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Longitudinal and global polarization of hyperons in Run 3 Pb-Pb collisions with ALICE

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Ultra-relativistic heavy-ion collisions create a hot and dense state of strongly interacting matter —the quark–gluon plasma (QGP). Its space–time evolution is dominated by strong collective expansion, which generates anisotropic flow and demonstrates the nearly perfect fluid nature of the QGP. This anisotropic expansion, in particular the elliptic flow coefficient 2, gives rise to local shear and vorticities along the beam axis. Through spin–orbit coupling, these vorticities are expected to induce a longitudinal component of hadron polarization. Such measurements provide sensitivity to the early-time dynamics of the collision and constrain key transport properties of the QGP, including its shear and bulk viscosities. A distinct effect, known as global polarization, arises from the very large initial orbital angular momentum present in non-central collisions. This angular momentum is transferred to the medium as its vorticity, resulting in a net alignment of the spins of final-state particles along the global angular momentum direction of the system.

In this talk, I will present new high-statistics results from Run 3 Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.36 TeV with the ALICE experiment. These include the more precise measurement of the longitudinal polarization of Λ hyperons at LHC energies, together with the first measurement of longitudinal polarization of Ξ hyperons. In addition, the first observation of global Λ polarization at LHC energies will be reported. These results provide new insight into the rotational structure of the QGP and give insight to the vortical property as well as transport properties of strongly interacting matter under extreme conditions.

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