Abstract Submitted
for the DPP06 Meeting of
The American Physical Society

An iterative semi-implicit scheme for KAW-mediated magnetic reconnection[1] NUNO LOUREIRO, CMPD – UMD / PPPL, GREG HAMMETT, PPPL — Recent results in the field of magnetic reconnection have come to emphasize the importance of going beyond the single fluid MHD description. In particular, the Hall term and/or finite Larmor radius (FLR) effects have been shown to be crucial in obtaining the long sought speed-ups of the reconnection rate. From the numerical point of view, these effects originate new difficulties as they introduce dispersive waves into the system [whistler, kinetic Alfven wave (KAW)] which have dispersion relations where the frequency $\omega \sim k_\perp^2$, i.e., extremely fast when compared to the macroscopic dynamics of the system. Explicit integration schemes show great difficulty in coping with these waves, yielding timesteps which are impractically small. In this work we discuss how semi-implicit methods can be adapted to deal with the KAW. The main idea resides in deriving a wave-like operator which mimics the real wave operator in the linear and nonlinear regimes, while being analytically invertible. Timestep enhacements by factors of $\sim$100 are obtained, with computational time per timestep roughly the same as with an explicit scheme. An error control method is derived and used to determine the timestep. This approach is thus both unconditionally stable and accurate. Comparisons with a purely explicit integration are found to be in excellent agreement.

[1]Work supported by The Center for Multiscale Plasma Dynamics, the U.S. Department of Energy Grant No. DE-FC02-04ER54784

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Date submitted: 19 Jul 2006 Electronic form version 1.4