

Beam energy and colliding system size dependence of heavy flavor production at STAR

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Abstract

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

14 In this talk, the first measurements of $\psi(2\text{S})$ and J/ψ polarization in heavy-ion
15 collisions at RHIC, performed in isobaric collisions, will be presented. Centrality
16 and transverse momentum dependence of the ratio of $\psi(2\text{S})$ yield over that of J/ψ
17 will be shown. These results together with measurements of the J/ψ and Υ states
18 yield suppression allow a comprehensive study of binding energy dependent modi-
19 fications to the quarkonium production in the medium. J/ψ polarization measure-
20 ment provides a new angle for studying QGP properties and the J/ψ production
21 mechanism. New measurements of inclusive $J\psi$ production in Au+Au collisions at
22 $\sqrt{s_{\text{NN}}} = 14.6, 19.6$ and 27 GeV will be also presented. Furthermore, measurements
23 of central-to-peripheral nuclear modification factors (R_{CP}) and elliptic flow (v_2) of
24 HFE in Au+Au collisions at $\sqrt{s_{\text{NN}}} = 54.4$ GeV will be shown.