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Conservative high order semi-Lagrangian method for the Vlasov Equation[1] JING-MEI QIU, Colorado School of Mines, ANDREW CHRISTLIEB, Michigan State University — We propose to solve Vlasov equation by a high order grid-based Eulerian approach. We design a class of conservative semi-Lagarangian numerical schemes that evolve point values, instead of integrated mass, for solving Vlasov equation with Strang splitting. Specifically, the proposed scheme uses Strang splitting to treat advection terms in different directions seperately; uses high order WENO (stands for weighted essentially non-oscillatory) reconstruction in each direction; and uses a conservative semi-Lagrangian scheme to update the point values of numerical solution. While the third, fifth, seventh and ninth order reconstructions are presented, the resulting scheme can be extended to arbitrary high order. As it is well known that WENO reconstructions have the advantages of being able to achieve high order accuracy in smooth part of the solution, while being able to capture sharp interface without oscillations. In our proposed scheme, we take those advantages. Moreover, the CFL time step restriction of regular finite difference or finite volume WENO scheme is removed, allowing cheaper and more flexible numerical realization. The quality of proposed methods are demonstrated through numerical experiments on basic test problems and on classical plasma simulation, such as Landau damping and two stream instability. Our numerical results strongly suggest the usage of high order methods in space.

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