Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Vlasov simulation in multiple spatial dimensions HARVEY ROSE, WILLIAM DAUGHTON, Los Alamos National Laboratory — One of the outstanding challenges encountered in modeling plasma is simulating the Vlasov equation over length and time scales that are physically relevant to real experiments. Plasma processes that depend sensitively on spatial dimension include linear ones such as diffraction and its nonlinear variant, self-focusing, cannot be simulated in one spatial dimension (1D). Direct multi-D Vlasov simulations are prohibitive while unphysical particle noise and Debye length resolution may severely constrain multi-D particle in cell (PIC) simulations. We have developed a Vlasov Multi-Dimensional (VMD) model that is specifically designed to take advantage of solution properties in regimes when plasma waves are confined to a narrow cone. Perpendicular grid spacing large compared to a Debye length is then possible without instability, enabling a factor of order 10 decrease in required computational resources compared to standard PIC methods in 2D and another factor of that order in 3D. Further advantage accrues in regimes where particle noise is an issue. VMD and PIC results in a 2D model of localized Langmuir waves are in quantitative agreement.

Harvey Rose
Los Alamos National Laboratory

Date submitted: 13 Jul 2009 Electronic form version 1.4