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Fully-kinetic simulations of the Rayleigh-Taylor instability in high-energy-density plasmas[1] E. PAULO ALVES, SLAC National Accelerator Laboratory, Menlo Park, USA, WARREN B. MORI, Department of Physics and Astronomy, UCLA, Los Angeles, USA, FREDERICO FIUZA, SLAC National Accelerator Laboratory, Menlo Park, USA — The Rayleigh-Taylor instability (RTI) in high-energy-density (HED) plasmas is a central problem in a wide range of scenarios. It dictates, for instance, the dynamics of supernovae in astrophysical plasmas, and is also recognized as a critical challenge to achieving ignition in inertial confinement fusion. In some of these conditions the Larmor radius or Coulomb mean free path (m.f.p.) is finite, allowing kinetic effects to become important, and it is not fully clear how the development of the RTI deviates from standard hydrodynamic behavior. In order to obtain an accurate description of the RTI in these HED conditions it is essential to capture the self-consistent interplay between collisional and collisionless plasma processes, and the role of self-generated electric and magnetic fields. We have explored the dynamics of the RTI in HED plasma conditions using first-principles particle-in-cell simulations combined with Monte Carlo binary collisions. Our simulations capture the role of kinetic diffusion as well as the self-generated electric (e.g. space-charge) and magnetic (e.g. Biermann battery) fields on the growth rate and nonlinear evolution of the RTI for different plasma conditions. We will discuss how different collisional m.f.p. relative to the collisionless plasma skin depth affect the RTI development.

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