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Mini-jet thermalization and diffusion of transverse momentum correlation in high-energy heavy-ion collisions

Abstract content

Transverse momentum correlation in azimuthal angle of produced hadrons due to mini-jets are studied first within the HIJING Monte Carlo model in high-energy heavy-ion collisions. Jet quenching in the early stage of thermalization is shown to lead to significant diffusion (broadening) of the correlation. Evolution of the transverse momentum density fluctuation that gives rise to such correlation in azimuthal angle in the later stage of heavy-ion collisions is further investigated within a linearized diffusion-like equation and is shown to be determined by the shear viscosity of the evolving dense matter. Such a diffusion equation for the transverse momentum fluctuation is solved with initial values given by HIJING and together with the hydrodynamic equation for the bulk medium. The final transverse momentum correlation in azimuthal angle is calculated along the freeze-out hyper-surface and is found further diffused for larger values of shear viscosity to entropy density ratio $\eta/s \sim 0.2 - 0.4$. Therefore the final transverse momentum correlation in azimuthal angle can be used to study the thermalization of mini-jets in the early stage of heavy-ion collisions and the viscous effect in the hydrodynamic evolution of the strongly coupled quark gluon plasma.

Summary

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