An iterative semi-implicit scheme for KAW-mediated magnetic 
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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 $\omega \sim k^2$ , 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 enhancements 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.

\textsuperscript{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

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