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Lambda polarization and spin correlations in a vortical fluid

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We computed the fermion spin distribution and correlations in vortical fluid employing event-by-event (3+1)D viscous hydrodynamics. Due to spin-vorticity coupling, the spin polarization density is proportional to the local fluid vorticity at the next-to-leading order of a gradient expansion in a quantum kinetic theory. As a result of strong collective flow, the spatial distribution of local vorticity on the freeze-out hypersurface converts to Lambda spins with intrinsic azimuthal angle distribution and correlation at RHIC and LHC energy. The azimuthal correlation of the transverse spin is shown to have a cosine form plus an offset due to a circular structure of the transverse vorticity around the beam direction and global angular momentum in non-central collisions. The longitudinal spin correlation shows a structure of vortex-pairing in the transverse plane due to the convective flow of hot spots in the radial direction. The dependence on colliding energy, rapidity, centrality and sensitivity to the shear viscosity are also investigated.

Preferred Track

Correlations and Fluctuations

Collaboration

Not applicable

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