Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Multi-fluid plasma modeling with Braginskii collisional transport processes[1] A. HO, U. SHUMLAK, S.T. MILLER, Univ of Washington — Magnetohydrodynamics (MHD) works well where transport processes are primarily advective. Extensions of the MHD model are capable of capturing some collisional phenomena such as electrical resistivity, which are important in systems with mean free paths less than the characteristic length. However, MHD models have difficulties resolving systems where the Debye length cannot be assumed to approach zero. These systems arise in low density, hot plasmas. By modeling the ions and electrons as distinct fluids, the 5-moment multi-fluid plasma model is able to capture these short-range transport processes that are not accounted for in MHD. To model the transport processes the Braginskii transport terms are added to the 5-moment model, which introduces viscosity, heat conduction, and binary species interactions. These transport properties are affected by strong magnetic fields, resulting in anisotropic collisional effects. The multi-fluid equations are evolved explicitly and are coupled with Maxwell's equations. This research extends the University of Washington's WARPXM code to include the Braginskii terms with the 5-moment multi-fluid plasma model. The implementation is validated against theoretical results from a Hartmann flow benchmark problem.

[1]This work is supported by a grant from the United States Air Force Office of Scientific Research.

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Date submitted: 24 Jul 2015 Electronic form version 1.4