Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Theory of the Plasma Bubble Deflection and Induced Electron Self-Injection Controlled by the Carrier-Envelope-Phase (CEP) of a short laser pulse TIANHONG WANG, JIHOON KIM, Cornell University, VLADIMIR KHUDIK, The University of Texas at Austin, GENNADY SHVETS, Cornell University — When an intense few-cycle laser pulse propagates in tenuous plasma, electrons are pushed asymmetrically in the polarization plane and forming behind a deflected/oscillating bubble. We present a quasi-static theory of electrons motion in a few-cycle pulse beyond the pondermotive approximation and show a quasi-static high-order correction force on the pondermotive force. This correction is carrier-envelope-phase dependent and has been implemented in the code: WAND-PIC [1]. Simulation results from WAND-PIC are compared with the full 3D particle-in-cell simulations and scaling of bubble deflection amplitude on laser parameters would be provided. We also present a Hamiltonian theory of electron self-injection in such a deflected/oscillating bubble. We derive the change of Hamiltonian of an electron caused by the periodic deflection and use the sufficient condition for the electron trapping [2] and give the threshold of injection as a function of deflection amplitude and CEP frequency. [1] WANDPIC Repository: https://github.com/tianhongg/WAND-PIC. [2] S. A. Yi, V. Khudik, S. Y. Kalmykov, and G. Shvets, Plasma Phys. Control. Fusion, vol. 53, 014012 (2010).

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Date submitted: 27 Jun 2020 Electronic form version 1.4