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Probing a new regime of ultra-dense gluonic matter using high-energy photons with the CMS experiment

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Gluons are found to become increasingly dominant constituents of nuclear matter when being probed at higher energies or smaller Bjorken-x values. This has led to the question of the ultimate fate of nuclear gluonic structure and its interaction with external probes at extreme density regimes when approaching the limit allowed by unitarity. In ultraperipheral collisions (UPCs) of relativistic heavy ions, the coherent heavy-flavor vector meson production via photon-nuclear interactions is of particular interest, since its cross section is directly sensitive to the nuclear gluon density at leading order. However, in experimental measurements, because each of the two nuclei in symmetric UPCs can serve both as a photon-emitter projectile and a target, this two-way ambiguity has prevented us from disentangling contributions involving high- and low-energy photon-nucleus interactions, thus limiting our capability of probing the extremely small-x regime, where nonlinear QCD effects are expected to emerge. In this talk, we will present a new measurement of coherent J/ψ photoproduction, where the two-way ambiguity is solved by implementing for the first time a forward neutron tagging technique in UPC PbPb collisions in 2018 at 5.02 TeV. The coherent J/ψ photoproduction cross section will be presented, for the first time, as a function of the photon-Pb center-of-mass energy in UPCs up to about 400 GeV, corresponding to an extremely low x of $\sim 5 \times 10^{-5}$. We will discuss the physics implications of this new result, as well as exciting opportunities in future LHC heavy ion runs.

What kind of work does this abstract pertain to?

Experimental

Which experiment is this abstract related to?

CMS

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