Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Numerical study of Direct Laser Acceleration in the Bubble Regime[1] XI ZHANG, VLADIMIR KHUDIK, Department of Physics, The University of Texas at Austin, SUNGHWAN YI, Los Alamos National Laboratory, GENNADY SHVETS, Department of Physics, The University of Texas at Austin — Direct Laser Acceleration (DLA) is an acceleration mechanism [1] that combines the traditional plasma wakefield acceleration inside the plasma bubble with direct energy gain from the laser pulse. Recent experiments [2] demonstrated an indirect signature of the DLA: highly efficient gamma-rays from resonantly excited betatron oscillations of accelerated electrons inside the plasma bubble. We will discuss our numerical modeling of the DLA (Direct Laser Acceleration) using the 3D VLPL code [3]. It is demonstrated that plasma electrons are self-injected into the expanding plasma bubble [4] and eventually catch up with the bubble-generating laser pulse. The energy is then directly transferred from the laser pulse to the electrons provided that the Doppler-shifted laser frequency coincides with that of the betatron oscillations. A simple analytic theory of the DLA is developed and the prospects for achieving high-energy gammas at the Texas Petawatt laser are discussed.

[1] A. Pukhov et al., Phys. Plasmas. 6, 2847 (1999).
[2] S. Cipiccia et al., Nature Phys. 7, 867-871 (2011).
[3] A. Pukhov, J. Plasma Phys. 61, 425-433 (1999).
[4] S. Kalmykov, S. A. Yi, V. Khudik, and G. Shvets, Phys. Rev. Lett., 135004 (2009).

[1] US DOE grants DE-FG02-12ER41794

Xi Zhang
Department of Physics, The University of Texas at Austin

Date submitted: 12 Jul 2013 Electronic form version 1.4