

Abstract Submitted
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Fully Implicit Moment-Based Acceleration of Vlasov-Ampere Particle in Cell (PIC) System WILLIAM TAITANO, Univ. of New Mexico, DANA KNOLL, Los Alamos Nat. Lab., LUIS CHACON, Oak Ridge Nat. Lab. — Explicit time integration is predominant in particle-in-cell (PIC) method. In explicit method, the time-step size is restricted by the CFL condition. This makes detailed investigation of such problems that occurs in ion time-scale challenging. Implicit method is not restricted by any of the numerical time-scales. Jacobian-Free-Newton-Krylov (JFNK) is one method that solves a coupled set of non-linear system of equations that promises investigation of implicit multi-time-scale kinetic plasma physics simulation possible [1]. With appropriate discretization, one can also use a mesh spacing which is larger than the Debye length. An alternative implicit approach have also been investigated by Degond et al [2]. The approach is formulated around a semi-implicit, reformulated Poisson's equation in order to remove the stiffness associated with the pure Poisson equation to solve for the electric-field. Our work is based on developing a moment-based approach which may allow us to abandon the tight JFNK iteration between fields and particles. We present our progress on this new multi-scale algorithm and contrast it with the approaches of [1] and [2]. We will also show a connection to moment-based acceleration of transport iteration used to solve for the neutron transport equation.

[1] G. Chen, et al., J. Comp. Phys. in press.

[2] P. Degond, et al., J. Comp. Phys.

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