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Measurements of light-by-light scattering and lepton pair photoproduction in PbPb collisions with the CMS experiment

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Ultrapерipheral lead-lead collisions at $\sqrt{s_{NN}} = 5.02$ TeV produce very large photon fluxes that provide the conditions to study photon-photon fusion processes in phase space regions inaccessible with proton-proton data. Measurements of light-by-light (LbyL) scattering and lepton pair photoproduction in ultraperipheral PbPb collisions will be presented with data collected by the CMS detector during the LHC Run 2. These processes open up a unique window through which to search for physics beyond the standard model, e.g., the LbL study allows for competitive searches for axion-like particles (ALPs) in the 5–100 GeV ALP mass range. The lepton pair photoproduction provides the first data-driven demonstration that the average transverse momentum of photons emitted from relativistic heavy ions has an impact parameter dependence, the latter determined based on the number of neutrons detected in the very forward pseudorapidity. All results are compared with quantum electrodynamics calculations and provide crucial new tests and constraints on models of photon-induced interactions in ultraperipheral collisions.

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