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Spin-dependent azimuthal asymmetry of coherent J/ψ photoproduction in peripheral PbPb collisions with CMS

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The Lorentz-boosted electromagnetic fields of relativistic heavy ions serve as intense sources of linearly polarized quasi-real photons. Under the s-channel helicity conservation hypothesis, a coherently photoproduced vector meson inherits this polarization, leading to a characteristic second-harmonic ($cos2\phi$) modulation in the azimuthal distribution of its decay products. Such modulation was recently observed for $\rho^0 \rightarrow \pi^+\pi^-$ in heavy-ion UPCs at mid-rapidity, where interference between two indistinguishable photon–nucleus production paths induces a strong correlation between the meson's transverse momentum and its polarization direction. This correlation diminishes at forward rapidity or in asymmetric collision systems, where the interference is suppressed.
In this talk, we present the first measurement of the $cos2\phi$ modulation in coherently photoproduced $J/\psi \rightarrow \mu^+\mu^-$ decays relative to the impact-parameter direction, estimated using event-plane techniques, providing a more robust estimator of the polarization axis. Both the centrality and rapidity dependence of the modulation are investigated. Compared with previous results for spin-0 final states (pions from coherent ρ^0 decays), this new study provides a direct test of the spin-state dependence of azimuthal asymmetries. Furthermore, we discuss the potential application of the intrinsic polarization of coherently photoproduced vector mesons as a complementary reaction-plane estimator in heavy-ion collisions and small systems (e.g., p-A).

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