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Role of Vorticity and Viscosity on Polarization of Λ-Hyperons in Hot QCD Medium

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The recent spin polarization measurement of Λ ($\bar{\Lambda}$) hyperons by the ALICE and STAR Collaborations has created a remarkable interest in the nuclear and high energy physics community to investigate the possible sources for hyperon polarization. It is suggested that in peripheral heavy ion collisions, the initial orbital angular momentum (OAM) manifests the vorticity, which primarily accounts for the spin polarization of the hyperon. Apart from the OAM, there are several other sources of vorticity, such as the shear viscosity, magnetic field, inhomogeneous transverse expansion, etc. In the present study, we couple the vorticity, viscosity, and magnetic field within the ambit of second-order relativistic viscous hydrodynamics and estimate the lifetime of the vortical quark-gluon plasma (QGP) fluid. We observe that the coupling of vorticity and viscosity significantly decreases the QGP evolution rate, and the inclusion of the magnetic field makes the evolution further slower. We observed that the medium evolution becomes highly nonlinear if we consider a coupling between vorticity, viscosity and magnetic field. Using the vortical QGP evolution, we obtain the global spin polarization of Λ-hyperon. Further, we investigate viscosity and magnetic field impact on the polarization of Λ-hyperon. This study provides a qualitative understanding of the QGP medium evolution and spin-polarization of hyperon in heavy-ion collisions. The details of the results will be presented along with the latest experimental developments in this direction.

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