Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Nonlinear Laser Energy Depletion in Laser-Plasma Accelerators[1]

B.A. SHADWICK, Department of Physics and Astronomy, University of Nebraska – Lincoln, C.B. SCHROEDER, E. ESAREY, Lawrence Berkeley National Lab —

Energy depletion of intense, short-pulse lasers via excitation of plasma waves is investigated numerically and analytically.[2] The evolution of a resonant laser pulse proceeds in two phases. In the first phase, the pulse steepens, compresses, and frequency red-shifts as energy is deposited in the plasma. The second phase of evolution occurs after the pulse reaches a minimum length at which point the pulse rapidly lengthens, losing resonance with the plasma. Expressions for the rate of laser energy loss and rate of laser red-shifting are derived and are found to be in excellent agreement with the direct numerical solution of the laser field evolution coupled to the plasma response. Both processes are shown to have the same characteristic length-scale. Channel- guided Gaussian laser pulses, in two and three dimensions are modeled and are well-described by this theory.

[1]Supported by the US DoE

[2]B. A. Shadwick, C. B. Schroeder, and E. Esarey, "Nonlinear laser energy depletion in laser-plasma accelerators," Phys. Plasmas **16**, 056704 (2009).

B. A. Shadwick
UNL

Date submitted: 20 Jul 2009 Electronic form version 1.4