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Laser guiding due to transverse frequency chirp and plasma inhomogeneity: Relevance to laser wakefield acceleration VISHWA BANDHU PATHAK, JORGE VIEIRA, GoLP/Instituto de Plasmas e Fusão Nuclear - Laboratório Associado, Instituto Superior Técnico, Lisbon, Portugal, RICARDO FONSECA, Departamento de Ciências e Tecnologias da Informação, Instituto Superior de Ciências do Trabalho e da Empresa, Lisbon, Portugal, LUIS SILVA, GoLP/Instituto de Plasmas e Fusão Nuclear - Laboratório Associado, Instituto Superior Técnico, Lisbon, Portugal — Multi-dimensional particle-in-cell (PIC) simulations using OSIRIS show that the transverse frequency chirp can induce pulse front tilt (PFT) in the laser as it propagates. The PFT leads to transverse inhomogeneity in the electron density at the laser front such that the laser drifts in the transverse direction followed by its wake and the injected/self-injected electron beam inside the blowout region. We further investigate the effect of the chirp and transverse plasma inhomogeneities (linear density gradient and parabolic plasma channel) on the transverse drift by developing an analytical model based on a variational principle approach. Theory and simulations predict a linear dependence of the frequency chirp on the transverse drift. In the presence of a linear density gradient the laser drifts towards the decreasing plasma density. We show that an appropriate transverse chirp can balance the drift, and can reduce/nullify the injected electron beam pointing angle. In extreme scenarios, dispersion effects due to transverse chirp can filament the laser generating multiple bubble in the same transverse plane.

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