Differential and Integral Equations Volume 14, Number 1, January 2001, pp. 117–127

THE RELAXATION LIMIT FOR SYSTEMS OF BROADWELL TYPE

Yun-guang Lu*
Department of Mathematics, National University of Colombia, Bogota, Colombia

Christian Klingenberg
Applied Mathematics, Würzburg University, Am Hubland, Würzburg 97074, Germany

(Submitted by: Y. Giga)

1. Introduction. This paper considers the Cauchy problem for the following systems of Broadwell's type

$$\begin{cases} f_{1t} + f_{1x} = \dfrac{F(f_1, f_2, f_3)}{\tau} \\ f_{2t} - f_{2x} = \dfrac{F(f_1, f_2, f_3)}{\tau} \\ f_{3t} = -\dfrac{F(f_1, f_2, f_3)}{2\tau} \end{cases} \tag{1}$$

When the nonlinear function F takes the special form $f_1 f_2 - f_3^2$, (1) is a simple mathematical model of gas kinetics, the so called Broadwell model [1] (see also [2], [6] and the references therein). It describes an idealization of a discrete velocity gas of particles in one dimension subject to a simple binary collision mechanism.

Let $\rho = f_1 + f_2 + 4f_3$, $m = f_1 - f_2$, $s = f_3$. (1) may be written as follows:

$$\begin{cases} \rho_t + m_x = 0 \\ m_t + (\rho - 4s)_x = 0 \\ s_t + \dfrac{\bar{F}(\rho, m, s)}{\tau} = 0 \end{cases} \tag{2}$$

Received for publication October 1997.

*This research was supported by the Humboldt Foundation and in part by the Chinese Academy of Science.

AMS Subject Classifications: 35L65, 35B40.