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Arbitrarily high-order semi-Lagrangian methods for the kinetic description of plasmas YAMAN GÜÇLÜ, ANDREW J. CHRISTLIEB, Michigan State University, WILLIAM N.G. HITCHON, University of Wisconsin-Madison —
In the kinetic description of low-temperature plasmas, deterministic mesh-based solvers excel for their capacity to resolve small electric fields in quasi-neutral regions, and to compute accurate ionization rates involving a small population of high energy electrons. Among these, semi-Lagrangian methods like the Convected Scheme (CS) are preferred, because of their ability to take large time-steps (no CFL limit) and their low numerical diffusion. The CS is mass conservative and positivity preserving, and was recently extended to arbitrarily high order of accuracy in phase-space [1,2]: the new scheme was applied to the Vlasov-Poisson system on periodic domains, and validated against classical 1D-1V test-cases. Here we introduce the effect of scattering collisions and wall recombination, include kinetic ions, and extend the model to 1D-2V. We investigate the formation of a planar presheath, and compare the new results to low-order simulations.

[1] Y. Güçlü, A.J. Christlieb and W.N.G. Hitchon, "High order semi-Lagrangian schemes and operator splitting for the Boltzmann equation." ICERM, June 3-7 2013. https://icerm.brown.edu/tw13-1-isbeaa.
[2] —, "Arbitrarily high-order Convected Scheme solution of the Vlasov-Poisson system." Submitted to J. Comput. Phys., July 2013.

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