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Efficient hybrid algorithms for collisional plasma simulation[1] Y. HUANG, UCLA, A.M. DIMITS, LLNL, R.E. CAFLISCH, UCLA, B.I. COHEN, LLNL, C.M. WANG, UCLA — We report on the development of efficient hybrid simulation algorithms for plasma systems that span a wide range of collisionality. Investigations of their performance, using ion-sheath- and electron-transport-based test problems, are presented. In these schemes the distribution function for one or more charged species is decomposed of into kinetic (particle) and fluid components. The fluid component is treated via standard Eulerian fluid simulation. One class of algorithms [R. E. Caflisch, et. al., Multiscale Modeling and Simulation, SIAM, 2008, in press.] is based on a combination of standard fixed-weigh particle-in-cell (PIC) simulation and binary Monte-Carlo collision operators. Here, particles are created by sampling from the fluid component, and paired for collisions with the kinetic-component particles. The other class of algorithms is based on evolving-weight delta-f PIC schemes and collision-field algorithms. The performance these algorithms depends strongly on the particular sets of criteria for (a) exchange between the particle and fluid components and (b) creation, destruction, and retention of the simulation particles.

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