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Laser-Plasma Modeling Using PERSEUS Extended-MHD Simulation Code for HED Plasmas[1] NATHANIEL HAMLIN, CHARLES SEYLER, Cornell University — We discuss the use of the PERSEUS extended-MHD simulation code for high-energy-density (HED) plasmas in modeling the influence of Hall and electron inertial physics on laser-plasma interactions. By formulating the extended-MHD equations as a relaxation system in which the current is semi-implicitly time-advanced using the Generalized Ohm's Law, PERSEUS enables modeling of extended-MHD phenomena (Hall and electron inertial physics) without the need to resolve the smallest electron time scales, which would otherwise be computationally prohibitive in HED plasma simulations. We first consider a laser-produced plasma plume pinched by an applied magnetic field parallel to the laser axis in axisymmetric cylindrical geometry, forming a conical shock structure and a jet above the flow convergence. The Hall term produces low-density outer plasma, a helical field structure, flow rotation, and field-aligned current, rendering the shock structure dispersive. We then model a laser-foil interaction by explicitly driving the oscillating laser fields, and examine the essential physics governing the interaction.

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Nathaniel Hamlin
Cornell University

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