Quarkonium measurements in heavy-ion collisions with the STAR experiment

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Measurements of quarkonium production have played an important role in understanding the properties of the Quark-Gluon Plasma (QGP) formed in relativistic heavy-ion collisions. Quarkonium suppression in the medium due to the color screening effect has been proposed as a direct signature of the QGP formation. However, other effects, such as cold nuclear matter (CNM) effects and regeneration, add additional complications to the interpretation of the observed suppression. Measurements of J/ψ suppression and elliptic flow (v_2) over a broad kinematic range in different collision systems can help disentangle the various mechanisms contributing to the observed J/ψ modification. Compared to charmonia, bottomonia receive less regeneration contribution due to the smaller bottom quark cross-section, thus providing a cleaner probe. Furthermore, different bottomonium states of different binding energies are expected to dissociate at different temperatures, and measurement of this "sequential melting" can help constrain the medium temperature.

In this talk, we will present the latest measurements of J/ψ and Υ productions in p+p, p+Au and Au+Au collisions at $\sqrt{s_{\mathrm{NN}}}$ = 200 GeV and in U+U collisions at $\sqrt{s_{\mathrm{NN}}}$ = 193 GeV by the STAR experiment. Based on the data taken in year 2015, the J/ψ and Υ measurements in p+p collisions provide new baselines for A+A collisions, while the measurements in p+Au collisions can help quantify the CNM effects. The double ratio of ψ(2S) to J/ψ production rates between p+p and p+Au collisions is measured at mid-rapidity for the first time. The nuclear modification factor (R_{AA}) and v_2 as a function of transverse momentum (p_{T}) for J/ψ in both Au+Au and U+U collisions will be shown to distinguish different effects. Furthermore, the R_{AA} for different Υ states will be presented as a function of p_{T} and centrality, and compared to that measured at the LHC as well as theoretical calculations.