

Long-time asymptotics for homoenergetic solutions of the Boltzmann equation

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Abstract

In this talk I will consider a particular class of solutions of the Boltzmann equation, known as homoenergetic solutions, which were introduced by Galkin and Truesdell in the 1960s. These solutions are a particular type of non-equilibrium solutions of the Boltzmann equation and are useful to describe the dynamics of Boltzmann gases under shear, expansion or compression. While their well posedness theory has many similarities with the theory of homogeneous solutions of the Boltzmann equation, their long-time asymptotics differs completely, due to the fact that these solutions describe far-from-equilibrium phenomena. Indeed, the long-time asymptotics cannot always be described by Maxwellian distributions. For several collision kernels the asymptotics of homoenergetic solutions is given by particle distributions which do not satisfy the detailed balance condition.

I will describe different possible long-time asymptotics of homoenergetic solutions of the Boltzmann equation, as well as some open problems in this direction. This analysis constitutes a first mathematically rigorous result on the dynamics of Boltzmann gases in open systems. These are joint works with A. V. Bobylev, R. D. James and J. J. L. Velázquez.