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Solving the Vlasov-Poisson Equation and Preserving the Positivity: Comparisons between the Operator Splitting and Flux Limiting Method[1] MICHAEL CARRIE, BRADLEY SHADWICK, Department of Physics and Astronomy, University of Nebraska-Lincoln — When solving the Vlasov-Poisson equation on a phase-space grid, one has to deal with preserving positivity of the distribution. Filamentation, a consequence of the entropy conserving property of the Vlasov equation, ultimately leads to gradients of the distribution function at the grid size level. To overcome this issue, numerical methods using flux limiters to enforce the positivity can be employed. The time-implicit numerical algorithm we developed is no exception to this positivity preserving issue. To assess if in the context of Vlasov-Poisson equation these negative values are of importance on the system dynamics, we present two versions of the algorithm, one based on the operator splitting method and one using a positivity preserving method to solve the unsplit system. It is shown numerically that the flux limiter method is causing more damaged in terms of Casimir invariants and phase-space volume rearrangements compared to the operator splitting scheme even with negative values. Moreover, the operator splitting method is faster, more efficient, and easier to implement compared to the flux limiting method which requires the use of iterative solvers (Newton-Krylov method for instance) for highly nonlinear (if and else statements), nonsymmetric, large systems.

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