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The Interaction of an Ultra-short Laser Pulse and Relativistic Electron Beam in a Corrugated Plasma Channel T.M. ANTONSEN, J.P. PALASTRO[1], IREAP, University of Maryland, L. DIVOL, Lawrence Livermore National Laboratory — Copropagation of a laser pulse and a relativistic electron beam in a corrugated plasma channel has been proposed for the direct laser acceleration of electrons [Palastro *et al.* Phys. Rev. E (2008)]. The corrugated plasma channel allows for the guiding of laser pulses composed of subluminal spatial harmonics. Phase matching between the electron beam and the spatial harmonics results in acceleration, but for high beam densities the pulse energy can be rapidly depleted. This depletion can result in interaction times shorter than the waveguide length limited time or pulse length dephasing time. We present an analytic model and self-consistent simulations of the electron beam-laser pulse interaction. A linear dispersion relation is derived. The effect of the electron beam on the pulse after the occurrence of axial bunching is examined. Injection of axially modulated electron beams is also explored. In particular, we find that a properly phased electron beam can transfer energy to the laser pulse as an inverse process to acceleration.

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