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Non-planar electron motion during direct laser acceleration by a linearly/circularly polarized laser pulse.[1] VLADIMIR KHUDIK, ALEXEY AREFIEV, XI ZHANG, GENNADY SHVETS, University of Texas at Austin — Direct Laser Acceleration (DLA) of electrons in plasma bubbles or ion channels is investigated in the general case of arbitrary polarization of laser pulse. When the laser pulse is linearly polarized, the laser electromagnetic field drives electron oscillations in the polarization plane, intuitively suggesting that the electron trajectory lies in the same plane. We show that strong modulations of the relativistic gamma-factor cause the free oscillations perpendicular to the plane of the driven motion to become unstable. As a consequence, out of plane displacements grow and the electron trajectory becomes strongly three-dimensional, even if it starts out planar during the early stage of the acceleration [1]. For a circularly polarized laser pulse, electron end up moving along a helical trajectory with slowly changing helix radius [2]. By deriving a set of dimensionless equations for paraxial ultra-relativistic electron motion, we have found an estimate for the maximum attainable electron energy for arbitrary laser and plasma parameters. [1] A. V. Arefiev et al, Phys. Plasmas 23, 023111 (2016); [2] V. Khudik et al, arXiv:1603.04757.

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