Contribution ID: **712** Type: **Poster**

Understanding effect of event-by-event fluctuations on light-nuclei yield ratio

Tuesday 5 September 2023 17:30 (2h 10m)

We investigate how the event-by-event fluctuations of the final-state distribution function of nucleons physically affect the yield ratio of light nuclei based on the coalescence model.

The yield ratio of light nuclei, $N_t N_p / N_d^2$ (with N_t, N_p, and N_d being triton, proton, and deuteron numbers, respectively) [1,2], is one of the observables suggested for a possible signal of the critical point of quantum chromodynamics (QCD). Based on the analyses with idealized setups, the yield ratio is known to be sensitive to the two-point neutron correlation and thus to the critical correlations. However, it is non-trivial how the yield ratio is affected by the other contributions in realistic setups of heavy-ion collisions, such as anisotropic flows [3] and the event-by-event fluctuations coming from the initial state.

In this talk, we establish a qualitative understanding of how event-by-event fluctuations affect the yield ratio [4]. We model the "single-event" distribution $f(x,p)$ by a superposition of n-Gaussian hot spots in phase space and randomize the positions and magnitudes of the hot spots from event to event. We obtain analytical formulae for the yields of light nuclei and related ratios under this setup. We investigate how each feature of the event-by-event distribution affects the yield ratio. We find that the event-by-event fluctuations increase the yield ratio, where the value takes maximum at a particular hot-spot number n depending on the fireball size. We also discuss the scale separation between the critical correlations and short-range thermal fluctuations using two different sizes of hot spots. The scale of critical correlations is bounded by the finite spacetime size of the fireball. We find that the effect in the yield ratio becomes larger for larger separation of hot-spot sizes. These understandings of the yield ratio will be important in analyzing the results of future realistic analyses based on state-of-the-art dynamical models.

References

[1] K. J. Sun, L. W. Chen, C. M. Ko and Z. Xu, Phys. Lett. B **774** (2017), 103-107.
[2] STAR Collaboration, arXiv:2209.08058 (2022).
[3] S. Wu, K. Murase, S. Tang and H. Song, Phys. Rev. C **106** (2022), 034905.
[4] K. Murase and S. Wu, in preparation.

Category

Theory

Collaboration (if applicable)

Primary authors: MURASE, Koichi (Yukawa Institute for Theoretical Physics, Kyoto University); WU, Shanjin

Presenter: MURASE, Koichi (Yukawa Institute for Theoretical Physics, Kyoto University)

Session Classification: Poster Session

Track Classification: Critical point searches