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Relativistic Modeling Capabilities in PERSEUS Extended-MHD Simulation Code for HED Plasmas[1] NATHANIEL HAMLIN, CHARLES SEYLER, Cornell University — We discuss the incorporation of relativistic modeling capabilities into the PERSEUS extended MHD simulation code for high-energy-density (HED) plasmas, and present the latest simulation results. The use of fully relativistic equations enables the model to remain self-consistent in simulations of such relativistic phenomena as hybrid X-pinches and laser-plasma interactions. We have overcome a major challenge of a relativistic fluid implementation, namely the recovery of primitive variables (density, velocity, pressure) from conserved quantities at each time step of a simulation. Our code recovers non-relativistic results along with important features of published Particle-In-Cell simulation results for a laser penetrating a super-critical hydrogen gas with Fast Ignition applications. In particular, we recover the penetration of magnetized relativistic electron jets ahead of the laser. Our code also reveals new physics in the modeling of a laser incident on a thin foil.

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