Long time behaviour of semi-Lagrangian schemes

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In this talk, we gather different theoretical or numerical results concerning the long time behavior of semi-Lagrangian schemes or it's corresponding advection equation. We first give a result on the stability of semi-Lagrangian schemes in $1D$ for both constant and non constant advection [1], and the theoretical time step restriction imposed on non constant advection is studied numerically. The so-called recurrence phenomenon is then studied mathematically for velocity grid points distribution used in the semi-Lagrangian discontinuous Galerkin method [2] for the linear advection equation, which gives a hint for the behavor on the non linear Vlasov-Poisson equation. Numerical results on $1D$ and $2D$ Vlasov-Poisson system show the pertinence of second order expansion and the existence or non-existence of the particular Best frequencies is exhibited [3]. Finally, we give some first numerical results, when we consider a change of temperature that is imposed through the right hand side of the Vlasov equation, and also for the advection on tokamak equilibrium triangular meshes.

References

[1] R. Ferretti, M. Mehrenberger, *Stability of semi-Lagrangian schemes of arbitrary odd degree under constant and variable advection speed*, in revision (Mathematics of Computation).

[2] M. Mehrenberger, L. Navoret, N. Pham, *Recurrence phenomenon for Vlasov-Poisson simulations on regular finite element mesh*, in revision (CiCP).

[3] J. Bernier, M. Mehrenberger, *Long-time behavior of second order linearized Vlasov-Poisson equations near a homogeneous equilibrium*, in revision (KRM).