Abstract Submitted
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A Fully Implicit Particle-in-Cell Method for the Symplectic Formulation of Electromagnetic Gyrokinetics.[1] LUIS CHACON, Los Alamos National Laboratory, SEUNG-HOE KU, AMIL SHARMA, CHOOG-SEOCK CHANG, PPPL, BENJAMIN STURDEVANT, Princeton Plasma Physics Laboratory, MARK ADAMS, LBL — A fully implicit particle-in-cell (PIC) method based on the work of G. Chen and L. Chacón [1] has been developed to study gyrokinetic electromagnetic modes in tokamak plasmas. A fully implicit time discretization scheme overcomes stability issues due to the inductive component of the electric field in the sympletic formulation of gyrokinetics [2] while avoiding a well-known "cancellation problem" associated with the Hamiltonian formulation of gyrokinetics [3]. We present our efforts to construct an effective preconditioner for this system, starting from an electron fluid model and accounting for additional effects due to the numerics of the PIC method. Application of the preconditioner requires the solution of a linear system of equations resulting from the discretization of a coupled PDE system. We present a multigrid strategy for solving the linear system based on semi-coarsening and block smoothing. Finally, we will present numerical results to validate our scheme, including the simulation of the ITG-KBM transition [4] and long wavelength Alfven waves, which has been problematic with previous approaches. [1] G. Chen, L. Chacon, Comput. Phy. Comm. 197, 73-87, 2015. [2] J.V.W. Reynders, Ph.D. thesis, Princeton University, 1992. [3] J.C. Cummings, Ph.D. thesis, Princeton University, 1995. [4] T. Gorler, N. Tronko, et al., Phys. Plasmas, 23, 072503, 2016.

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