Measurement of ${}^{4}_{\Lambda}$He lifetime in Au+Au collisions from STAR fixed target mode experiment

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Hypernuclei are bound nuclear systems of nucleons and hyperons. The intrinsic properties of hypernuclei, such as their binding energy and lifetime, provide experimental avenues for studying the hyperon-nucleon (Y-N) interaction. The Y-N interaction, as an essential ingredient in the equation of state of high-baryon-density matter, remains poorly constrained. The precise measurement of Λ hypernuclei lifetimes, and its difference to that of the free Λ, will shed light towards the understanding of the Y-N interactions. In particular, the study of isospin mirror hypernuclei, such as (${}^{4}_{\Lambda}$H-${}^{4}_{\Lambda}$He), may help us gain insight into the isospin dependence of the Y-N interaction. Although there have been numerous measurements of the ${}^{4}_{\Lambda}$H lifetime, there is a scarcity of lifetime measurements for ${}^{4}_{\Lambda}$He due to its low production rate and low reconstruction efficiency. The high statistics data, collected with the STAR fixed target mode (FXT) Au+Au collisions ($\sqrt{s_{NN}}$ = 3.0 - 7.7 GeV), provides a great opportunity to measure the ${}^{4}_{\Lambda}$He production with good precision.

In this presentation, we will report the first ${}^{4}_{\Lambda}$He lifetime measurement in heavy-ion collisions with the STAR FXT Au+Au collisions. A comparison of the lifetimes of ${}^{4}_{\Lambda}$H and ${}^{4}_{\Lambda}$He will provide a rigorous test for model calculations, accounting for isospin differences.