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Warm wavebreaking of laser-driven plasma waves[1] C.B. SCHROEDER, E. ESAREY, B.A. SHADWICK, W.P. LEEMANS, LOASIS Program, Lawrence Berkeley National Laboratory — We present a calculation of the maximum amplitude (wavebreaking field) of a nonlinear electron plasma wave, valid for nonrelativistic plasma temperatures and arbitrary wave phase velocities, that can be applied to plasma waves driven by short-pulse laser-plasma interactions. This is in contrast to previous calculations of the wavebreaking limit, which are not valid in the regime of present short-pulse laser-plasma interaction experiments. We analyze the nonlinear electron plasma waves excited by intense short-pulse lasers propagating in underdense plasmas using a warm, relativistic fluid model of a nonequilibrium, collisionless plasma. Properties of the nonlinear plasma wave, such as the plasma temperature evolution and nonlinear wavelength, as well as the laser intensity required to reach wavebreaking, are presented. The influence of the presence of an intense laser field on the wavebreaking amplitude is examined. The relation between the wavebreaking amplitude and particle trapping is discussed.

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Carl Schroeder
Lawrence Berkeley National Laboratory

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