Measurements of Hypernuclei Production and Their Properties in Heavy-Ion Collisions at STAR

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Hypernuclei, bound states of nuclei with one or more hyperons, serve as a natural laboratory to investigate the hyperon-nucleon (Y-N) interaction, an important ingredient for the equation-of-state (EoS) of nuclear matter. Precise measurements of hypernuclei properties and their production yields in heavy-ion collisions are crucial for the understanding of the strength of the Y-N interaction and their production mechanisms. The strangeness population factor, $S_{\rm A} = ({}^{A}_{\Lambda}{\rm H}/{}^{A}{\rm He})/(\Lambda/p)$ (A=3,4), is of particular interest as it directly relates to the ratio of light nuclei and hypernuclei coalescence parameters. Moreover, it is suggested that S_A might be sensitive to the onset of deconfinement. The STAR Beam Energy Scan II program and isobar collisions offer a great opportunity to investigate energy and system size dependence of hypernuclei production.

In this talk, we present new measurements on transverse momentum (p_T), rapidity (y), and centrality dependence of ${}^{3}_{\Lambda}{\rm H}$, ${}^{4}_{\Lambda}{\rm H}$, and ${}^{4}_{\Lambda}{\rm He}$ production yields in Au+Au collisions from $\sqrt{s_{\rm NN}}$ = 3 to 27 GeV, as well as in Ru+Ru and Zr+Zr collisions at $\sqrt{s_{\rm NN}}$ = 200 GeV. Strangeness population factors $S_{3,4}$ as functions of collision energy, centrality, p_T, and y are also reported. In addition, we present new measurements on ${}^{4}_{\Lambda}{\rm He}$ and ${}^{5}_{\Lambda}{\rm He}$ lifetimes. These results are compared with phenomenological model calculations, and the physics implications on the hypernuclei production mechanism and properties of Y-N interaction are discussed.