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Global Spin Alignment of (Anti-)4Li in Non-Central Heavy-Ion Collisions

Non-central heavy-ion collisions produce hot and dense nuclear matter with significant fluid vorticity, which induces global polarizations of particles with non-zero spins along the direction of the total orbital angular momentum. This phenomenon has been observed for hyperons and vector mesons in experiments. In the present study, we demonstrate that polarized nucleons lead to global spin alignment of the unstable nucleus ^{4}Li, which decays via $^4\mathrm{Li} \rightarrow {}^3\mathrm{He} + \mathrm{p}$. Assuming ^{4}Li formed through the coalescence of polarized nucleons at kinetic freeze-out, we obtain the angular distribution of the daughter particle 3He. The quantum corrections up to ^{2} in the coalescence calculation is included through the Moyal star product. We find that the angular distribution has a $\cos(2\theta^*)$ dependence, where θ^* is the angle of the daughter particle ^{3}He in the rest frame of ^{4}Li with respect to the quantization axis. We also find that it depends on both the vorticity and the polarization of nucleons at the kinetic freeze-out stage. Future measurements on the spin alignment of ^{4}Li thus offer a promising method to probe the spin dynamics and vortical structure of nuclear matter produced in heavy-ion collisions.

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