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Evidence for light-by-light scattering and searches for axion-like particles in ultraperipheral PbPb collisions at s_{NN}=5.02TeV (Article) (Open Access)

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Abstract

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Evidence for the light-by-light scattering process, γγ→γγ, in ultraperipheral PbPb collisions at a centre-of-mass energy per nucleon pair of 5.02TeV is reported. The analysis is conducted using a data sample corresponding to an integrated luminosity of 390μb^{-1} recorded by the CMS experiment at the LHC. Light-by-light scattering processes are selected in events with two photons exclusively produced, each with transverse energy E_T^{γ}>2GeV, pseudorapidity $|\eta^{\gamma}|$<2.4, diphoton invariant mass $m^{\gamma\gamma}$>5GeV, diphoton transverse momentum $p_T^{\gamma\gamma}$<1GeV, and diphoton acoplanarity below 0.01. After all selection criteria are applied, 14 events are observed, compared to expectations of 9.0±0.9(theo) events for the signal and 4.0±1.2(stat) for the background processes. The excess observed in data relative to the background-only expectation corresponds to a significance of 3.7 standard deviations, and has properties consistent with those expected for the light-by-light scattering signal. The measured fiducial light-by-light scattering cross section, $\sigma_{fid}(\gamma\gamma\to\gamma\gamma)$=120±46(stat)±28(syst)±12(theo)nb, is consistent with the standard model prediction. The $m^{\gamma\gamma}$ distribution is used to set new exclusion limits on the production of pseudoscalar axion-like particles, via the (Figure presented.) process, in the mass range (Figure presented.).

SciVal Topic Prominence

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Author keywords

CMS Light-by-light PbPb Photoproduction UPC

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