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Measurement of $K^{*0,\pm}$ Mesons in Heavy-Ion Collisions at RHIC

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Neutral and charged vector mesons can exhibit sensitivity to isospin-violating phenomena arising from Landau level splitting when a strong magnetic field (B) is present in a QCD medium [1]. A possible case involves the neutral K^{*0} ($d\bar{s}$) and the charged K^{*+} ($u\bar{s}$), which are close in mass and share the same isospin, yet their constituent quarks possess different magnetic moments, differing by roughly a factor of five. Recent measurements by NA61/SHINE reporting isospin asymmetry between neutral and charged kaons challenge the conventional expectation of isospin symmetry in QCD, although the underlying origin of this effect remains unresolved [2] . If a B-field induces a yield difference between K^{*0} and $K^{*\pm}$, it could influence the inclusive kaon yields via feed-down channels ($K^{*0} \to K^{\pm} + \pi^{\mp}$, $K^{*\pm} \to K^0_S + \pi^{\pm}$).

In this presentation, we examine the invariant mass peak positions and widths, transverse momentum (p_T) spectra, yields (dN/dy), and average transverse momenta ($\langle p_T \rangle$) of $K^{*0,\pm}$ mesons at mid-rapidity. The analysis spans collisions involving isospin-asymmetric systems (Au+Au, Ru+Ru, Zr+Zr) and isospin-symmetric systems (O+O), alongside p+p collisions at $\sqrt{s_{NN}} = 200$ GeV. We present particle ratios such as $K^{*\pm}/K^{*0}$ and $K^{\pm}/K^0_S$ as functions of p_T and collision centrality across different systems. Results from p+p collisions, where magnetic field effects are expected to be negligible, provide a valuable baseline for comparison. Furthermore, we include results from the BES-II Au+Au dataset ($\sqrt{s_{NN}} = 7.7$–19.6 GeV) to explore the energy dependence of these ratios. These results will be compared to model calculations.

[1]. K. Xu et. al., Phys. Lett. B 809, 135706 (2020)
[2] H. Adhikary et. al, (NA61/SHINE collaboration), Nature Commun. 16, 2849 (2025)

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