Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Variational Formulation of Particle Algorithms for Kinetic E&M Plasma Simulations; A High Fidelity Approach[1] ALEXANDER STAMM, BRADLEY SHADWICK, University of Nebraska-Lincoln — The recent variational technique [1-4] for rigorously deriving discrete, self-consistent equations for electromagnetic particle codes has been further developed in several coordinate systems. The primary advantage of the Lagrangian formulation is the connection between symmetries of the system and conservation laws, which in the present case resolves the grid-heating issue. However, the approach also simplifies coordinate transformations and enables the particle method to be formulated in moving window coordinates and a cylindrical geometry with a truncated Fourier decomposition in angle. For some laser-plasma interaction scenarios, these lead to significant computational savings as compared to the traditional lab frame. New time advance integrators were developed in both the lab frame coordinate system and the moving window. A comparison of symplectic methods to more straightforward explicit and implicit methods allow us to make conclusions about the limits of phase-space fidelity in macro-particle methods.

[1] E. G. Evstatiev and B. A. Shadwick, J. Comput. Phys. 245, 376 (2013).
[2] B. A. Shadwick, A. B. Stamm, and E. G. Evstatiev, Phys. Plasmas 21, 055708 (2014).
[3] A. B. Stamm, B. A. Shadwick, and E. G. Evstatiev, IEEE Trans. Plasma Sci. 42, 1747 (2014).
[4] A. B. Stamm and B. A. Shadwick, AIP Conf. Proc. (Submitted).

[1]This work was supported by the DoE under grant DE-SC0008382.

Alexander Stamm
University of Nebraska-Lincoln

Date submitted: 24 Jul 2015 Electronic form version 1.4