Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Fourier-Hermite spectral method for the Vlasov equation ENRICO CAMPOREALE, GIAN LUCA DELZANNO, BENJAMIN BERGEN, J. DAVID MOULTON, LANL — We present a spectral method to solve the Vlasov equation for collisionless plasma, by means of an expansion of the distribution function into a Fourier-Hermite basis. The proof-of-principle results are obtained for the 1D-1V Vlasov-Poisson equation, and the focus of this work is to compare the performance of this approach with a standard Particle-in-Cell (PIC) method. With a fully-implicit time integrator, the Fourier-Hermite method conserves charge, momentum, and energy exactly. Currently no PIC code is able to conserve these three quantities simultaneously. We show results for several cases routinely used as benchmarks in computational plasma physics: Langmuir wave, Landau damping, two-stream instability, and ion-acoustic wave. It is shown that the Fourier-Hermite method can achieve a much more accurate solution in a tiny fraction of the time relative to PIC.

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Date submitted: 12 Jul 2013 Electronic form version 1.4