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PROBLEM OF EVAPORATION-CONDENSATION FOR A TWO COMPONENT GAS IN THE SLAB

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Abstract. This paper studies the non linear Boltzmann equation for a two component gas in the situation of hard spheres. A Hilbert expansion of the solution is performed. The first order of the fluid equations shows the ghost effect. The fluid system is solved when the boundary conditions are close to each other.

The boundary conditions for the kinetic system are satisfied by adding for the first and the second order Knudsen layers. In a last part the rest term is rigorously controled by using a decomposition into a low part velocity and a high part velocity. This constitutes a generalization to the case of a two component gas of the results presented in [15, 16].

1. **Introduction.** Consider a mixture constituted by vapor and noncondensable gas whose the stationary behaviour is studied. The part of the space where the mixture is situated between two phases of a condensed gas represented by two vertical planes. Suppose that the model is homogeneous in space in the y and in the z direction. So we can consider that the space variable x belongs to $[-1, 1]$. The vertical planes are respectively kept at temperatures T_I and T_{II}. Denote n_I (resp. n_{II}) the density of saturation of the vapor at temperature T_I (resp. T_{II}). The first component of the gas denoted by A is constituted by vapor and can condense on each boundary. The other component denoted by B cannot condense. The molecules of the two gases are supposed mechanically identical i.e they have the same mass and the same diameter ([26]). The distribution functions f^A and f^B are solutions to the stationary Boltzmann equation for a two component gas ([12])

$$\xi \frac{\partial}{\partial x} f^A(x,v) = \frac{1}{\varepsilon} Q(f^A, f^A)(x,v) + \frac{1}{\varepsilon} Q(f^A, f^B)(x,v),$$
$$\xi \frac{\partial}{\partial x} f^B(x,v) = \frac{1}{\varepsilon} Q(f^B, f^A)(x,v) + \frac{1}{\varepsilon} Q(f^B, f^B)(x,v),$$
$$x \in [-1,1], \quad v \in \mathbb{R}^3, \tag{1}$$

with

$$\varepsilon = \frac{\sqrt{\pi}}{2} K_n = \frac{\sqrt{\pi}}{2} \frac{l}{2} \text{ and } \quad l = \frac{1}{\sqrt{2}\pi d^2 n_I}. \tag{2}$$

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