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Photonuclear production of strange particles in ultra-peripheral Pb–Pb collisions with ALICE

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In this study, the production of strange particles is investigated in ultra-peripheral Pbndash;Pb collisions (UPCs) at $\sqrt{s_{\mathrm{NN}}}$ = 5.36 TeV, using data from the ALICE experiment at the LHC. The analysis focuses on selecting photo-nuclear reactions, where a quasi-real photon emitted by the fully ionized nucleus either acts as a point-like particle interacting with a parton in the target nucleus or fluctuates into a vector meson that interacts with the nucleus or parton through the strong interaction. These collisions are characterized by a rapidity boost of the center-of-mass frame in the direction of the target nucleus, creating a rapidity gap on the opposite side, referred to as single-gap topology.

Due to the large impact parameter in such collisions, hadronic interactions are suppressed, allowing charged hadron yields, particularly those of strange particles, to serve as sensitive probes for studying the interplay between hadronic and electromagnetic interactions. By examining the baryon-to-meson ratio, specifically the $\Lambda/\mathrm{K}^0_\mathrm{S}$ yield ratio as a function of transverse momentum (p_T), this analysis aims to distinguish between cold nuclear matter effects and those associated with the formation of quark-gluon plasma (QGP) droplets.

The recent upgrades of the ALICE detector for Run 3, including continuous readout and enhanced tracking systems, significantly improve strange particle identification, especially at low transverse momentum. With a substantially higher interaction rate, ALICE has already collected approximately 40 times more minimum bias events in Run 3 than in Runs 1 and 2 combined. This large dataset provides new opportunities to advance our understanding of UPC physics, strangeness production, and the potential emergence of collective behavior in photo-nuclear interactions.

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