence, H. E.; Torbert, R. B.; Burch, J. L.; (2016), Energy limits of electron acceleration in the plasma sheet during substorms: A case study with the Magnetospheric Multiscale (MMS) mission, Geophysical Research Letters, Volume 43, Issue 15, pp. 7785-7794, doi: 10.1002/2016GL069691