Measurements of Global and Local Polarization of Hyperons in Heavy Ion Collisions from STAR

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The observation of hyperon polarization has revealed the existence of large vorticities in the medium created by heavy-ion collisions. Global polarization indicates vorticities perpendicular to the reaction plane due to the system's orbital angular momentum. With the high-statistics data collected by the STAR experiment for Au+Au and isobar (Ru+Ru, Zr+Zr) at $\sqrt{s_{\rm NN}} = 200$ GeV and Au+Au collisions at $\sqrt{s_{\rm NN}} = 19.6, 27$ GeV, we present the measurements of global polarization for Λ, $\bar{\Lambda}$ as a function of centrality, transverse momentum, pseudorapidity, and azimuthal angle relative to the event plane. These measurements allow us to study possible magnetic field driven effects through the polarization difference between Λ and $\bar{\Lambda}$ hyperon. Furthermore, the study of collsions system size dependence of global polarization can provide essential insights into the polarization phenomena.
The local polarization indicates vorticities along the beam direction due to anisotropic transverse expansion of the medium. We present the measurements of Λ, $\bar{\Lambda}$ hyperon local polarization in isobar and Au+Au collisions at $\sqrt{s_{\rm NN}} = 200$ GeV. Comparisons with the measurements in Pb+Pb collisions at LHC allow us to study collision system size and energy dependence of the vorticities. These results provide new insights into polarization mechanism and vorticity fields in heavy-ion collisions as well as additional constraints on properties and dynamics of the matter created in the collisions.

References

[1] STAR Collaboration, Hyperon polarization along the beam direction relative to the second and third harmonic event planes in isobar collisions at $\sqrt{s_{NN}} = 200$ GeV, arXiv:2303.09074(accepted by PRL).