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Applications of the Two-Fluid Plasma Model to Simulate Instabilities with and without Background Magnetic Fields BHUVANA SRINIVASAN, GIAN LUCA DELZANNO, XIANZHU TANG, Los Alamos National Laboratory, URI SHUMLAK, University of Washington — The two-fluid plasma model consists of the 5-moment equations to describe the ion and electron fluids. This provides a continuity, momentum, and energy equation for each of the ion and electron fluids. Maxwell's equations are used to evolve the electric and magnetic fields. Washington Approximate Riemann Plasma (WARPX) code is a finite element code based on the two-fluid plasma model which uses the Runge-Kutta discontinuous Galerkin method. The two-fluid plasma model is applied to simulate instabilities with and without background magnetic fields. A Z-pinch is simulated to study the development of two-fluid small-scale instabilities with $k\rho_i \sim 1$. The small-scale instabilities lead to electromagnetic fluctuations and drift-turbulence. In the absence of background magnetic fields, the development of a Rayleigh-Taylor instability is simulated in a stratified plasma which has potential applications in inertial confinement configurations and astrophysics. The effect of two-fluid physics on the nonlinear evolution of the Rayleigh-Taylor instability is explored.

Bhuvana Srinivasan
Los Alamos National Laboratory

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