Discrete kinetic theory of gases

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The discretization of the set of the molecule velocities allows to replace the continuous Boltzmann equation by a system of partial differential equations which reveals to have an interesting mathematical structure. Indeed, this system has the main properties of the Boltzmann equation. So the discrete models give some light about fundamental problems related to the Boltzmann equation.

By using simple models without "spurious" summational invariants, the boundary conditions are specified in two cases: First on an impermeable wall and second on a liquid interface with the condensation or evaporation phenomenon.

The "quasi-isotropic" models are models with some symmetry properties and for which the summational invariants are only the physical ones (mass, momentum and energy). These models are chosen with a view to reduce the anisotropic character involved in discrete models, and to have a good connexion with the real world.

There are many applications: The wave shock structure, the steady or unsteady Couette flows, the evaporation/condensation problems, and so on. In particular for the evaporation/condensation problem between two interfaces, the phenomenon of the temperature inversion is obtained: The temperature does increase from the hot interface to the cold interface.