

Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

A Fully-Implicit, Ion-Electron, Vlasov-Poisson Algorithm

WILLIAM TAITANO, University of Idaho, DANA KNOLL, Los Alamos National Laboratory, LUIS CHACON, Oak Ridge National Laboratory, IDAHO NATIONAL LABORATORY COLLABORATION, CENTER FOR SPACE NUCLEAR RESEARCH COLLABORATION — The Jacobian-Free-Newton-Krylov method (JFNK) is an advanced non-linear algorithm that allows solution to a coupled systems of non-linear equations [1]. We put forth a new JFNK-based implicit plasma simulation algorithm. We have studied this algorithm within the context of a two-species Vlasov-Poisson system where the Vlasov equations are solved in an Eulerian frame [2]. We have investigated the route of non-linear-elimination/kinetic-enslavement to reduce the size of block Jacobian matrix in order to solve the field-kinetic system implicitly. The non-linear-elimination/kinetic-enslavement technique allows reduction in the size of non-linear system but still retains high order temporal accuracy and strong non-linear coupling. Our new algorithm make implicit time-dependent, coupled, field-kinetic systems more attractive. As will be shown, a fully implicit run was able to achieve 22 times speed-up compared to the explicit run for our ion-acoustic-showckwave simulation [2].

[1] D.A. Knoll and D.E. Keyes, *J. Comput. Phys.* vol. 193 (2004)

[2] W.T. Taitano, Masters Thesis, Nuclear Engineering, University of Idaho (2010)

William Taitano
University of Idaho

Date submitted: 15 Jul 2010

Electronic form version 1.4