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Nonuniform-temperature effects on the phase transition

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At RHIC, a fireball forms in the Au-Au collision and rapidly cools during expansion, inside which the QCD matter undergoes a phase transition from quark-gluon-plasma to the hadronic phase. The phase transition signals are expected to be observed via the measurements of fluctuations of conserved charges such as baryon numbers [1]. As the realistic fireball is a temporally fast evolving and spatially highly nonuniform system, both the dynamical evolution and the spatially-nonuniform-temperature (and chemical potential) distribution should affect the fluctuations of QCD phase transition.
In this talk, based on the local equilibrium assumption and the Markov assumption, we will present the spatially-nonuniform-temperature effects on the QCD phase transition temperature, the fluctuations, and the correlation length via a simplified Ising-like model [3]. Different from the dynamical effects, which delay the phase transition, we reveal that the nonuniform-temperature effects lead to higher phase transition temperature. Besides, the suppression of the critical fluctuations can be as stronger as the dynamical slowing down effects, in which the nonzero-momentum modes of fluctuations play a crucial role.

[1] J. Adamet al. (STAR Collaboration), Phys. Rev. Lett.126,092301 (2021).
[2] M. Stephanov and Y. Yin, Phys. Rev. D98, 036006 (2018).
[3] Jun-Hui Zheng and Lijia Jiang, Phys. Rev. D 104, 016031 (2021)

Theory / experiment

Theory

Group or collaboration name

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