K^* Production as a Probe of Final-State Hadronic Interactions in High Baryon Density Regimes at RHIC BES-II energies

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Abstract

Exploring the properties of strongly interacting matter at extreme temperatures and densities is a fundamental goal of relativistic heavy-ion collisions. Short-lived resonances such as $K^{*0}(\bar{K}^{*0})$ ($\sim$ 4.16 fm/c) are considered one of the best candidates to investigate the late-stage hadronic phase produced in heavy-ion collisions. Due to their short lifetimes, the decay daughters of these resonances can experience various in-medium effects such as rescattering and regeneration. As a result, studying the ratio of resonances to their corresponding stable particles with similar quark content ($(K^{*0} + \bar{K}^{*0})/(K^+ + K^-)$) can provide insights into the interplay of these in-medium processes.

Here, we present precise measurements of the $K^{*0}(\bar{K}^{*0})$ mesons in Au+Au collisions at $\sqrt{s_{NN}}$= 7.7, 11.5, 14.6, 19.6, and 27 GeV, using data from the STAR Beam Energy Scan II (BES-II) program at RHIC. We present transverse momentum (p_T) spectra at mid-rapidity ($|y| < 1.0$) using its hadronic decay channel ($K^{*0}(\bar{K}^{*0}) \rightarrow K^{\pm} + \pi^{\mp}$), p_T -integrated yields (dN/dy), mean transverse momentum ($\langle p_T \rangle$) and particle ratios across different collision centralities and center-of-mass energies. The results will be compared with various model predictions, and the underlying physics will be explored and discussed in detail.