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Phi Meson and K* Spin Alignment in High Energy Nuclear Collisions at STAR

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The large initial global angular momentum in non-central collisions, when acting together with spin-orbital coupling, can lead to global polarization of produced quarks. Such effect eventually manifests itself as non-vanishing polarization of hardrons with non-zero spin. Vector mesons, unlike hyperons which have large contributions from resonance decay, are originated predominantly from primordial production, and their alignment are generally additive. Thus, the spin alignment of vector meson is expected to be sensitive to different hadronization scenarios [1] and the vorticity of the colliding system [2-4].

We present STAR's measurement of the global spin alignment of φ and K* vector mesons for Au + Au collisions at $\sqrt{s_{NN}}$ = 7.7, 11.5, 14.5, 19.6, 27, 39 and 200 GeV. The alignment is quantified by the diagonal spin density matrix element ρ_{00} with respect to the normal of the event plane. The ρ_{00} measurement based on the 1st- and 2nd-order event plane will be presented and the relationship between the two will be discussed. The result will be shown as a function of the transverse momentum, the collision centrality and the beam energy. The implications of our results on the vorticity and the hadronization scenarios will be discussed. The dependence on the emission angle with respect to the reaction plane will be presented and compared to model calculations. The dependence on event-by-event charge asymmetry and its implication on the chiral separation effect under the initial magnetic field will also be discussed.

References
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Author: YE, Zhenyu (University of Illinois at Chicago)

Presenter: ZHOU, Chensheng (SINAP/BNL)

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