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Probing the spin dynamics of QCD medium and initial strong magnetic field in heavy-ion collisions via global spin alignment of vector mesons at RHIC

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In non-central heavy-ion collisions (HIC), the large initial angular momentum can induce a non-vanishing polarization for hadrons with non-zero spin. The global spin alignment of vector mesons, quantified by the 00th element of spin density matrix (ρ_{00}), can offer information on the spin-orbital interactions of the QCD medium. Surprisingly large signal of vector meson ρ_{00} compared to hyperon spin polarization poses challenges to the conventional theoretical understanding of polarization in HIC. Preliminary observations from Beam Energy Scan (BES-I) of large deviations of ρ_{00} from 1/3 for ϕ mesons can only be explained by introducing the vector meson strong force fields.

In this talk, we will present transverse momentum and collision centrality dependence of ϕ, K^{*0}, $\overline{K^{*0}}$, K^{*+}, and K^{*-} vector mesons using recent high statistics Beam Energy Scan (BES-II) data of Au+Au collisions at $\sqrt{s_{\mathrm{NN}}}$ = 7.7 - 27 GeV, and isobar collisions (Zr+Zr and Ru+Ru) at $\sqrt{s_{\mathrm{NN}}}$ = 200 GeV. The BES-II data will provide unprecedented precision in ρ_{00} at these energies. Comparison of ρ_{00} between Au+Au and isobar species can provide information on the system size dependence of ρ_{00}. Moreover, since the magnetic moment of charged and neutral K^{*} differ by a factor of seven, the comparison of their ρ_{00} may serve as a new probe for the initial strong magnetic field in HIC.

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