

Abstract Submitted  
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**Grid-Free Particle Simulations for Electrostatic Plasmas<sup>1</sup>**

ROBERT KRASNY, BEN SONDAY<sup>2</sup>, LYUDMYLA BARANNYK, University of Michigan, ANDREW CHRISTLIEB, Michigan State University — A novel grid-free particle method for electrostatic plasma simulations is presented. The method employs numerical techniques from vortex methods in computational fluid dynamics including: (1) a multipole treecode algorithm to reduce the cost of evaluating the electric field induced by a set of point charges, (2) kernel smoothing to handle the singularity in the Coulomb potential, and (3) adaptive particle insertion to maintain resolution of the charge distribution in phase space using the Lagrangian flow map. The proposed method is intended as an alternative to particle-in-cell (PIC) methods. Simulations are presented for the instability of cold and warm collisionless electron beams in a neutralizing background of fixed ions.

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