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Measurements of the Upsilon meson production in Au+Au collisions at the STAR experiment

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In ultra-relativistic heavy-ion collisions, creation of a novel state of matter—the quark-gluon plasma (QGP)—is expected. Studying the properties of this medium of deconfined quarks and gluons has been a focus of high energy nuclear physics and poses a significant experimental challenge. Among various probes, quarkonium production is a crucial one since their production is expected to be suppressed in the QGP due to the dissociation caused by the color screening effect, which is viewed as a direct evidence of the QGP formation. The dissociation process is dependent on the quarkonium binding energy and thus occurs for different states at different temperatures. By measuring the "sequential melting"of different quarkonium states in the medium, constraints on the QGP temperature can be inferred.

In this talk, we will present recent measurements on the Υ production in Au+Au collisions at $\sqrt{s_{\mathrm{NN}}} = 200$ GeV via both the di-muon and di-electron channels by the STAR experiment at RHIC. At RHIC energies, other effects affecting the quarkonium production—such as the inelastic interactions with final-state hadrons and coalescence of deconfined heavy quarks—are deemed much less significant for the Υ mesons than for the charmonia, which makes the bottomonium family a cleaner probe. The nuclear modification factors for both the ground and excited Υ states are reported as a function of collision centrality and transverse momentum, and compared with similar measurements at the LHC as well as theoretical calculations. Furthermore, the Υ productions in p+p and p+Au collisions at $\sqrt{s_{\mathrm{NN}}} = 200$ GeV are measured via the di-electron channel, which provide a refined p+p reference and quantification of the cold nuclear matter effect.

Experimental Collaboration

STAR

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