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Light-by-light scattering in ultraperipheral collisions of heavy ions with future FoCal and ALICE 3 detectors

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We discuss possible future studies of photon-photon (light-by-light) scattering using planned FoCal and ALICE 3 detectors. We include different mechanisms of $\gamma\gamma \to \gamma\gamma$ scattering such as double-hadronic photon fluctuations, t/u-channel neutral pion exchange or resonance excitations ($\gamma\gamma \to R$) and deexcitation ($R \to \gamma\gamma$). The broad range of (pseudo)rapidities and lower cuts on transverse momenta open a necessity to consider not only dominant box contributions but also other subleading contributions. Here we include low mass resonant $R = \pi^0, \eta, \eta'$ contributions. The resonance contributions give intermediate photon transverse momenta. However, these contributions can be eliminated by imposing windows on di-photon invariant mass. We study and quantify individual box contributions (leptonic, quarkish). The electron/positron boxes dominate at low $M_{\gamma\gamma}$ $<\tilde{}1\tilde{}$GeV di-photon invariant masses. The PbPb$\to$PbPb$\gamma\gamma$ cross section is calculated within equivalent photon approximation in the impact parameter space. Several differential distributions are presented and discussed. We consider four different kinematic regions. We predict cross section in the (mb-b) range for typical ALICE 3 cuts, a few orders of magnitude larger than for the current ATLAS or CMS experiments. We also consider the two-π^0 background which can, in principle, be eliminated at the new kinematical range of the ALICE 3 measurements by imposing dedicated cuts on di-photon transverse momentum and $slash$or so-called vector asymmetry.

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