First Measurements of Hyper-Nucleus ${}^{3}_{\Lambda}$H Global Polarization in Au+Au collisions at STAR

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Abstract

The large angular momentum generated in non-central heavy-ion collisions contributes to the formation of vorticity within the medium, which subsequently induces polarization of particles with non-zero spin. The global polarization of Λ-hyperons near mid-rapidity increases at lower energies, which can be attributed to the correlation between angular momentum and enhanced baryon stopping. Recent model predictions suggest that the decay products of polarized hyper-nucleus (${}^{3}_{\Lambda}$H) are highly sensitive to their spin structure [1]. Additionally, in regions of high baryon density, the enhanced production of ${}^{3}_{\Lambda}$H makes their polarization measurement feasible.

In order to understand the spin structure of the ${}^{3}_{\Lambda}$H hyper-nucleus as well as its production mechanism, we have carried out a systematic study of the global polarization of the ${}^{3}_{\Lambda}$H hyper-nucleus using 3 GeV Au+Au collisions with about 2 billion events collected during 2021 by STAR. Both 2-body and 3-body decays are used for the reconstruction of the ${}^{3}_{\Lambda}$H. Collision centrality and rapidity dependence of the polarization will be presented. Finally, the results will be compared with model predictions based on different assumptions of spin structures.

References

[1] Kai-Jia Sun, Dai-Neng Liu, Yun-Peng Zhen, Jin-Hui Chen, Che Ming Ko, and Yu-Gang Ma. Global Polarization of (Anti-)Hypertriton in Heavy-Ion Collisions. 5 2024. arXiv: 2405.12015.