Abstract Submitted
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Properties of Discontinuous Galerkin Algorithms and Implications for Edge Gyrokinetics[1] G.W. HAMMETT, A. HAKIM, Princeton Plasma Physics Laboratory, E.L. SHI, I.G. ABEL, T. STOLTZFUS-DUECK, Princeton University — The continuum gyrokinetic code Gkeyll uses Discontinuous Galerkin (DG) algorithms, which have a lot of flexibility in the choice of basis functions and inner product norm that can be useful in designing algorithms for particular problems. Rather than use regular polynomial basis functions, we consider here Maxwellian-weighted basis functions (which have similarities to Gaussian radial basis functions). The standard Galerkin approach loses particle and energy conservation, but this can be restored with a particular weight for the inner product (this is equivalent to a Petrov-Galerkin method). This allows a full-F code to have some benefits similar to the Gaussian quadrature used in gyrokinetic δf codes to integrate Gaussians times some polynomials exactly. In tests of Gkeyll for electromagnetic fluctuations, we found it is important to use consistent basis functions where the potential is in a higher-order continuity subspace of the space for the vector potential $A_{||}$. A regular projection method to this subspace is a non-local operation, while we show a self-adjoint averaging operator that can preserve locality and energy conservation. This does not introduce damping, but like gyro-averaging involves only the reactive part of the dynamics.

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