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Multi-scale modeling of relativistic shear flow interface EDISON LIANG, Rice University — Recent large scale 2D and 3D Particle-in-Cell (PIC) simulations have demonstrated that in unmagnetized relativistic electron-ion shear flows, strong transverse d.c. magnetic fields are created by self-generated currents on opposite sides of the shear interface due to the electron counter-current instability. Instead of dissipating the shear flow energy via turbulence and mixing as in MHD simulations, the kinetic results show that a relativistic shear flow stabilizes itself via the formation of a robust ion vacuum gap supported by the self-generated magnetic field, which effectively separates the opposing ion flows with no mixing. This strongly magnetized shear interface appears stable and lasts many tens of light crossing times of the simulation box, while the electrons are energized to reach the ion kinetic energy, with approximately 10 percent of the total energy in electromagnetic fields. Here we report our recent attempts to recreate the essential features of the PIC simulation results using a 2-fluid non-ideal MHD approximation. The goal is to perform fluid-scale global simulations of shear interfaces and apply them to macroscopic astrophysical systems such as relativistic jets passing through ambient matter.

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