PHARE : AMR hybrid Particle In Cell

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Résumé

Hybrid PIC codes models plasmas with a kinetic formalism for ions and fluid for the electrons. Neglecting electron kinetic scales is a priori an advantage for modeling larger domains and longer times than possible with fully kinetic codes.
However, the ubiquitous formation of sub-ion scale current sheets, that need to be well resolved to reach a correct macroscopic state, and the quadratic dispersion of Hall mediated waves, make large scale hybrid-PIC simulation extremely challenging. In practice, high resolution hybrid codes are used in domains marginally larger than those reached by fully kinetic codes, and large domains are modeled at the price of poor spatial resolutions not able to correctly handle kinetic processes.

A promising approach, so-caled adaptive mesh refinement (AMR), consists in adapting the mesh resolution spatially and dynamically to map the critical regions of the solution. This now mainstream method in fluid codes is still poorly used in kinetic particle codes.
The project PHARE aims at developing a Hybrid PIC code with AMR to fill the gap between sub-ion scales and global scales. We discuss the first results obtained with this code, made for the community to use, and future development such as the evolution multi-formalisms AMR hierarchies.

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