Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

Efficient Hybrid Methods for Coulomb Collisions in a Plasma[1]
A.M. DIMITS, B.I. COHEN, LLNL, R.E. CAFLISCH, UCLA — We report on a class of hybrid methods for the simulation of plasmas with Coulomb collisions, initially proposed by Caflisch et. al. These achieve significant efficiency at moderately small Knudsen number by combining a fluid solver to evolve the mostly dominant Maxwell part of the distribution function, and particle-in-cell and binary Monte-Carlo collision implementations to evolve the non-Maxwellian part of the distribution function. To represent the collisional interaction between the kinetic and Maxwellian components, particles are sampled from the fluid component and paired with the kinetic particles for collisions. Simulation particles must also be created at a rate that is sufficient to account for physical processes that drive the distribution function away from Maxwellian, and can be removed if collisions sufficiently drive the distribution function toward a Maxwellian. The performance these algorithms depends critically on the particular criteria for the exchange between the kinetic and fluid components and for the creation, destruction, and retention of the simulation particles.

[1]Work performed for US DOE by LLNL under Contract DE-AC52-07NA27344.

Andris Dimits
Lawrence Livermore National Laboratory

Date submitted: 20 Jul 2010 Electronic form version 1.4