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The Fluctuating Boltzmann Equation and Short-Range Charge Correlations in Relativistic Heavy-Ion Collisions

Short-range correlations among hadrons in relativistic heavy-ion experiments are typically regarded as non-hydrodynamic and subtracted from the data. However, the fluid nature of the quark-gluon plasma (QGP) gives rise to short-range correlations stemming from hydrodynamic fluctuations. These correlations, driven by fluctuation-dissipation relations near local equilibrium, provide key insights into the transport properties of the QGP and can become particularly significant in the vicinity of the QCD critical region.

In this talk, we present a theoretical framework for calculating two-particle correlations of charged hadrons. Using the Schwinger-Keldysh formalism, we first derive an evolution equation for four-point functions of fields in complex scalar field theory. This equation can be interpreted using the Boltzmann-Langevin Equation (BLE), which predicts the two-particle correlations in momentum space amongst the charges of a conducting fluid. Our results demonstrate how measuring these short-range charge correlations in heavy ion collisions can constrain the transport properties of the QGP in detail.

Category

Theory

Collaboration (if applicable)

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