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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 laser-plasma interactions in relativistic and nonrelativistic regimes. By formulating the fluid equations as a relaxation system in which the current is semi-implicitly time-advanced using the Generalized Ohm's Law, PERSEUS enables modeling of two-fluid phenomena in dense plasmas without the need to resolve the smallest electron length and time scales. For relativistic and nonrelativistic laser-target interactions, we have validated a cycle-averaged absorption (CAA) laser driver model against the direct approach of driving the electromagnetic fields. The CAA model refers to driving the radiation energy and flux rather than the fields, and using hyperbolic radiative transport, coupled to the plasma equations via energy source terms, to model absorption and propagation of the radiation. CAA has the advantage of not requiring adequate grid resolution of each laser wavelength, so that the system can span many wavelengths without requiring prohibitive CPU time. For several laser-target problems, we compare existing MHD results to extended-MHD results generated using PERSEUS with the CAA model, and examine effects arising from Hall physics.

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Nathaniel Hamlin
Cornell University

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