Plasma Modeling with Speed-Limited Particle-in-Cell Techniques[1] THOMAS G. JENKINS, Tech-X Corporation, G. R. WERNER, University of Colorado, J. R. CARY, University of Colorado/Tech-X Corporation, P. H. STOLTZ, Tech-X Corporation — Speed-limited particle-in-cell (SLPIC) modeling is a new particle simulation technique [G. R. Werner and J. R. Cary, arXiv:1511.08225 (2015)] for modeling systems wherein numerical constraints, e.g. limitations on timestep size required for numerical stability, are significantly more restrictive than is needed to model slower kinetic processes of interest. SLPIC imposes artificial speed-limiting behavior on fast particles whose kinetics do not play meaningful roles in the system dynamics, thus enabling larger simulation timesteps and more rapid modeling of such plasma discharges. The use of SLPIC methods to model plasma sheath formation and the free expansion of plasma into vacuum will be demonstrated. Wallclock times for these simulations, relative to conventional PIC, are reduced by a factor of 2.5 for the plasma expansion problem and by over 6 for the sheath formation problem; additional speedup is likely possible. Physical quantities of interest are shown to be correct for these benchmark problems. Additional SLPIC applications will also be discussed.

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