

Recent results on vector meson photoproduction and interference effects in Ultra Peripheral Collisions at STAR

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In ultraperipheral heavy-ion collisions (UPCs), vector meson photoproduction, e.g. ρ^0 and J/ψ , has been considered one of the most sensitive probes for studying the gluonic structure in heavy nuclei. The linear polarization of the photons involved in these processes can help to image the nucleus through the spin interference effect in vector meson photoproduction. Many efforts have been made to study this interference effect in RHIC and LHC experiments. Recently, STAR at RHIC observed spin interference effect from the ρ^0 vector meson photoproduction in Au+Au and U+U UPCs. Nevertheless, determining whether interference happens at the vector meson level or among its decay daughters is not feasible using ρ^0 data. This is because both the ρ^0 and its decay pions are bosons, and the ρ^0 has short lifetime. On the other hand, the J/ψ vector mesons decay into two fermions, having a longer lifetime and a non-localized wave function, which brings more information on the aforementioned phenomenon.

In this talk, we will report measurements of the differential cross sections of photoproduced J/ψ in Au+Au, Ru+Ru and Zr+Zr UPCs at $\sqrt{s_{NN}} = 200$ GeV recorded by STAR. The results will be presented for different combinations of neutron emissions. These data provide important constraints for nuclear parton distribution functions and sub-nucleonic shape fluctuations in heavy nuclei. We also present the latest measurements of the angular modulation arising from the spin interference effect for coherent J/ψ photoproduction in Au+Au, Ru+Ru and Zr+Zr UPCs. The physical implications of these measurements will be discussed together with model comparisons. Finally, we will discuss future prospects of these measurements during the final 2025 RHIC run.