

# Analytical Solution and Lie Algebra of Relativistic Boltzmann Equation

*Sunday, 26 October 2025 14:00 (25 minutes)*

In this talk, based on the problem and physics-oriented approach, combined with our knowledge of relativistic kinetic theory, we present for the first time the invariant Lie algebra admitted by the relativistic Boltzmann equation, from which the group invariant transformations can be constructed. As the immediate application of this Lie algebra, we demonstrate that in the case of hard sphere interaction, the relativistic BKW (Bobylev, Krook and Wu) solution —constructed here in a more straightforward manner —can be mapped onto an expanding solution in FLRW spacetime given by \cite{Bazow:2016} using moment method. Furthermore, we show that this mapping can be generalized to a broader class of cases where the cross-section respects a scale transformation  $\sigma \rightarrow \lambda^\alpha \sigma$ , under momentum scaling  $p \rightarrow \lambda p$ . Consequently, solving the Boltzmann equation in an expanding background becomes unnecessary; one may solve the simpler Minkowski-space problem and apply the symmetry map.

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**Session Classification:** Parallel III, Invited Talk

**Track Classification:** 新的理论方法 (new theoretical methods)