Measurement of $J/\psi$ polarization in Ru+Ru and Zr+Zr collisions at $\sqrt{s_{NN}} = 200$ GeV at STAR

Dandan Shen (for the STAR Collaboration)
Shandong University

Abstract

The large scale set by the charm mass means the heavy quark pairs are produced early in heavy-ion collisions and experience the full evolution of the quark-gluon plasma (QGP) created in these collisions. Because of this, $J/\psi$ serves as one of the important probes to study the properties of the QGP. In Ru+Ru and Zr+Zr collisions at $\sqrt{s_{NN}} = 200$ GeV recorded by the STAR experiment, it has been observed that the $J/\psi$ yield is strongly suppressed and its elliptic flow is consistent with zero indicating the $J/\psi$’s strong coupling with the medium and its potentially small regeneration contribution, respectively. Besides those observable, the $J/\psi$ polarization can shed new light on the QGP properties and the $J/\psi$ production mechanism in heavy-ion collisions. For example, it has been hypothesized that the $J/\psi$ polarization can be observed due to the spin-orbit coupling between $J/\psi$ and the QGP’s large angular momentum in non-central heavy-ion collisions. The early production of $J/\psi$ also makes its polarization potentially sensitive to the strong magnetic field at the early stage.

In this talk, we will present the first measurement of $J/\psi$ polarization in heavy-ion collisions at RHIC. The study is carried out by reconstructing the $J/\psi$ through its di-electron decay channel in the mid-rapidity ($|y| < 1$) and the $J/\psi$ transverse momentum range of $0.2 < p_T < 10$ GeV/c. The $J/\psi$ polarization parameters are measured in the Helicity frame, Collins-Soper frame and with respect to the event plane. We conclude by presenting the physics implications of this measurement.