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Quantum mechanical softening of hypertriton

Understanding the properties of hypernuclei helps to constrain the interaction between hyperon and nucleon, which is known to play an essential role in determining the properties of neutron stars. Experimental measurements have suggested that the hypertriton (${}^3_\Lambda$H), the lightest hypernucleus, exhibits a halo structure with a deuteron core encircled by a Λ hyperon at a distance of about 10 fm. This large $\Lambda - d$ distance in ${}^3_\Lambda$H wave function is found to cause a suppressed ${}^3_\Lambda$H yield and a softening of its transverse momentum (p_T) spectrum in relativistic heavy-ion collisions. Within the coalescence model based on nucleons and Λ hyperons from a microscopic hybrid hydro model with a hadronic afterburner for nuclear cluster production in Pb-Pb collisions at $\sqrt{s_{NN}}$= 5.02 TeV, we show how this softening of the hypertriton p_T spectrum appears and leads to a significantly smaller mean p_T for ${}^3_\Lambda$H than for helium-3 (^{3}He). The latter is opposite to the predictions from the blast-wave model which assumes that ${}^3_\Lambda$H and ^{3}He are thermally produced at the kinetic freeze-out of heavy ion collisions. The discovered quantum mechanical softening of the (anti-)hypertriton spectrum can be experimentally tested in relativistic heavy-ion collisions at different collision energies and centralities and used to obtain valuable insights to the mechanisms for light (hyper-)nuclei production in these collisions.

Field of Research

Strangeness

Experiment/Theory

Experiment

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