Measurements of Hypernuclei Production in the High Baryon Density Region with the STAR Detector at RHIC

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Light hypernuclei are expected to be abundantly produced in intermediate to low energy heavy-ion collisions due to the high baryon density. However, their production mechanisms are currently not well understood. Measuring the hypernuclei can not only shed light on the production mechanisms, but also bear implications on the hyperon-nucleon interaction, which is critical to understanding the nuclear equation-of-state in the high baryon density region where strangeness is a degree of freedom.

The STAR BES II program including fixed target Au+Au collisions taken in 2018-2021 is particularly suited to study hypernuclei. The high statistics data allow measurements of rapidity and transverse momentum differential yields. STAR was also able to run the Express Stream Production at the online farm with sufficient data to observe a clear ${}^{5}_{\Lambda}\mathrm{He}$ signal through the ${}^{4}\mathrm{He} + \mathrm{p} + \pi$ decay.

In this talk, results for light hypernuclei (${}^{3}_{\Lambda}\mathrm{H}$, ${}^{4}_{\Lambda}\mathrm{H}$, ${}^{4}_{\Lambda}\mathrm{He}$) production yields in Au+Au collisions at $\sqrt{s_{\mathrm{NN}}} = 27, 19.6$ and 3 GeV will be presented. The 27 and 19.6 GeV data were taken in the collider mode, while the 3 GeV data were taken using the fixed-target mode, which covers mid-rapidity to target rapidity. The measured hypernuclei rapidity distributions are compared to calculations from transport models. The energy dependence of mid-rapidity yields is compared to theoretical calculations from thermal and transport models and the implications on the production mechanisms will be discussed. We will also present studies of hypernuclei properties including binding energy and Dalitz decays from the online Express Stream Production.