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Hyperon Spin Observables in Au+Au Collisions at RHIC BES-II: Global and Local Polarization, Spin Correlations

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The observation of hyperon polarization in heavy-ion collisions has established spin phenomena as powerful probes of the properties of the quark-gluon plasma (QGP) and the dynamics of strongly interacting matter. Global polarization reflects the medium's overall vorticity, while local polarization is expected to arise from anisotropic flow–induced vorticities, although current theoretical descriptions remain incomplete.

In this talk, we present recent STAR results on hyperon spin observables in Au+Au collisions from the RHIC Beam Energy Scan Phase II (BES-II) program. Global polarization measurements of Λ, Ξ, and Ω hyperons at $\sqrt{s_{NN}} = 7.7$–27 GeV provide new insights into the polarization mechanism, including possible magnetic-field–driven effects through the comparison between Λ and $\bar{\Lambda}$ polarizations. In addition, we report the status of spin correlation measurements of Λ–(anti)–Λ hyperon pairs, which probe the local structure and dynamics of spin polarization in the QGP.

Furthermore, we employ Event Shape Engineering to study the contribution of elliptic flow related effects to local polarization of Λ and $\bar{\Lambda}$ hyperons in Au+Au collisions at $\sqrt{s_{NN}} = 19.6$ GeV. These measurements allow to investigate the relation among the initial geometry, elliptic flow, and local polarization.

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