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ϕ-Meson Spin Alignment and the Azimuthal Angle Dependence of Λ ($\bar{\Lambda}$) Polarization in Au+Au collisions at RHIC

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Relativistic heavy-ion collisions produce a state of matter with surprising fluid properties. The study of the vorticity allows us to access a fundamental property of this matter. The STAR experiment at RHIC has observed for the first time a significant alignment between the angular momentum of the medium produced in non-central collision and the spin of $\Lambda(\bar{\Lambda})$ hyperons (J=1/2), revealing that the matter produced in heavy-ion collisions is by far the most vortical system ever observed. Such vorticity is expected to be maximal at the equator, and due to the low viscosity of the system, the vorticity may not propagate efficiently to the poles. This may lead to a larger in-plane than out-of-plane polarization for hyperons.
The same strong vorticity, when acting together with particle production mechanisms (e.g. coalescence and hadronization) may also influence the spin alignment of ϕ-mesons (J=1). In this talk, we will present azimuthal angle (with respect to the reaction plane) dependence of Λ and $\bar{\Lambda}$ polarization in $20-50\%$ central Au+Au collisions at $\sqrt{s_{NN}}$ = 200GeV. We will also present ϕ-meson spin alignment parameters in Au+Au collisions at $\sqrt{s_{NN}}$ = 19.6, 27, 39, 62.4 and 200GeV, as a function of centrality and transverse momentum. The implications of our results on vorticity and particle production mechanisms will be discussed.

List of tracks

QCD phase diagram (BES)

Primary authors: SUN, Xu (Central China Normal University); TU, Biao (Central China Normal University)

Presenter: TU, Biao (Central China Normal University)

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