Probing novel baryonic Spin Hall Effect via measurement of local spin polarization of Λ hyperons in STAR Beam Energy Scan

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The Spin Hall Effect (SHE) is instrumental in investigating quantum effects in many-body systems. Recently, theoretical calculations indicate that the gradient of baryonic chemical potential (analogous to the electric field) can induce a sizable spin Hall current. Such an effect is expected to be observed through the energy dependence of the angular modulation of the difference between the local polarization of Λ and $\bar{\Lambda}$ hyperons at the RHIC Beam Energy Scan (BES) energies. The sign as well as the pattern of energy dependence is predicted to be significantly different with and without the baryonic spin Hall current.

In this talk, we will present the first measurements of splitting in Λ hyperons' local spin polarization ($< P_x^{\Lambda-\bar{\Lambda}} sin(2\varphi_\Lambda - 2\Psi_2) >$, $< P_y^{\Lambda-\bar{\Lambda}} cos(2\varphi_\Lambda - 2\Psi_2) >$ and $< P_z^{\Lambda-\bar{\Lambda}} sin(2\varphi_\Lambda - 2\Psi_2) >$, where Ψ_2 is the second-order event-plane) as functions of transverse momentum, rapidity, and collision centrality in RHIC BES-II Au+Au collisions at $\sqrt{s_{NN}}$= 14.6, 19.6 and 27 GeV. This can provide important insights on the spin current possibly created in a highly dense baryonic environment.