Initial electromagnetic field dependence of photon-induced production in isobaric collisions at STAR

Kaifeng Shen (for the STAR Collaboration)
University of Science and Technology of China

Abstract

Strong electromagnetic field arising from the Lorentz-contraction and a large number of charges (Z) in the colliding nuclei at ultrarelativistic speeds can generate a large flux of quasi-real photons. Consequent photon-induced interactions could reasonably explain the observed enhancements of J/ψ and e^+e^- pair productions at very low transverse momenta (p_T) in peripheral high-energy heavy-ion collisions, via photonuclear ($\propto Z^2$) and photon-photon ($\propto Z^4$) processes. The STAR experiment has collected a large sample of $^{96}_{44}$Ru+$^{96}_{44}$Ru and $^{96}_{40}$Zr+$^{96}_{40}$Zr collisions at $\sqrt{s_{\rm NN}}$ = 200 GeV in 2018. The isobaric collisions, with different number of charges and same number of nucleons in the colliding nuclei, provide a unique opportunity to test the electromagnetic field dependence of photon-induced production.

In this presentation, we will present the first measurement of the electromagnetic field dependence of J/ψ and e^+e^- pair productions at very low p_T, via comparisons between the new measurements in isobaric collisions as well as to the published results in Au+Au collisions at $\sqrt{s_{\rm NN}} = 200$ GeV. Besides, the angular modulation of dielectron pairs in isobaric collisions which is related to vacuum birefringence will also be presented. The physical implications of these results will be discussed.