

Production of Unstable Light Nuclei in Au+Au Collisions at $\sqrt{s_{NN}} = 3$ GeV with the STAR Detector

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Abstract

In relativistic heavy-ion collisions, a large number of light nuclei can be produced. Studying the production mechanism of light nuclei can help us understand the evolution process of relativistic heavy-ion collisions. There have been numerous studies on stable light nuclei, while research on unstable light nuclei is still relatively lacking. Unstable light nuclei are fragile resonance states, and they provide a different perspectives for understanding the production mechanisms of nuclei in heavy-ion collisions.

In this presentation, we present a new method to extract the signals of unstable light nuclei in relativistic heavy-ion collision experiments, specifically ${}^4\text{Li}$ and ${}^5\text{Li}$. This method is based on the phase-shift data from low-energy nuclear scattering experiments as well as the Lednicky-Lyuboshitz model, and partial wave analysis of the nuclear-nuclear final state interactions in heavy-ion collisions will be implemented. We will present the centrality and rapidity dependence of the yield (dN/dy), transverse momentum (p_T) spectra, and mean transverse momentum ($\langle p_T \rangle$) as well as directed flow v_1 of ${}^4\text{Li}$ and ${}^5\text{Li}$ in Au+Au collisions at $\sqrt{s_{NN}} = 3$ GeV. The spin-degeneracy-scaled yield of ${}^4\text{Li}$ is significantly lower than that of ${}^4\text{He}$, which may provide new insight into the mechanism of light-nuclei formation.