11:00, 22-AUG-2019
G201-KPSI, Kyoto, JAPAN
The 67th KPSI Seminar, QST

Characterization of Ionization Injection in Gas Mixtures Irradiated by PW Laser Pulses

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Abstract

Effects of ionization injection in low and high Z gas mixtures for the laser wake field acceleration of electrons are analyzed with use of balance equations and original particle-in-cell simulations via tests of probe particle trajectories in real plasma fields and via direct simulations of charge loading during the ionization process. It is shown that electrons arising at the maximum of laser pulse field after optical ionization are trapped in the first bucket of a laser pulse wake. Electrons, which produced by optical field ionization at the front of laser pulse, propagates downwards; some of them are trapped in the second bucket, third bucket and so on. Efficiency of ionization injection is not high, few pC/mm, this injection becomes competitive to the wave breaking injection at lower plasma density and in a rather narrow range of laser pulse intensity.