Abstract Submitted
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High-performance modeling of plasma-based acceleration and laser-plasma interactions.[1] JEAN-LUC VAY, GUILLAUME BLACLARD, Lawrence Berkeley National Laboratory, BRENDAN GODFREY, University of Maryland/Lawrence Berkeley National Laboratory, MANUEL KIRCHEN, University of Hamburg, PATRICK LEE, University of Paris-Saclay, REMI LEHE, MATHIEU LOBET, Lawrence Berkeley National Laboratory, HENRI VINCENTI, Commissariat lEnergie Atomique/Lawrence Berkeley National Laboratory — Large-scale numerical simulations are essential to the design of plasma-based accelerators and laser-plasma interations for ultra-high intensity (UHI) physics.The electromagnetic Particle-In-Cell (PIC) approach is the method of choice for self-consistent simulations, as it is based on first principles, and captures all kinetic effects, and also scale favorably to many cores on supercomputers. The standard PIC algorithm relies on second-order finite-difference discretization of the Maxwell and Newton-Lorentz equations. We present here novel formulations, based on very high-order pseudo-spectral Maxwell solvers, which enable near-total elimination of the numerical Cherenkov instability and increased accuracy over the standard PIC method for standard laboratory frame and Lorentz boosted frame simulations. We also present the latest implementations in the PIC modules Warp-PICSAR and FBPIC on the Intel Xeon Phi and GPU architectures. Examples of applications will be given on the simulation of laser-plasma accelerators and high-harmonic generation with plasma mirrors.

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