Recent Results from the Gkeyll Discontinuous Galerkin Kinetic Code

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Gkeyll is a discontinuous Galerkin (DG) code under development for modeling the edge plasma in fusion devices and basic plasma experiments. Gkeyll implements high-order accurate, energy-conserving numerical algorithms for general Hamiltonian systems and for collision/diffusion terms. We will discuss details of the recent extension of the code dimensionality to 2x+2v, which has been tested with simulations of ETG-driven turbulence in a local 2D limit. We are working on extension of the code to the full 3x+2v of gyrokinetics. The inclusion of magnetic fluctuations with kinetic electrons has been challenging for many gyrokinetic algorithms in the past, requiring special treatment to reduce the Ampere cancellation problem. We have developed novel versions of DG that can handle gyrokinetic magnetic fluctuations in an efficient way, finding that it is important that the electrostatic potential ϕ be in a smoother subspace than the parallel vector potential $A_{||}$. As a test of the algorithm, we show that Gkeyll reproduces the Alfven wave dispersion relation even at very low $k_\perp \rho_s$ in an efficient way with just the normal time step needed to resolve the electron dynamics.

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