Geometric Particle-in-Cell Simulations of the Vlasov–Maxwell System in Curvilinear Coordinates

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Numerical schemes that preserve the structure of the kinetic equations can provide new insights into the long time behavior of fusion plasmas. An electromagnetic particle-in-cell solver for the Vlasov-Maxwell equations that preserves at the discrete level the non-canonical Hamiltonian structure of the Vlasov-Maxwell equations has been presented in [Kraus et al. 2017]. Whereas the original formulation has been obtained for Cartesian coordinates, in this talk, we will present how a coordinate transformation can be integrated into the semi-discrete Poisson structure. For the discretisation in time, we discuss several (semi-)implicit methods either based on an Hamiltonian splitting or a discrete gradient method combined with an antisymmetric splitting of the Poisson matrix and compare their conservation properties and computational efficiency.

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