

Recent heavy-flavor results from STAR

Barbara Trzeciak (for the STAR Collaboration)

Abstract

In ultra-relativistic heavy-ion collisions, a dense and hot QCD medium, called the Quark-Gluon Plasma (QGP) and composed of de-confined quarks and gluons, is created. Heavy quarks (charm and beauty) are produced dominantly in hard partonic scatterings in the early stage of the collisions and experience the whole medium evolution. Therefore, they are ideal probes to investigate the QGP properties. Measurements of open heavy-flavor hadron production provide information on the transport properties of the QGP, the degree of the heavy quark thermalization, and the hadronization mechanism. On the other hand, measurements of quarkonium production in heavy-ion collisions give us insight into the color screening mechanism, which causes the quarkonium bound states to dissociate in the QGP, and thermodynamic properties of the QGP. Quarkonium studies in $p+p$ and $p+A$ collisions serve as the necessary baseline for A+A collisions, and help to understand the quarkonium production mechanism and the cold nuclear matter effects, respectively.

In this talk, we will report recent results on open heavy-flavor and quarkonium production in the STAR experiment at RHIC. Measurements of the J/ψ suppression and elliptic flow in isobar (Ru+Ru and Zr+Zr) collisions at $\sqrt{s_{NN}} = 200$ GeV, as well as studies of the system size and energy dependence of the J/ψ suppression will be shown. Production of quarkonia in $p+p$ collisions, including J/ψ production in jets and with jet activity, will also be presented. Moreover, we will show measurements of electrons from open heavy-flavor hadron decays, and D^0 , D^\pm , D_S , and Λ_C production in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. The extracted total charm quark production cross section per nucleon-nucleon collision in Au+Au collisions will be reported. We will also present the first measurements of the production yield and radial profile of D^0 -tagged jets in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. Finally, prospects of heavy-flavor measurements in STAR with high luminosity Au+Au RHIC Runs in 2023 and 2025 at $\sqrt{s_{NN}} = 200$ GeV will be discussed.