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An Implicit Solver for the Vlasov–Poison Equation[1] MICHAEL CARRIÉ, B.A. SHADWICK, Department of Physics and Astronomy, University of Nebraska - Lincoln, Lincoln NE — Due to the numerical difficulties associated with the convective term in the Vlasov-equation and the robustness and ease of implementation of PIC codes, phase-space grid methods have received little attention for describing laser-plasma interactions and has been limited to low-dimensional problems. However, this method is theoretically noiseless and can be of great interest in applications where noise is of crucial importance and fine grained phase-space resolution is needed (for example, when studying particle trapping). In the scope of electron acceleration in under-dense plasmas over a long distance (cm to m), we present the development of an implicit 1D1V Vlasov solver using a phase-space grid method. Benchmarking tests revealed surprisingly good results; all invariants are very well conserved with a relative error up to 10^{-5}. However, as filaments scale down to the grid resolution, oscillations are introduced in the solution and negative values for the distribution function appear. Nevertheless, their contributions to the macroscopic values (electric field, density, Vlasov invariants) are negligible. We present a number to standard test cases to illustrate the potential of this approach.

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