Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Laser wakefield acceleration using lasers with longitudinal and transverse frequency chirp V.B. PATHAK, GoLP/IPFN Instituto Superior Técnico (IST) Lisbon, Portugal, J. VIEIRA, GoLP/IPFN, Instituto Superior Técnico, Lisboa, Portugal, R.A. FONSECA, DCTI, ISCTE, Lisbon University Institute, Lisbon, Portugal, L.O. SILVA, GoLP/IPFN, Instituto Superior Técnico, Lisboa, Portugal — We develop an analytical model, supported by multi-dimensional particle-in-cell simulations with OSIRIS, to study the effect of longitudinal and transverse frequency chirp on the laser evolution in the laser wakefield accelerator. On one hand, the longitudinal chirp leads to asymmetric temporal laser profile, and on the other hand, the transverse chirp leads to pulse-front tilt with respect to the laser-propagation direction. In the weakly relativistic regime, positive (negative) longitudinal chirp compresses (stretches) the laser pulse, increasing (decreasing) the peak vector potential and wakefield amplitude. In the blowout regime, longitudinal chirp can relax the self-guiding conditions at the laser front. Consequently, a laser with longitudinal positive chirp leads to higher self-injection rate, and thus to higher self-trapped electrons in comparison to a negatively chirped laser. Tilted-front laser, due to the transverse chirp, excites asymmetric plasma waves, thus causing off-axis injection. Simulations show that the self-injected bunch propagate along the axis of the asymmetric wakefield. Thus, the transverse electron bunch dynamics can be controlled by the transverse frequency chirp.

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Date submitted: 21 Jul 2011 Electronic form version 1.4