${}^{5}_{\Lambda}$He, ${}^{4}_{\Lambda}$H(e), and ${}^{3}_{\Lambda}$H Measurements from the Beam-Energy Scan-II Program

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Despite extensive measurements on the production yields of light nuclei in heavy-ion collisions, a consensus on their formation mechanism remains elusive. While coalescence models can describe $A < 4$ nuclei yields with remarkable accuracy over a wide range of collision energies, recent results at the LHC indicate that the yields of ^{4}He is underestimated by such models. In contrast to normal nuclei, hypernuclei carry strangeness and offer an additional dimension for such studies. In particular, the ${}^{5}_{\Lambda}$He and the $A = 4$ mirror hypernuclei (${}^{4}_{\Lambda}$H(0^{+}), ${}^{4}_{\Lambda}$He(0^{+})) are all bounded substantially tighter compared to the hypertriton (${}^{3}_{\Lambda}$H). The large radius of the ${}^{3}_{\Lambda}$H leads to suppression in coalescence models, but not in the thermal model where the size of the nucleus does not play a role. The existence of excited states (${}^{4}_{\Lambda}$H($^{*}1^{+}$), ${}^{4}_{\Lambda}$He($^{*}1^{+}$)) may also enhance the measured yields through feed-down. As such, studying the $A = 3 - 5$ hypernuclei yields allow us to extract information on the effects of hypernuclear binding, spin, and isospin content on hypernuclei production in heavy-ion collisions.

In this talk, we will present the first measurements of ${}^{5}_{\Lambda}$He production in heavy-ion collisions utilizing the fixed-target dataset at $\sqrt{s_{NN}} = 3$ GeV from the STAR beam energy scan II program. We will also present the yields of ${}^{4}_{\Lambda}$He, ${}^{4}_{\Lambda}$H, and ${}^{3}_{\Lambda}$H from $\sqrt{s_{NN}} = 3 - 27$ GeV. The transverse momentum spectra and rapidity distributions will be shown. Their mean transverse momenta will be presented as a function of energy, and compared to a blast-wave expectation using the freeze-out parameters from light hadrons. Calculations from the thermal model and coalescence model will be compared to these results, and the physics implications will be discussed.