Hyperon Polarization in Isobar Collisions and Correlation of Global Polarization with Directed Flow 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, while local polarization indicates vorticities along the beam direction due to anisotropic transverse expansion of the medium. With the high-statistics data collected by the STAR experiment for isobar Ru+Ru and Zr+Zr collisions at $\sqrt{s_{\rm NN}}$ = 200 GeV, we present the measurements of global polarization for Λ, $\bar{\Lambda}$, and $\Xi^{\pm}$ 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 Ru+Ru and Zr+Zr, owing to a larger magnetic field expected in the former.

Furthermore, the first measurements of Λ hyperon local polarization along the beam direction relative to the second and third-order event planes in isobar collisions will be presented. Comparisons with previous measurements in Au+Au and Pb+Pb collisions at RHIC and the LHC will be performed to gain important insights into the collision system size and energy dependence of the vorticities in heavy-ion collisions.

Previous measurements have shown a similar trend in the energy dependence between the global polarization and the slope of directed flow, suggesting a strong correlation between the initial tilt of the system and the vorticity[1]. For the first time, this correlation is investigated, and the dependence of the Λ global polarization as well as directed flow on the first-order flow vector (q_1) is presented in Au+Au collisions at $\sqrt{s_{\rm NN}} = 19.6$ GeV.

References

[1] S. A. Voloshin, EPJ Web Conf. 171 (2018) 07002.