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Hybrid simulations of weakly collisional plasmas QIAN XIA, BRIAN REVILLE, Queen's University at Belfast, MICHAIL TZOUFRAS, Department of Physics and Astronomy, UCLA — Laser produced plasma experiments can be exploited to investigate phenomena of astrophysical relevance. The high densities and velocities that can be generated in the laboratory provide ideal conditions to investigate weakly collisional or collisionless plasma shock physics. In addition, the high temperatures permit magnetic and kinetic Reynolds numbers that are difficult to achieve in other plasma experiments, opening the possibility to study plasma dynamo. Many of these experiments are based on a classic plasma physics problem, namely the interpenetration of two plasma flows. To investigate this phenomenon, we are constructing a novel multi-dimensional hybrid numerical scheme, that solves the ion distribution kinetically via a Vlasov-Fokker-Planck equation, with electrons providing a charge neutralizing fluid. This allows us to follow the evolution on hydrodynamic timescales, while permitting inclusion ofcollisionlesseffects on small scales. It also could be used to study the increasing collisional effects due to the stiff gradient and weakly anisotropic velocity distribution. We present some preliminary validation tests for the code, demonstrating its ability to accurately model key processes that are relevant to laboratory and astrophysical plasmas.

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