Project Details

ROSES ID: NNH08ZDA001N
Selection Year: 2009
Program Element: Focused Science Topic

Topic: Integrate Non-MHD/Kinetic Effects on Magnetic Reconnection, Particle Energization, and Plasma Heating into Global Models.

Project Title:
Integration of Anomalous Transport Effects by Kinetic Instabilities into Global Models

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Summary:
This proposal in response to the "Living With a Star Targeted Research and Technology" research announcement NNH08ZDA001N-LWSTRT, is aimed at addressing the following outstanding questions that pose limitations on the capability of existing global models to provide accurate representation of magnetospheric dynamics:

(1) What are the kinetic instabilities revealed from observations that may lead to global effects?

(2) How should the effects of localized kinetic instabilities be incorporated into global simulation models?

(3) What differences would the effects of localized kinetic instabilities make on the macroscopic fluid simulation when these effects are incorporated into the code?

We have recently developed a novel theoretical method to extract physical information on the plasma wave characteristics from THEMIS spacecraft data, taken during a dipolarization event. By continuing to employ such a method for other events and for other spacecraft data (e.g., Cluster) we shall establish the true picture of what kinetic instabilities are really operative near the reconnection or current disruption region. We have also recently developed a theoretical formalism to incorporate the effects of kinetic instabilities into the global fluid model by means of anomalous resistivity and turbulent transport coefficients. We shall integrate these coefficients into the Hall-MHD code, and solve the code over model magetotail geometry. We shall demonstrate the differences with simulations without the anomalous transport coefficients. This will serve as an example for other simulation groups that perform existing global simulations of the magnetosphere. In the future, the present method can be further evolved into a more realistic space weather forecasting tool.

Publication References:

no references