Abstract Submitted
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Reduction of finite-grid heating in particle-in-cell simulation using interpolated symplectic time-integration[1] LUKE ADAMS, GREGORY WERNER, JOHN R CARY[2], University of Colorado — Symplectic integration methods are being investigated to determine if sufficiently smooth force interpolations can suppress the finite-grid instability and diffusive energy growth. The finite-grid instability arises in particle-in-cell (PIC) simulations when the Debye length is not resolved by the grid, while diffusive energy growth can occur even once the Debye length is resolved. Both numerical effects cause unphysical heating of the plasma over time. Sufficiently smooth symplectic methods preserve phase space structure, and explicit symplectic methods with smooth force interpolations have been found to have superior energy conservation properties than other explicit symplectic integrators [1,2]. Consequently, smooth symplectic algorithms may mitigate the growth of the grid instability, and enable explicit time integration that allows the Debye length to be under-resolved without incurring the computational cost of an implicit method. The effects of grid resolution on the unphysical energy growth rate in electrostatic PIC simulations will be presented for both standard and smooth symplectic time-integrators. [1] JR Cary and I Doxas, J. Comput. Phys., 107 (1), 98-104. [2] I Doxas and JR Cary, Physics of Plasmas, 4 (7), 2508-2518.

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