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Beam energy dependence of heavy flavor production in Au+Au collisions at STAR

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Quarkonia and open heavy-flavor hadrons are important probes to study the properties of the quark-gluon plasma (QGP) created in heavy-ion collisions. Heavy quarks (charm and bottom) are primarily generated at initial hard partonic scatterings and undergo the whole QGP evolution. Therefore, they are excellent probes of the QGP properties. Production of quarkonia depends on the dissociation and regeneration processes in the QGP, and also on the cold nuclear matter effect. To disentangle these effects and infer QGP properties, it is important to carry out differential precision measurements for various quarkonium states at different collision energies and system sizes. The STAR experiment offers opportunity to study the energy and colliding system size dependence of heavy-flavor production through large statistics samples of isobaric collisions ($^{96}_{44}\text{Ru} + ^{96}_{44}\text{Ru}$ and $^{96}_{40}\text{Zr} + ^{96}_{40}\text{Zr}$) at $\sqrt{s_{\text{NN}}} = 200$ GeV, as well as Au+Au collisions at $\sqrt{s_{\text{NN}}} = 14.6, 19.6, 27$ GeV and 54 GeV collected in the phase II of Beam Energy Scan program.

In this talk, the first measurements of $\psi(2S)$ and J/ψ polarization in heavy-ion collisions at RHIC, performed in isobaric collisions, will be presented. Centrality and transverse momentum dependence of the ratio of $\psi(2S)$ yield over that of J/ψ will be shown. These results together with measurements of the J/ψ and Υ states yield suppression allow a comprehensive study of binding energy dependent modifications to the quarkonium production in the medium. J/ψ polarization measurement provides a new angle for studying QGP properties and the J/ψ production mechanism. New measurements of inclusive J/ψ production in Au+Au collisions at $\sqrt{s_{\text{NN}}} = 14.6, 19.6$ and 27 GeV will be also presented. Furthermore, measurements of central-to-peripheral nuclear modification factors (R_{CP}) and elliptic flow (v_2) of HFE in Au+Au collisions at $\sqrt{s_{\text{NN}}} = 54.4$ GeV will be shown.

Category

Experiment

Collaboration (if applicable)

STAR Collaboration

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