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Effect of hydrodynamic fluctuations on mixed harmonic cumulants

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We analyze the effect of hydrodynamic fluctuations on normalized mixed harmonic cumulants (nMHC) based on a realistic dynamical model of the high-energy heavy-ion collisions for the first time.

The spacetime evolution of quark-gluon plasma (QGP) in high-energy heavy-ion collisions is described by hydrodynamics. The transport properties of QGP such as shear and bulk viscosity have been studied by comparing hydrodynamic calculations with flow observables of experimental data.
Recently, hydrodynamics fluctuations turned out to affect the flow coefficients and correlations and thus cannot be ignored for the precise determination of the QGP properties.

In this study, we investigate the effect of the hydrodynamic fluctuations on general flow correlations in detail using an integrated dynamical model, where we combine the TrENTo initial conditions, relativistic fluctuating hydrodynamic code (rfh), and UrQMD as an afterburner. We calculate nMHC, which are useful observables to differentiate models, to compare the models of hydrodynamics.We first show the effect of hydrodynamic fluctuations on nMHC. We also analyze the effect of hydrodynamic fluctuations with different viscosity temperature dependencies. We find that the effect of hydrodynamic fluctuations in a $nMHC(v_2^2, v_4^2)$ is similar to that of decreasing the shear viscosity. We argue the importance of considering hydrodynamic fluctuations in dynamical models for the determination of the QGP properties.

Theory / experiment

Theory

Group or collaboration name

Primary authors: SAKAI, Azumi; NONAKA, Chiho; OSHIMA, Kazuki; MURASE, Koichi (Yukawa Institute for Theoretical Physics, Kyoto University)

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