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Taking larger timesteps with speed-limited particle-in-cell simulation[1] GREGORY WERNER, University of Colorado, JOHN CARY, University of Colorado and Tech-X Corp. — Particle-in-cell (PIC) simulation is often impractical because it includes too much unnecessary physics. For example, to avoid instability in many simulations the timestep must be small enough to resolve the plasma frequency, even if plasma oscillations do not play a significant role. Other methods (e.g., MHD/fluid and hybrid approaches) allow faster simulation, but often don't include enough physics. A new method, speed-limited PIC (SLPIC) simulation, offers kinetic simulation with an arbitrary-strength approximation tied to the timestep. With a small (standard PIC) timestep, SLPIC is identical to PIC, while a larger timestep (e.g., large compared to the inverse plasma frequency) results in the relaxation of fast particles over slower timescales. SLPIC is therefore useful in situations where the particle distribution functions change slowly compared to the timestep required by PIC. For example, SLPIC can simulate collisionless sheaths with a timestep hundreds of times larger than the inverse plasma frequency. SLPIC involves relatively isolated changes of a standard PIC code and poses no extra difficulties for parallelism; complexities of PIC, such as field solvers, collisions, and boundary conditions, carry over naturally to SLPIC with little change.

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