

# Convergence analysis of asymptotic preserving schemes for strongly magnetised plasmas

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**Mots-clés :** asymptotic preserving (AP) schemes, Vlasov–Poisson system, error estimates

We will provide a comprehensive convergence analysis of the asymptotic preserving implicit-explicit particle-in-cell (IMEX-PIC) methods introduced in [1] for the Vlasov–Poisson system with a homogeneous external magnetic field, which is strong, *i.e.*, of order  $\mathcal{O}(1/\varepsilon)$  with  $\varepsilon \ll 1$ . In this regime, classical error estimates blow up as the scaling parameter  $\varepsilon$  tends to zero. We will present, however, some  $\varepsilon$ -uniform error estimates which work for various regimes. Then, the extension of the analysis to inhomogeneous magnetic fields and to higher order error estimates (in terms of  $\varepsilon$ ) will be discussed, which requires coupling the system with an additional equation for the energy, *cf.* [2]. The theoretical results will be accompanied by some numerical examples. This is a joint work with Francis Filbet (IMT, Toulouse) and Miguel Rodrigues (IRMAR, Rennes).

## Références

- [1] FILBET & RODRIGUES, *Asymptotically stable Particle-In-Cell methods for the Vlasov–Poisson system with a strong external magnetic field*, SIAM J. Numer. Anal., 2016.
- [2] FILBET & RODRIGUES, *Asymptotically preserving Particle-in-Cell methods for inhomogeneous strongly magnetized plasmas*, SIAM J. Numer. Anal., 2017.