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Vector meson spin alignment caused by local quark polarization

Vector meson spin alignment, as well as the well-known hyperon spin polarization, is a probe for the rotational motion of quark-gluon plasma. However, the spin alignment of vector mesons is much more complicated than the spin polarization of hyperons.

In our recent paper [PLB 817, 136325 (2021)], we established the most general relation between the vector-meson spin-density matrix and the quark polarization in a quark recombination model. Using the relation, we study the vector meson spin alignment in heavy-ion collisions. Interestingly, we find that the spin-density matrix element ρ_{00} of a vector meson does not unambiguously signal the global quark polarization. Instead, the deviation of ρ_{00} from $1/3$ can also be caused by local quark polarizations. We propose several observables that can distinguish between the local and the global polarizations. Measurements of these observables in future experiments can shed light on the puzzles in ϕ and K^{*0} spin alignments.

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