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Fourth-Order Continuum Methods for Simulating Plasma Kinetics in Phase Space[1] G.V. VOGMAN, University of California, Berkeley, P. COLELLA, Lawrence Berkeley National Lab — Continuum methods for solving the Maxwell-Boltzmann equation system offer a high-fidelity means of simulating plasma kinetics. These methods are advantageous because they can be cast in conservation-law form, are not susceptible to sampling noise, and can be implemented using high-order numerical methods. The continuum approach evolves a distribution function in position-velocity phase space by numerically solving a hyperbolic advection equation in up to six dimensions. A fourth-order accurate method has been developed to solve the continuum kinetic Vlasov-Poisson system in one spatial and one velocity dimension. This method has been extended to two velocity dimensions to model magnetized plasmas. Adaptive mesh refinement is implemented to reduce computational cost and to allow for the extension of the model into more dimensions. The governing equation is solved in its conservation-law form using a fourth order finite volume discretization. The model demonstrates conservation of mass, momentum, and energy, and is benchmarked against theoretical predictions for Landau damping, two-stream instability, and the Dory-Guest-Harris instability. Features of the continuum model as well as its extension into additional phase space dimensions are discussed.

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G. V. Vogman
University of California, Berkeley

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