Semi-Lagrange methods based on Cartesian Mesh for Plasma Turbulence

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In this talk, we present a new algorithm based on Cartesian mesh for solving Vlasov type equation. The advection part of Vlasov type equation is discretized by a semi-Lagrangian scheme, where a new WENO type Hermite interpolation is proposed.
The advantage is that on the one hand, this interpolation is 3rd order accurate for smooth solution, and on the other hand, it avoids numerical oscillations for discontinuous case. Moreover the interpolation has low computational connection, thus it is suitable for parallelization. We present a specific application to the 4D drift-kinetic model, which consists of a drift kinetic Vlasov equation and a quasi-neutrality equation. The quasi-neutrality equation is an elliptic equation with Dirichlet boundary condition. This equation is discretized with classical finite difference scheme, while the boundary condition is treated by an extrapolation technique, which permits to use arbitrary geometry boundary.