Quantitative Fluid Approximation for Heavy Tailed Kinetic Equations

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Résumé

When studying kinetic equations (which describe the motion and interaction of a system of particles), it is traditional to consider, the macroscopic equations which describe the evolution of the conserved quantities of the system of particles under consideration (as for example the mass), since they are usually easier to handle. They can be obtained from the kinetic equation once an appropriate scaling and limiting procedure has been carried out. For a system of particles whose equilibrium density decays rapidly to infinity (e.g. for a Gaussian distribution), the macroscopic equation obtained is a classical diffusion equation. If the equilibrium density has a slow decay (of the algebraic type), it has been shown, so far only for equations where only one quantity is conserved, that after appropriate scaling one obtains a fractional diffusion equation.

In this talk, I will present an extension of these results to the case where the linear kinetic equations considered conserve not only mass, but also momentum and energy. After appropriate scaling, a system of classical diffusion equations for the conserved quantities is obtained in the limit if the equilibrium density decays sufficiently fast to infinity. If the equilibrium density decays more slowly, we obtain fractional diffusion equations for mass and energy, while the equation for momentum is trivial. The proof is based on spectral analysis and energy estimates. They are constructive and provide explicit convergence rates.

The results of joint work with Emeric Bouin (Université Paris Dauphine) and Clément Mouhot (University of Cambridge).

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sciencesconf.org:conf-ada:640877