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Hydrodynamic Simulation of Counterstreaming Plasmas with a Multifluid Model[1] DEBOJYOTI GHOSH, RICHARD BERGER, THOMAS CHAPMAN, ANDRIS DIMITS, Lawrence Livermore National Laboratory, JEFFREY BANKS, Rensselaer Polytechnic Institute — The dynamics of counterstreaming plasmas is important in many applications such as astrophysical flows and high energy-density physics (HEDP) foil experiments. Conventional hydrodynamic codes, including multispecies codes, fail to capture this phenomenon due to a single velocity field representing all plasma species or streams. In this talk, we present a multifluid model that solves a distinct set of Euler equations for each fluid, thus representing each plasma stream with its own velocity field. Inter-fluid interactions comprise electrostatic forces, friction, and thermal equilibration. An inertialess electron model is used to avoid the numerical difficulties of resolving electron dynamics. The governing equations are discretized in space using the conservative finite-difference formulation and the 5th order MPWENO scheme. High-order, conservative, multi-stage implicit-explicit time integrators are used to evolve the solution in time, where the convective and acoustic time scales are integrated explicitly, while the temporally-stiff friction and thermal equilibration terms are integrated implicitly. We present plasma interpenetration simulations that are representative of HEDP foil experiments.

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