Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Numerical Study of Self and Controlled Injection in 3D and 2D Wakefield Accelerators ASHER DAVIDSON, MING ZENG, WEI LU, CHANG JOSHI, UCLA, LUIS SILVA, JOANA MARTINS, RICARDO FONSECA, IST, WARREN MORI, UCLA — In plasma based accelerators (LWFA and PWFA), the methods of injecting high quality electron bunches into the accelerating wakefield is of utmost importance for various applications. We investigate the use of a two-stage ionization injected LWFA to achieve high quality monoenergetic beams through the use of 3D PIC simulations. The first stage constitutes the Injection Regime, which is 99.5% He and 0.5% N, while the second stage constitutes the Acceleration Regime, which is entirely composed of He. Two of the simulations model the parameters of the LWFA experiments for the LLNL Callisto laser, at laser powers of 90 and 100TW. energies as high as 660MeV were observed in the 90TW simulation, and those as high as 1.07MeV were observed in the 100TW simulation. The affect of the matching condition of the spot size in this LWFA is discussed. A third simulation at a much higher energy pulse (500TW) is being conducted, for further research. In addition, we investigate the use of higher order gaussean modes in LWFA as an alternative method to self-inject electrons in a pre-ionized plasma.

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Date submitted: 18 Jul 2012 Electronic form version 1.4