Probing gluon structure with J/ψ photoproduction in isobaric ultra-peripheral collisions at $\sqrt{s_{NN}}$ = 200 GeV with the STAR

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In ultra-peripheral collisions (UPCs), coherent J/ψ photoproduction has been recognized as one of the most sensitive probes of the nuclear gluon distribution. Recently, STAR published differential measurements on photoproduced J/ψ in ultra-peripheral d+Au and Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV. These results provide important constraints on gluon distribution functions and sub-nucleonic shape fluctuations in both light and heavy nuclei. Compared to d+Au and Au+Au collisions, the collision system size in isobaric collisions ($^{96}_{44}Ru$ + $^{96}_{44}Ru$ and $^{96}_{40}Zr$ + $^{96}_{40}Zr$) lies in between. Therefore, the measurement of coherent J/ψ photoproduction in isobaric UPCs offers a unique opportunity to study the system size dependence of gluon structure.

In this talk, we present the differential cross sections of photoproduced coherent J/ψ as a function of rapidity (y) in $^{96}_{44}Ru$ ($^{96}_{40}Zr$) + $^{96}_{44}Ru$ ($^{96}_{40}Zr$) UPCs at $\sqrt{s_{NN}}$ = 200 GeV. The results will also be shown for different combinations of neutron emission, where neutrons are detected by zero degree calorimeters, which help resolve the photon-gluon emitter ambiguity. More importantly, these data provide crucial constraints on the system size dependence of the gluon structure within nuclei in the kinematic range x_{parton}, the momentum fraction carried by the gluon, $\sim 0.015 - 0.03$. The results are compared with theoretical model calculations and previous STAR measurements, and the physics implications are discussed.