Measurements of ${}^{4}_{\Lambda}$H and ${}^{4}_{\Lambda}$He production in $\sqrt{s_{\rm NN}}$ = 3.0 - 3.9 GeV Au+Au collisions from STAR

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Abstract

Hypernuclei, which are bound states of nuclei with at least one hyperon, serve as excellent experimental probes for studying the hyperon-nucleon (Y-N) interaction. The A=4 mirror hypernuclei (${}^{4}_{\Lambda}$H(0^+) and ${}^{4}_{\Lambda}$He(0^+)) is substantially tighter bound compared to the hypertriton (${}^{3}_{\Lambda}$H). The existence of the spin-1 excited states (${}^{4}_{\Lambda}$H*(1^+) and ${}^{4}_{\Lambda}$He*(1^+)) may also enhance the measured yields through feed-down. As such, their yields allow us to gain insight on the effects of hypernuclear binding, spin and isospin content on their production in heavy-ion collisions.

In this talk, we will present the first measurements of A=4 hypernuclei (${}^{4}_{\Lambda}$H and ${}^{4}_{\Lambda}$He) production from the RHIC-STAR experiment utilizing the fixed target datasets. The transverse momentum $p_{\rm T}$ spectra and yields dN/dy as a function of rapidity will be shown from $\sqrt{s_{\rm NN}}$ = 3.0, 3.2, 3.5 and 3.9 GeV Au+Au collisions. The dN/dy and $< p_{\rm T} >$ of ${}^{4}_{\Lambda}$H and ${}^{4}_{\Lambda}$He will be compared between the aforementioned energies to investigate their energy dependencies. The rapidity and energy dependencies of the ratio of ${}^{4}_{\Lambda}$H to ${}^{4}_{\Lambda}$He will also be shown to investigate the isospin dependence. Furthermore, calculations from thermal model and transport model (JAM) plus coalescence afterburner will be compared to these results and the relevant physics implications will be discussed.