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Production and Polarization of Hypernuclei in Heavy-Ion Collisions

Particles of non-zero spin produced in non-central heavy-ion collisions are expected to be polarized along the direction perpendicular to the reaction plane because of their spin-orbit interactions in the produced matter, and this has indeed been observed for many hyperons and vector mesons. Here, we show that the hypertriton ($^3_{\Lambda}\text{H}$), which is the lightest hypernucleus, is also polarized in these collisions. Using the coalescence model based on the kinetic freezeout baryons for light (hyper-)nuclei production, we find that the angular distribution of the decay product of polarized $^3_{\Lambda}\text{H}$ is highly sensitive to the spin configuration of its wavefunction, providing a novel way to determine its spin structure. We also predict the beam energy dependence of $^3_{\Lambda}\text{H}$ and $^3_{\bar{\Lambda}\bar{H}}$ polarizations in heavy-ion collisions from a few GeV to several TeV based on the measured Λ and $\bar{\Lambda}$ polarizations. We further discuss the possibility of studying the spin correlations among nucleons and Λ hyperons in the produced hadronic matter from the measured Λ polarization in non-central heavy-ion collisions.

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