Baryon-strangeness correlations in Au+Au 200 GeV collisions from RHIC-STAR

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The study of baryon-strangeness correlations in heavy-ion collisions is expected to be a diagnostic of a strongly-interacting matter [1]. The ratio of the mix-cumulant between net-baryon and net-strangeness to the second-order net-strangeness cumulant multiplied by -3 is predicted to be unity for the ideal QGP, while the ratio for the hadronic gas increases with increasing the baryon chemical potential ($\mu_{\rm B}$), varying from around 0.6 ($\mu_{\rm B} = 0$ MeV) to 1.2 ($\mu_{\rm B} = 600$ MeV). According to the previous measurement [2] using identified protons, kaons, and their antiparticles, the ratio exhibits the value of ~ 0.04 in Au+Au central collisions at $\sqrt{s_{\rm NN}} = 200$ GeV, which is much smaller than the theoretical guidance. This observation is qualitatively consistent with the model calculations, where the signal is significantly suppressed by excluding hyperons from the measurements [3].

In this talk, we report on the baryon-strangeness correlations, the second-order net-strangeness cumulant, and their ratio including hyperons (Λ, $\bar{\Lambda}$, Ξ^-, $\bar{\Xi}^+$) in Au+Au 200 GeV collisions. Hyperons are reconstructed using the invariant mass technique, and the contributions from combinatorial backgrounds have been carefully removed through the purity corrections [4]. As a result, we find that the signal of the baryon-strangeness correlation has been drastically enhanced by including hyperons. The resutls will be presented as a function of collision centrality, transverse momentum, and rapidity acceptance. The comparison with UrQMD transport model calculations will be also discussed.

References

[1] V. Koch, A. Majumder, J. Randrup, Phys. Rev. Lett. 95, 182301 (2005).

[2] J. Adam et al. (The STAR collaboration), Phys. Rev. C 100, 014902 (2019), Erratum: Phys. Rev. C 105, 029901(E)(2022)

[3] Z. Yang, X. Luo, B. Mohanty, Phys. Rev. C 95, 014914 (2017)

[4] T. Nonaka, Nuclear Inst. and Methods in Physics Research, A 1039 , 167171 (2022)