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Nonlinear transport velocity and evolution of intense short-pulse lasers in underdense plasma[1] CARL SCHROEDER, ERIC ESAREY, WIM LEEMANS, Lawrence Berkeley National Laboratory, BRADLEY SHADWICK, University of Nebraska, Lincoln — The nonlinear transport velocity of a relativistically-intense, short-pulse laser propagating in a cold underdense plasma is investigated. The transport velocity of the laser intensity in the plasma determines the phase velocity of a plasma wave driven by the short-pulse laser. Expressions for the plasma wave phase velocity dependence on the relativistic laser intensity are derived in the adiabatic and quasi-static regimes. The relativistic laser evolution (energy depletion, frequency shifting, and intensity steepening) is also examined. In a laser-plasma-based accelerator, the plasma wave phase velocity excited by the laser pulse determines the dephasing length of the plasma accelerating structure, and therefore the energy gain of the accelerated charged particle beam.

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