

Measurement of quarknonium production and polarization in Ru+Ru and Zr+Zr collisions at $\sqrt{s_{\text{NN}}} = 200$ GeV with the STAR experiment

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Abstract

1 Quarkonia are important probes to the properties of the quark-gluon plasma
2 (QGP) created in heavy-ion collisions. Production of quarkonia involves several
3 effects, including dissociation and regeneration in the QGP and cold nuclear mat-
4 ter effects. To disentangle these effects and infer QGP properties, it is desirable
5 to carry out differential measurements for different quarkonium states with high
6 precision. The large-statistics sample from isobaric collisions ($^{96}_{44}\text{Ru} + ^{96}_{44}\text{Ru}$ and
7 $^{96}_{40}\text{Zr} + ^{96}_{40}\text{Zr}$) at $\sqrt{s_{\text{NN}}} = 200$ GeV, collected by the STAR experiment in 2018,
8 provides us a unique opportunity to study quarkonia production in the QGP.

9 In this contribution, the first measurement of $\psi(2\text{S})$ production in heavy-ion
10 collisions at RHIC will be presented. $\psi(2\text{S})$ is reconstructed via the e^+e^- decay
11 channel with machine learning techniques to enhance the signal significance. Cen-
12 trality and transverse momentum dependence of the ratio of $\psi(2\text{S})$ yield over that
13 of J/ψ will be shown. These results together with measurements of the yield sup-
14 pression for J/ψ and different Υ states allow a comprehensive study of binding
15 energy dependent modifications to the quarkonium production in the medium. In
16 addition, the first measurement of J/ψ polarization in heavy-ion collisions at RHIC
17 will also be shown in both Helicity and Collins-Soper frames, which provides a new
18 angle for studying QGP properties and the J/ψ production mechanism in these
19 collisions.