Study of Entanglement Enabled Spin Interference in peripheral $Au + Au$ collisions with coherently photoproduced ρ mesons in the STAR experiment

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Abstract

Entanglement Enabled Spin Interference (EESI), an example of the Cotler-Wilczek process, was used to measure the structure of nuclei and neutron skins in ultraperipheral (UPC) Au+Au and U+U collisions. Study of the interference in peripheral heavy-ion collisions provides novel information on the impact parameter dependence of the interference signal, the entanglement criteria, and wavefunction decoherence. On one hand, the medium created in such collisions can act as a semi-opaque screen and decohere or weaken the interference effect. On the other hand, the interference is expected to be stronger as the impact parameter decreases. Furthermore, it remains unclear whether the coherence of the photon/pomeron emitters can be preserved, given the breakup of nuclei in hadronic interactions.

In this talk, we will present the p_T and centrality dependence of the $\langle 2cos(2\Delta\phi)\rangle$ modulation of photoproduced ρ mesons in peripheral Au+Au collisions at $\sqrt{s_{NN}} = 200\,\text{GeV}$ measured with the STAR experiment. The data will be compared to theoretical model calculations. The interpretation of the results will be discussed in the framework of the Cotler-Wilczek process and future opportunities for nuclear physics will be proposed.