Three-Dimensional Study of Laser Injection of Electrons into Plasma Wakefields*, P.B. LEE, C.B. SCHROEDER, B.A. SHADWICK, J.S. WURTELE, University of California Berkeley; W.P. LEEMANS, LBNL; E. ESAREY, NRL - Optical injection schemes can eliminate the need for conventional injectors, based on RF technology, in plasma-based accelerators. An optical injection scheme for a laser wakefield accelerator [1] is studied with a three dimensional particle transport code and with three dimensional plasma wakefields. The scheme employs two counter propagating laser pulses which beat,thereby producing a pondermotive wave. The beating dephases the background electrons with respect to the electron plasma wakefield, allowing the electrons to be trapped and accelerated. Numerical simulations of test particles, representing a full six-dimensional phase space with prescribed plasma fields, are used to study both the transverse and longitudinal dynamics of the plasma electrons. The quality of the resulting electron bunches is compared to other state-of-the-art sources such as rf photocathodes. Space charge effects are also discussed.

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[1] E. Esarey, R.F. Hubbard, W.P. Leemans, A. Ting and P. Sprangle, PRL 79, 2682 (1997).