Collision energy and system size dependence of J/ψ production in heavy-ion collisions with the STAR experiment

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Abstract

J/ψ is an important probe to study the properties of the quark-gluon plasma (QGP) created in heavy-ion collisions. Measurements of J/ψ yield suppression in Au+Au collisions at $\sqrt{s_{\rm NN}} = 200$ GeV suggest that J/ψ production in heavy-ion collisions is affected by the interplay of several effects, including dissociation and regeneration in the QGP, and cold nuclear matter effects. Studying the properties of the QGP via J/ψ requires a good understanding of all these effects, which is very challenging and requires high precision measurements. All these effects are expected to strongly depend on collision energy and collision system. STAR collected large data samples of Au+Au collisions at $\sqrt{s_{\rm NN}} = 54.4$ GeV in 2017 and isobaric collisions ($^{96}_{44}Ru$ + $^{96}_{44}Ru$ and $^{96}_{40}Zr$ + $^{96}_{40}Zr$) at $\sqrt{s_{\rm NN}} = 200$ GeV in 2018. These datasets provide an unique opportunity to study collision energy and system size dependence of the J/ψ production with good precision.

In this contribution, precision measurements of inclusive J/ψ production via the e^+e^- decay channel will be presented. The centrality and transverse momentum dependence of the nuclear modification factors in Au+Au collisions at $\sqrt{s_{\rm NN}} = 54.4$ GeV, and $^{96}_{44}Ru$ + $^{96}_{44}Ru$ and $^{96}_{40}Zr$ + $^{96}_{40}Zr$ collisions at $\sqrt{s_{\rm NN}} = 200$ GeV will be presented. These results will be compared to the similar measurements in Au+Au and Cu+Cu collisions at $\sqrt{s_{\rm NN}} = 200$ GeV and physics implications will also be discussed.