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Local and global polarization of Λ hyperons across RHIC-BES energies: The roles of spin hall effect, initial condition, and baryon diffusion (remote)

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We perform a systematic study on the local and global spin polarization of Λ and $\overline{\Lambda}$ hyperons in relativistic heavy-ion collisions at beam energy scan energies via the (3+1)-dimensional CLVisc hydrodynamics model with AMPT and SMASH initial conditions. Following the quantum kinetic theory, we decompose the polarization vector as the parts induced by thermal vorticity, shear tensor and the spin Hall effect (SHE). We find that the polarization induced by SHE and the total polarization strongly depends on the initial conditions. At 7.7GeV, SHE gives a sizeable contribution and even flips the sign of the local polarization along the beam direction for AMPT initial condition, which is not observed for SMASH initial condition. Meanwhile, the local polarization along the out-of-plane direction induced by SHE with AMPT initial condition does not always increase with decreasing collision energies. Next, we find that the polarization along the beam direction is sensitive to the baryon diffusion coefficient, but the local polarization along the out-of-plane direction is not. Our results for the global polarization of Λ and $\overline{\Lambda}$ agree well with the STAR data. Interestingly, the global polarization of $\overline{\Lambda}$ is not always larger than that of Λ due to various competing effects. Our findings are helpful for understanding the polarization phenomenon and the detailed structure of quark-gluon plasma in relativistic heavy-ion collisions.

Category

Theory

Collaboration (if applicable)

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