

Some considerations on radiometric effects

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In connection with Crookes' radiometer, the following two basic problems are considered:

1. An oblate sphere with discontinuous surface temperature is placed in an infinite expanse of a gas. If the Knudsen number (the ratio of the molecular mean free path to the characteristic length) is not zero, a steady flow is induced around the oblate sphere and a force acts on it (radiometric force). When the Knudsen number is small and the temperature variation along the oblate sphere is small, the explicit formula for the force is derived with the help of the generalized slip-flow theory developed by Y. Sone and the symmetry relations for the linearized Boltzmann equation derived by S. Takata.

2. A flat plate with one side heated is placed in a gas enclosed in a square box (two-dimensional problem). The steady flow of the gas induced in the container is investigated numerically with special interest in the flow near the edges of the plate, on the basis of the BGK model of the Boltzmann equation. The discontinuity in the velocity distribution function caused by the presence of the edges is described accurately. From the result, the cause of the radiometric force is clarified.