

1 Vector meson photoproduction and interference effects in Ultra Peripheral 2 Collisions at STAR

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4 In ultra-peripheral heavy-ion collisions (UPCs), vector meson photoproduction, e.g., ρ^0 and
5 J/ψ , has been considered one of the most sensitive probes for studying the gluonic structure in
6 heavy nuclei. The linear polarization of the photons involved in these processes can help to image
7 the nucleus through the so-called spin interference effect in vector meson photoproduction. Many
8 efforts have been made to study this interference effect in RHIC and LHC experiments. Recently,
9 STAR at RHIC discovered the spin interference effect from the ρ^0 vector meson photoproduction
10 in Au+Au and U+U UPCs. However, the possibility that the interference can happen at the level of
11 vector mesons cannot be falsified using ρ^0 data due to its' shorter lifetime. The J/ψ vector mesons,
12 having longer lifetime and non-localized wave function, bring more information into these.

13 In this talk, we will report measurements of the differential cross sections of photoproduced ρ^0
14 and J/ψ in Au+Au UPCs at $\sqrt{s_{NN}} = 200$ GeV recorded by STAR. The results will be presented
15 for different combinations of neutron emissions. These data provide important constraints for
16 nuclear parton distribution functions and sub-nucleonic shape fluctuations in heavy nuclei. We
17 also present the latest measurements of angular modulation arising from the spin interference
18 effect for the coherent ρ^0 and J/ψ photoproduction. We observe a large $\cos(2\Delta\phi)$ modulation in
19 the angular separation between the vector mesons and one of its decay daughters, predicted to
20 be a signature of the spin interference effect. Finally, we will discuss the future prospects during
21 the final RHIC runs in 2023-2025.