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Effects of dimensionality on computer simulations of laser-ion acceleration: When are three-dimensional simulations needed?[1] L. YIN, D. J. STARK, B. J. ALBRIGHT, Los Alamos National Laboratory — Laser-ion acceleration via relativistic induced transparency provides an effective means to accelerate ions to tens of MeV/nucleon over distances of 10s of μm. These ion sources may enable a host of applications, from fast ignition and x-rays sources to medical treatments. Understanding whether two-dimensional (2D) PIC simulations can capture the relevant 3D physics is important to the development of a predictive capability for short-pulse laser-ion acceleration and for economical design studies for applications of these accelerators. In this work, PIC simulations are performed in 3D and in 2D where the direction of the laser polarization is in the simulation plane (2D-P) and out-of-plane (2D-S). Our studies indicate modeling sensitivity to dimensionality and laser polarization. Differences arise in energy partition, electron heating, ion peak energy, and ion spectral shape. 2D-P simulations are found to over-predict electron heating and ion peak energy. The origin of these differences and the extent to which 2D simulations may capture the key acceleration dynamics will be discussed.

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