Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Effects of dimensionality and laser polarization on kinetic simulations of laser-ion acceleration in the transparency regime[1] DAVID STARK, LIN YIN, BRIAN ALBRIGHT, FAN GUO, Los Alamos National Laboratory — The often cost-prohibitive nature of three-dimensional (3D) kinetic simulations of laser-plasma interactions has resulted in heavy use of two-dimensional (2D) simulations to extract physics. However, depending on whether the polarization is modeled as 2D-S or 2D-P (laser polarization in and out of the simulation plane, respectively), different results arise. In laser-ion acceleration in the transparency regime, VPIC particle-in-cell simulations show that 2D-S and 2D-P capture different physics that appears in 3D simulations. The electron momentum distribution is virtually two-dimensional in 2D-P, unlike the more isotropic distributions in 2D-S and 3D, leading to greater heating in the simulation plane. As a result, target expansion time scales and density thresholds for the onset of relativistic transparency differ dramatically between 2D-S and 2D-P [1]. The artificial electron heating in 2D-P exaggerates the effectiveness of target-normal sheath acceleration (TNSA) into its dominant acceleration mechanism, whereas 2D-S and 3D both have populations accelerated preferentially during transparency to higher energies than those of TNSA. [1] D. J. Stark, L. Yin, B. J. Albright, and F. Guo. Phys. Plasmas 24, 053103 (2017).

[1]Funded by the LANL Directed Research and Development Program.

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Date submitted: 13 Jul 2017 Electronic form version 1.4