Interim Contractor Report #12

10/01/97 - 10/31/97

Physics of Boundaries and their Interactions in Space Plasmas

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I. Large Scale Simulation of the Magnetopause:

We are refining our simulation model further by experimenting with several schemes for including the effects of cold magnetospheric ions in the simulation. The initial results are quite promising and we are uncovering a host of new physical effects. We have now fully resolved some of the difficulties that we had encountered in saving and manipulating the large data sets that are generated by these runs. We are, however, still working on further development of visualization algorithms. This is required in order to be able to analyze the details of the various boundaries that are formed. Finally, we are preparing the highlights of our research to be presented as two talks/posters at the upcoming Fall AGU.

II. Linear Kinetic Code:

We extended our new linear kinetic code to the fully electromagnetic regime. We are now in the testing and debugging phase of this effort. We want to make sure that the code predicts the proper eigenfunctions and growth rates in the regions where there are known analytical/numerical results. Once this phase is completed, we will then use the code to examine the linear properties of the Kelvin-Helmholtz instability associated with thin current sheets at the magnetopause. In particular, we will compare the obtained growth rates against the linear growth rates obtained from our large scale hybrid simulations of the magnetopause. The details of this code and our linear studies will be presented at the fall AGU meeting.

III. Inflow-Outflow Boundary Conditions:

We have successfully implemented the inflow-outflow boundary conditions for the asymmetric configuration at the magnetopause in our vectorized 2-D hybrid code. The boundary conditions are adjusting properly to changes in the reconnection region. However, we have encountered some difficulties with the equilibrium. Using our equilibrium, a rather large initial perturbation is set off which leads to undesirable effects. We are currently working on resolving this issue and are experimenting with several other types of equilibrium. We are also spending time on the parallel version of this code. One issue that we are tackling is in regards to the input/output on the parallel machine. Since I/O, if not properly optimized, can result in a significant slow down of the code, we are spending a good deal of effort on the I/O problem. Finally, we are preparing some of this work for a presentation at the Fall AGU.

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13. ABSTRACT (Maximum 200 words)

This report describes the work done by SciberNet, Inc. during the month of October. We are working on the further refinement of the model used in our large-scale hybrid simulations of the magnetopause. Specifically, we are experimenting with several ways of modeling the effects of cold magnetospheric ions into our simulations. In addition, we are preparing two presentations for the upcoming Fall AGU highlighting the results of these simulations. We have also made progress in our development of a new kinetic linear code which we are using to study the linear properties of the Kelvin-Helmholtz instability at the magnetopause. We have extended the code from the electrostatic limit to the fully electromagnetic regime and are currently in the process of debugging and testing the code. Finally, we have made several test runs with our 2-D hybrid code for the magnetopause. The inflow-outflow boundary conditions are working properly. However, there are issues related to the setup and evolution of the original equilibrium that we are still trying to resolve. Finally, we are preparing several presentation for the upcoming Fall AGU.

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