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Energy-Conserving Semi-Lagrangian Discontinuous Galerkin Schemes for Vlasov-Poisson Systems[1] JAMES ROSSMANITH, Iowa State University — In many laboratory settings a common approach is to model the plasma via kinetic equations (i.e., some form of the Boltzmann equation). In this description the plasma is represented through a probability density function (PDF) that self-interacts through electromagnetic forces. Kinetic models are valid over most of the spatial and temporal scales that are of physical relevance in many application problem; however, they are computationally expensive due to the high-dimensionality of phase space and the disparate length and time scales that they resolve. In this work we describe efforts to develop high-order accurate numerical methods for collisionless plasma. In this setting the canonical model is the Vlasov-Poisson system. After briefly reviewing key properties of the Vlasov-Poisson system, we describe a class of numerical methods for solving Vlasov-Poisson based on coupling high-order discontinuous Galerkin finite element methods with semi-Lagrangian time-stepping. We show how to modify such numerical schemes to maintain important physical properties such as charge, mass, and energy conservation, as well positivity of the probability density function. The resulting numerical method is tested on several numerical examples.

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