Abstract Submitted
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Two-stage acceleration of externally injected electrons in plasma bubble derived from the combination of DLA and LWFA. VLADIMIR KHUDIK, University of Texas at Austin, TIANHONG WANG, DANIEL VICUNA, Cornell University, XI ZHANG, University of Texas at Austin, GENNADY SHVETS, Cornell University — Simultaneous interactions of accelerated electrons directly with a laser pulse and with a laser wakefield are studied using a novel quasistatic 3D particle-in-cell code. Relativistic electrons externally injected into the plasma bubble's decelerating phase can gain significant energy through the direct laser acceleration (DLA) mechanism from the driving laser pulse [1-3], increasing the amplitude of betatron oscillations. With time, the resonant interaction condition is violated, leading to gradual dephasing between electrons and laser wave, and to eventual slipping of the electrons to the back of the plasma bubble. After that, the oscillating electrons experience the second stage of acceleration gaining energy only from the bubble wakefield. We analyze each stage of acceleration and show that electrons undergoing two stages emits much more X-ray radiation compared with those accelerated during one wakefield stage. This work was supported by DOE grant DESC0007889 and by AFOSR grant FA9550-16-1-0013. [1] X. Zhang, V. N. Khudik and G. Shvets, Phys. Rev. Lett. 114, 184801 (2015). [2] X. Zhang, V. N. Khudik, A. Pukhov and G. Shvets, Plasma Phys. Control. Fusion 58 034011 (2016). [3] V. N. Khudik, X. Zhang and G. Shvets, arXiv: 1610.0945 (2015).

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