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Simplex-In-Cell Method for Kinetic Plasma Simulation SAMUEL TOTORICA, JULIAN KATES-HARBECK, JONATHAN ZRAKE, Kavli Institute for Particle Astrophysics and Cosmology, Stanford University, TOM ABEL, Kavli Institute for Particle Astrophysics and Cosmology, Stanford University; Institut Lagrange de Paris, Institut d'Astrophysique de Paris — We present a new particle-based method for kinetic plasma simulation that interprets the simulation particles as tracers of the distribution function in phase space. The construction of a piecewise linear approximation to the distribution function is enabled by interpolation of the tracer particles. With access to the full distribution function, moments such as density and velocity dispersion are defined continuously over the spatial domain. Charge and current densities obtained in this way are utilized in an improved particle-mesh force calculation, reducing particle discretization noise and more accurately modeling the continuum limit. The new method is implemented for 1D2V and compared with a cloud-in-cell deposit for electrostatic and electromagnetic test problems. Significant computational savings are shown when using the new method to model linear evolution. To simulate into the nonlinear regime we implement adaptive refinement of the mesh defined by the tracer particles, capturing the fine detail in the distribution function. These ideas may also be used as a post processing tool for standard PIC simulations, where the continuous density and velocity fields obtained eliminate the necessity of averaging over control volumes and associated statistical noise.

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