Probing novel baryonic spin Hall effect using Λ spin polarization at STAR

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Abstract

The Spin Hall Effect (SHE) is a generation of spin polarization for moving spin carriers in materials under an external electric field and is instrumental in investigating quantum effects in many-body systems [1]. Recent theoretical calculations indicate that the gradient of baryonic chemical potential (analogous to the electric field) can induce a sizeable spin Hall current in Au+Au collisions at $\sqrt{s_{NN}} \sim 10$ GeV. Furthermore, at the RHIC Beam Energy Scan (BES) energies, the sign as well as the pattern of energy dependence of the difference between the harmonics of spin polarization of Λ and $\overline{\Lambda}$ hyperons, can be significantly different with and without the presence of baryonic spin Hall current [2, 3, 4].

In this talk, we will present the harmonic coefficients of Λ hyperons' spin polarization ($P_x sin(2\Delta\phi)$, $P_y cos(2\Delta\phi)$, $P_z sin(2\Delta\phi)$) as functions of transverse momentum, rapidity, and collision centrality in RHIC BES-II Au+Au collisions at $\sqrt{s_{NN}} = 7.7$, 14.6, 19.6, and 27 GeV. These measurements serve as the first experimental probe of the predicted baryonic SHE in heavy-ion collisions.

References

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