Lecture Notes in Mathematics

Edited by A. Dold and B. Eckmann

451

Probabilistic Methods in Differential Equations

Proceedings of the Conference Held at the University of Victoria, August 19–20, 1974

Edited by M. A. Pinsky

Springer-Verlag
Berlin · Heidelberg · New York 1975

Asymptotics and Limit Theorems for the Linearized Boltzmann Equation[1]

Richard S. Ellis[2]

We consider the initial value problem for the linearized Boltzmann equation

$$\frac{\partial p}{\partial t} + \xi \cdot \operatorname{grad} p = \frac{1}{\epsilon} Qp, \quad \lim_{t \downarrow 0} p = f, \tag{1}$$

where the initial data $f = f(x,\xi)$ and the solution $p = p_\epsilon(t,x,\xi)$, $t > 0$, $x \in \mathbb{R}^3, \xi = (\xi_1,\xi_2,\xi_3) \in \mathbb{R}^3$. Q is the linearized collision operator corresponding to a spherically symmetric intermolecular potential, and $\epsilon > 0$ is a parameter which represents the mean free path. Corresponding to the conservation of number, momentum, and energy in an individual collision, Q has a five-dimensional nullspace spanned by 1, ξ_i $(i = 1,2,3)$, and $|\xi|^2$.

We are interested in the asymptotic behavior of the solution of (1) as $\epsilon \downarrow 0$. This is formally treated at the physical level of rigor by the Chapman-Enskog-Hilbert procedure [9; pp. 254-262]. Given a nice f, we define

1. This is a report on joint work with Mark A. Pinsky.

2. Supported in part by National Science Foundation Grant GP-28576