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Electron self-injection due to a plasma density downramp and gas ionization in a plasma wakefield accelerator in the blowout regime S.A. YI, E.C. D'AVIGNON, V. KHUDIK, G. SHVETS, The University of Texas at Austin — We study self-injection into a plasma wakefield accelerator (PWFA) in the blowout regime analytically and through particle-in-cell (PIC) simulations. We propose a new injection mechanism into a plasma wakefield accelerator, where growth of the blowout region is enabled through a slow decrease in background plasma density along the direction of propagation. Deepening of the potential well due to this growth causes a reduction of electron Hamiltonian in the co-moving frame. This reduction depends on the shape of the blowout region, its growth rate, and impact parameter of the electron. When the reduction is greater than mc^2 [1,2], the electron becomes trapped inside the bubble. We demonstrate this effect using analytic expressions for the bubble potentials [3], and estimate plasma density gradients, and beam charge and size required for injection. We also apply the injection criterion to electron trapping through gas ionization. This work is supported by the US DOE grants DE-FG02-04ER41321 and DE-FG02-07ER54945. [1] S. Kalmykov, S.A. Yi, V. Khudik, and G. Shvets, *Phys. Rev. Lett.* **103**, 135004 (2009). [2] S.A. Yi, V. Khudik, S. Kalmykov, and G. Shvets, *Plasma Phys. Contr. Fus.*, in press. [3] W. Lu, C. Huang, M. Zhou, M. Tzoufras et al., *Phys. Plasmas* **13**, 056709 (2006).

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