

Overview of recent UPC measurements with the ATLAS Detector

Wednesday 27 August 2025 11:20 (20 minutes)

Relativistic heavy-ion collisions at the LHC generate intense electromagnetic fields, enabling a rich program of photon-induced processes in ultra-peripheral collisions (UPCs). This talk presents an overview of recent UPC measurements by the ATLAS Collaboration, spanning precision tests of quantum electrodynamics, probes of nuclear structure, and searches for physics beyond the Standard Model. Exclusive dilepton production provides stringent constraints on nuclear photon fluxes, their impact parameter dependence, and photon energy spectra. Measurements with forward neutron tagging further refine the impact parameter sensitivity, while tau-pair production offers a unique probe of the tau lepton's anomalous magnetic moment. Beyond QED and QCD studies, UPCs provide a unique environment for exotic searches. A dedicated search for magnetic monopoles via the Schwinger mechanism is presented with comparisons to semiclassical predictions and MoEDAL's results. The large photon flux in UPCs also enables the first observation of coincident production of $\gamma\gamma \rightarrow \mu^+\mu^-$ and a ρ meson in UPC. These results can provide tighter constraints on photon fluxes and nuclear charge form factors, as well as insights into nuclear gluon PDFs, beyond those from inclusive ρ meson photoproduction. Diffractive photonuclear processes, including exclusive J/ψ production, offer insights into nuclear gluon structure and spatial fluctuations. Additionally, jet production in UPCs is explored as a new probe of nuclear PDF modifications, with measurements disentangling photo-nuclear, diffractive, and two-photon processes. These data constrain nuclear PDFs in poorly explored kinematic regimes and may reveal the radial dependence of nuclear modifications. Together, these results demonstrate the versatility of UPCs in probing fundamental physics—from precision QED and nuclear structure to exotic particle searches—highlighting the LHC's role as a photon-photon and photon-nucleus collider.

Author: SPEAKER, ATLAS

Co-author: MEONI, Evelin (Universita della Calabria e INFN (IT))

Presenter: SPEAKER, ATLAS

Session Classification: Parallel