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Entropy methods in kinetic theory: the interplay of physics and functional inequalities

José A. Cañizo¹

Lyapunov functionals are a basic tool to study the asymptotic behaviour of ordinary differential equations, but in general they are difficult to find. Kinetic equations are usually integro-differential partial differential equations derived from the microscopic behaviour of particles, and they model physical systems at several scales, including fluids, gases, aggregates, and biological populations in more recent applications. Entropy is a central concept in many of these equations, and it provides a Lyapunov functional that has been used to study the asymptotic behaviour of many of these PDE. Several deep functional inequalities are involved in this, and there have been many recent results linking them to the behaviour of this kind of equations. We will give an overview of the topic and comment on some of these advances.

¹Departamento de Matemática Aplicada
Universidad de Granada
Facultad de Ciencias, Avda. Fuentenueva S/N, 18071 Granada
canizo@ugr.es