

Measurement of global spin alignment of ϕ and K^* vector mesons at RHIC

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Abstract

In non-zero impact parameter heavy-ion collisions, a large initial orbital angular momentum (OAM) can be present. Such a large OAM can induce a non-vanishing polarization for hadrons with non-zero spin. The global spin alignment of vector mesons is quantified by the 00^{th} element of the spin density matrix (ρ_{00}) with respect to the quantization axis, i.e. normal to the reaction plane. It can offer information on the spin-orbital interactions of the QCD medium.

In this talk, we will present the transverse momentum (p_T) and collision centrality dependence of ρ_{00} for ϕ and K^* vector mesons using data from the RHIC Beam Energy Scan (BES) program on Au+Au collisions at $\sqrt{s_{NN}} = 11.5 - 200$ GeV, and from isobar collisions (Ru+Ru and Zr+Zr) at $\sqrt{s_{NN}} = 200$ GeV. At RHIC BES energies, the ϕ mesons show noticeably large ρ_{00} values, while the K^{*0} results are mostly in line with the non-polarization baseline. The magnitude of ϕ meson ρ_{00} can not be explained by conventional mechanisms but may be attributed to the influence of a vector meson strong force field. The measurement of the global spin alignment can reveal information about the strong force field as well as the spin dynamics of the QCD medium. Moreover, the ρ_{00} measurements in Au+Au and isobar species can provide information on the system size dependence of ρ_{00} .