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Spectral/Discontinuous Galerkin approach to fully kinetic simulations of magnetized plasmas GIAN LUCA DELZANNO, OLEKSANDR KOSHKAROV, Los Alamos National Laboratory, VADIM ROYTERSHTEYN, Space Science Institute, Boulder, CO, USA, GIANMARCO MANZINI, Los Alamos National Laboratory — We propose a new method for the solution of the Vlasov-Maxwell equations for magnetized plasmas. It is based on a spectral expansion of the velocity space with Asymmetrically-Weighted Hermite Polynomials (AWHP), together with the discontinuous-Galerkin (DG) approximation for the spatial coordinate. The spectral expansion allows significant reduction in the number of degrees of freedom required to represent velocity space, while still retaining kinetic effects. Moreover, the spectral expansion is isomorphic to the classical fluid-moment expansion, hence providing a fine control over the fluid to kinetic regime transition through the number of polynomials/moments used. The DG approximation guarantees high accuracy and the ability to handle complex geometries. At the same time, its high locality ensures parallel efficiency leading to optimal scalability, which is desirable for large scale kinetic simulations on modern HPC architectures. Here, we demonstrate the properties and capabilities of the Spectral Plasma Solver framework based on the Hermite-DG approximation (SPS-DG) on the classical example of decaying magnetized plasma turbulence, the Orszag-Tang vortex test. We further compare SPS-DG with fully kinetic standard tools, such as Particle-In-Cell codes.

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