Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Accurately pushing relativistic particles in strong field[1] FEI LI, Univerisity of California Los Angeles, VIKTOR K. DECYK, KYLE G. MILLER, ADAM TABLEMAN, FRANK S. TSUNG, University of California, Los Angeles, MARIJA VRANIC, RICARDO A. FONSECA, Instituto Superior Tcnico, Lisboa, Portugal, WARREN B. MORI, University of California, Los Angeles — Next-generation high-power laser with intensities exceeding 10^{23} W/cm^2 are enabling new physics regimes and applications. In strong EM fields, the motion of charged particles and their spin is effected by radiation reaction (RR). Standard PIC codes using operator-splitting methods to advance the particle 6D phase space have been shown to fail in the strong field regime. In addition, some problems require tracking the particle spin which means that the phase space expands to nine-dimensional now. Therefore, numerical algorithms that enable high-fidelity modeling of 9D phase space in strong fields are required. We present a new particle pusher based on the analytical solutions to the equation of motion, together with the semi-classical form of RR in Landau-Lifshitz, and Bargmann-Michel-Telegdi equation for the evolution of the spin. The analytical solutions are obtained by only assuming a locally uniform and constant field during a time step. Owing to the analytical integration of particle trajectory and spin orbit, the constraint on the time step can be greatly reduced. We present examples of single-particle tracking and full PIC simulations to show the proposed particle pusher can greatly improve the accuracy of particle trajectory in 9D phase space for given fields.

[1]This work was supported by DOE, SciDAC, LLNL and NSF.

Fei Li
Univerisity of California Los Angeles

Date submitted: 05 Nov 2020 Electronic form version 1.4