

Seminar 2023

Math

The Kinetic and Hydrodynamic Bohm
Criteria for Plasma Sheath Formation

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Abstract: In this talk, we investigate mathematically the formation of a plasma boundary layer (sheath), and to analyze the Bohm criteria which are required for the formation. Bohm derived originally the hydrodynamic Bohm criterion from the stationary Euler--Poisson system. Boyd and Thompson proposed the kinetic Bohm criterion. Then Riemann pointed out (although without a rigorous proof) that the criterion is a necessary condition for the solvability of the stationary Vlasov--Poisson system. In this talk, we clarify in all possible cases whether or not there is a stationary solution. Eventually, it is seen that the Bohm criterion is necessary but not sufficient for the solvability. Furthermore, the hydrodynamic criterion can be derived from the kinetic criterion. Therefore, it is of great interest to find the relation between the solutions of the Vlasov--Poisson and Euler--Poisson systems. To clarify the relation, we study the delta mass limit of stationary solutions of the Vlasov--Poisson system. This talk is based on joint works with Professor M. Takayama (Keio Univ.).



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