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A Multifluid Numerical Algorithm for Interpenetrating Plasma Dynamics[1] DEBOJYOTI GHOSH, CHRISTOS KAVOUKLIS, RICHARD BERGER, THOMAS CHAPMAN, JEFFREY HITTINGER, Lawrence Livermore Natl Lab — Interpenetrating plasmas occur in situations including inertial confinement fusion experiments, where plasmas ablate off the hohlraum and capsule surfaces and interact with each other, and in high-energy density physics experiments that involve the collision of plasma streams ablating off discs irradiated by laser beams. Single-fluid, multi-species hydrodynamic models are not well-suited to study this interaction because they cannot support more than a single fluid velocity; this results in unphysical solutions. Though kinetic models yield accurate solutions for multi-fluid interactions, they are prohibitively expensive for at-scale three-dimensional (3D) simulations. In this study, we propose a multifluid approach where the compressible fluid equations are solved for each ion species and the electrons. Electrostatic forces and inter-species friction and thermal equilibration couple the species. A high-order finite-volume algorithm with explicit time integration is used to solve on a 3D Cartesian domain, and a high-order Poisson solver is used to compute the electrostatic potential. We present preliminary results for the interpenetration of two plasma streams in vacuum and in the presence of a gas fill.

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