The Cauchy problem in kinetic theory

Glassey, Robert T., author

Abstrak

This clearly written, self-contained volume studies the basic equations of kinetic theory in all of space. It contains up-to-date, state-of-the-art treatments of initial-value problems for the major kinetic equations, including the Boltzmann equation (from rarefied gas dynamics) and the Vlasov-Poisson/Vlasov-Maxwell systems (from plasma physics). This is the only existing book to treat Boltzmann-type problems and Vlasov-type problems together. Although these equations describe very different phenomena, they share the same streaming term.

The author proves that solutions starting from a given configuration at an initial time exist for all future times by imposing appropriate hypotheses on the initial values in several important cases. He emphasizes those questions that a mathematician would ask first: Is there a solution to this problem? Is it unique? Can it be numerically approximated?

The topics treated include the study of the Boltzmann collision operator, the study of the initial-value problem for the Boltzmann equation with "small" and "near equilibrium" data, global smooth solvability of the initial-value problem for the Vlasov-Poisson system with smooth initial data of unrestricted size, conditions under which the initial-value problem for the Vlasov-Maxwell system has global-in-time solutions (in both the smooth and weak senses), and more.