Photon-induced J/ψ production and polarization effects in isobar collisions at STAR

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Abstract

In relativistic heavy-ion collisions, J/ψ photoproduction serves as a sensitive probe for studying the gluonic structure in heavy nuclei. Differential measurements of photon-induced J/ψ production provide important constraints on gluon distribution functions and sub-nucleonic shape fluctuations. The linear polarization of photons involved in these processes enables imaging of the nucleus via spin interference effect in vector meson photoproduction, which can be quantified by measuring the azimuthal angular modulation between the J/ψ momentum and its decay daughters' momenta. Moreover, the decay daughters of these vector mesons inherit polarization of the photons, which could be used to access the initial collision geometry. Thus, measurement of differential cross sections of J/ψ photoproduction and the azimuthal anisotropy of their decay daughters offer a novel and direct probe into both the gluonic structure and the initial collision geometry.

In this contribution, we will present the differential cross sections of photon-induced coherent J/ψ in Ru+Ru and Zr+Zr ultra-peripheral collisions (UPCs) at $\sqrt{s_{NN}} = 200$ GeV. These cross-section measurements will also be compared with existing d+Au and Au+Au data to investigate system size dependencies. Furthermore, we will report the azimuthal angular modulation measurements of the photon-induced J/ψ in isobaric UPCs. Finally, we will present the measurements of the azimuthal anisotropy of electrons decayed from photon-induced J/ψ with respect to the event plane in non-central collisions from the same collision systems. Physics implications of these results will be discussed together with model comparisons.