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A Conservative Multiscale 2D3V Curvilinear Phase-Space Moving Grid Algorithm for the Vlasov Equation with Applications to High Energy Density Systems[1] WILLIAM TAITANO, Los Alamos National Laboratory — In high energy density systems such as inertial confinement and magnetic liner fusion experiments, the relevant length and velocity scales span many orders of magnitude from the initially preheated fuel to compressed burning plasmas, making kinetic simulations challenging. To deal with these challenges, we have developed a conservative 2D3V moving phase-space grid strategy for the hybrid Vlasov ion and fluid electron system. The configuration space grid is evolved to track macroscopic features such as shocks while the velocity space grid is expanded/contracted with the heating/cooling of the plasma. We transform the equations in terms of logical coordinates in phase-space with corresponding inertial terms (i.e., mesh motion terms). In configuration space, these inertial terms are cast in a particular form that lends the discretized equations to automatically satisfy the geometric conservation law. In velocity space, the grid is normalized and evolved in terms of the thermal speed and the resulting inertial terms are discretized using the technique of discrete nonlinear constraints to satisfy the underlying conservation symmetries. We will demonstrate the new algorithm's capability on several challenging benchmark implosion problems in cylindrical and spherical coordinates.

[1]Los Alamos National Laboratory LDRD Office Early Career Research

William Taitano
Los Alamos National Laboratory

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