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Hydrodynamic effects on spin polarization in AA and pA collisions

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We have implemented the 3+1 dimensional CLVisc hydrodynamics model with \trento-3D initial conditions to investigate the spin polarization of Λ hyperons along the beam direction in p+Pb collisions at $\sqrt{s_{NN}} = 8.16$ TeV. Following our previous theoretical framework based on quantum kinetic theory, we consider three different scenarios: Λ equilibrium, s quark equilibrium, and iso-thermal equilibrium scenarios. We have computed the second Fourier sine coefficients of spin polarization along the beam direction, denoted as $\langle P_z \sin 2(\phi_p - \Psi_2)\rangle$, with $\phi_p - \Psi_2$ being the azimuthal angle relative to the second-order event plane Ψ_2, as functions of multiplicity, transverse momentum and pseudo-rapidity in the three scenarios. Additionally, we have also computed the spin polarization along the beam direction, P_z, as a function of the azimuthal angle. We find that the spin polarization induced by thermal vorticity always provides an opposite contribution compared to the shear-induced polarization in p+Pb collisions. The total spin polarization computed by the current hydrodynamic model disagrees with the data measured by LHC-CMS experiments.

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