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A Symplectic Energy and Momentum Conserving Spectral Particle Method DAVID FILLMORE, PETER MESSMER, Tech-X Corporation — abstract-Particle plasma models, including the particle-in-cell (PIC) model class, generally follow the trajectories of a large number of macro-particles under the influence of both external and internal electromagnetic fields. The charge and current density terms in the Maxwell equations are obtained by prescribing a shape function that is centered on each particle. The PIC methods are among the most efficient for plasmas out of local thermodynamic equilibrium, but, through the use of grid interpolations, suffer from numerical grid heating (or cooling). In this poster we describe a spectral particle method that conserves both energy and momentum, and is thus devoid of grid heating, but at the computational cost of scaling as the product of the number of particles and the number of spectral grid points, or wave vectors. The algorithm is derived from a discrete action principle which ensures that it is symplectic, or that it conserves phase space volume. We present some simple numerical examples for a collision free plasma, including the classic counter stream instability, and compare the symplectic algorithm to results of standard PIC solutions.

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