

Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Implicit Plasma Kinetic Simulation Using The Jacobian-Free Newton-Krylov Method WILLIAM TAITANO, DANA KNOLL, Idaho National Laboratory, LUIS CHACON, Oak Ridge National Laboratory — The use of fully implicit time integration methods in kinetic simulation is still area of algorithmic research. A brute-force approach to simultaneously including the field equations and the particle distribution function would result in an intractable linear algebra problem. A number of algorithms have been put forward which rely on an extrapolation in time. They can be thought of as linearly implicit methods or one-step Newton methods. However, issues related to time accuracy of these methods still remain. We are pursuing a route to implicit plasma kinetic simulation which eliminates extrapolation, eliminates phase-space from the linear algebra problem, and converges the entire nonlinear system within a time step. We accomplish all this using the Jacobian-Free Newton-Krylov algorithm. The original research along these lines considered particle methods to advance the distribution function [1]. In the current research we are advancing the Vlasov equations on a grid. Results will be presented which highlight algorithmic details for single species electrostatic problems and coupled ion-electron electrostatic problems.

[1] H. J. Kim, L. Chacón, G. Lapenta, “Fully implicit particle in cell algorithm,” 47th Annual Meeting of the Division of Plasma Physics, Oct. 24-28, 2005, Denver, CO

Dana Knoll
Idaho National Laboratory

Date submitted: 16 Jul 2009

Electronic form version 1.4