

Toward global full-f electromagnetic gyrokinetic PIC simulations.

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The global gyrokinetic particle-in-cell code ORB5 [S. Jolliet et al., *Comp. Phys. Comm.*, 177, 409 (2007)] can simultaneously include electromagnetic perturbations, general ideal MHD axisymmetric equilibria, strong flows, heat and particle sources (preserving density, zonal and parallel flows), collisions and the ability to solve the full core plasma including the magnetic axis.

During the last two years, the ORB5 code was almost entirely refactored, with the main aim of porting and optimising the code on the newest emerging HPC architectures. In this work, we illustrate the new features and performances of the resulting code and focus on some of the numerical issues related to the porting of a particle-in-cell codes to heterogeneous GPU-equipped nodes, or multi- and many-core CPUs (e.g. Skylake, KNL). Moreover, we will discuss the first steps toward full-f global electromagnetic particle-in-cell simulations, where no information about the equilibrium distribution function is required, neither in the Vlasov equation, nor in the field equations.