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Features of Discontinuous Galerkin Algorithms in Gkeyll, and Exponentially-Weighted Basis Functions[1] G. W. HAMMETT, A. HAKIM, Princeton Plasma Physics Laboratory, E.L. SHI, Princeton University — There are various versions of Discontinuous Galerkin (DG) algorithms that have interesting features that could help with challenging problems of higher-dimensional kinetic problems (such as edge turbulence in tokamaks and stellarators). We are developing the gyrokinetic code Gkeyll based on DG methods. Higher-order methods do more FLOPS to extract more information per byte, thus reducing memory and communication costs (which are a bottleneck for exascale computing). The inner product norm can be chosen to preserve energy conservation with non-polynomial basis functions (such as Maxwellian-weighted bases), which alternatively can be viewed as a Petrov-Galerkin method. This allows a full-F code to benefit from similar Gaussian quadrature employed in popular δf continuum gyrokinetic codes. We show some tests for a 1D Spitzer-Härm heat flux problem, which requires good resolution for the tail. For two velocity dimensions, this approach could lead to a factor of ~ 10 or more speedup.

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Gregory Hammett
Princeton Univ

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