Precision measurements of light hypernuclei lifetime and R_3 in Au+Au Collisions from STAR experiment

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Hypernuclei are bound nuclear systems of correlated nucleons and hyperons. Therefore, the production of hypernuclei in heavy-ion collisions provides an experimental avenue for studying the hyperon−nucleon (Y-N) interaction, which is an important ingredient, not only in the equation-of-state (EoS) of astrophysical objects such as neutron stars but also in the description of the hadronic phase of a heavy-ion collision. The strength of the Y-N interaction can be investigated by measuring the properties of hypernuclei. For example, light Λ-hypernuclei containing one hyperon are conventionally understood as a weakly bound system of a Λ and a nucleus, suggesting their lifetimes are close to the free-Λ lifetime.

In heavy-ion collisions, light hypernuclei are expected to be abundantly produced at low energies due to the high baryon density. In this poster, we will report precise lifetime measurements of ${}^{3}_{\Lambda}H$, ${}^{4}_{\Lambda}H$ and ${}^{4}_{\Lambda}He$ in Au+Au collisions at $\sqrt{s_{NN}}$ = 3 GeV and 7.2 GeV, recorded by the STAR experiment at RHIC in the fixed-target mode in 2018. We also present the relative branching ratio R_3 of ${}^{3}_{\Lambda}H$ and ${}^{4}_{\Lambda}H$, where R_3 is the fraction of the two-body decay rate out of the sum of two-body and three-body decay rates. The results will be compared with model calculations and physics implications will be discussed.