Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Numerical heating in Particle-In-Cell simulations with Monte Carlo binary collisions[1] E PAULO ALVES, SLAC National Accelerator Laboratory, Menlo Park, CA, USA, WARREN MORI, UCLA, Department of Physics and Astronomy, Los Angeles, CA, USA, FREDERICO FIUZA, SLAC National Accelerator Laboratory, Menlo Park, CA, USA — The binary Monte Carlo collision (BMCC) algorithm is a robust and popular method to include Coulomb collision effects in Particle-in-Cell (PIC) simulations of plasmas. While a number of works have focused on extending the validity of the model to different physical regimes of temperature and density, little attention has been given to the fundamental coupling between PIC and BMCC algorithms. Here, we show that the coupling between PIC and BMCC algorithms can give rise to (nonphysical) numerical heating of the system, that can be far greater than that observed when these algorithms operate independently. This deleterious numerical heating effect can significantly impact the evolution of the simulated system particularly for long simulation times. In this work, we describe the source of this numerical heating, and derive scaling laws for the numerical heating rates based on the numerical parameters of PIC-BMCC simulations. We compare our theoretical scalings with PIC-BMCC numerical experiments, and discuss strategies to minimize this parasitic effect.

[1]This work is supported by DOE FES under FWP 100237 and 100182.

E Paulo Alves
SLAC National Accelerator Laboratory, Menlo Park, CA, USA

Date submitted: 14 Jul 2017 Electronic form version 1.4