



Contribution ID: 71

Type: **not specified**

## Electromagnetic processes in ultra peripheral lead-lead collisions with ATLAS

*Tuesday, 4 April 2017 09:00 (20 minutes)*

The large equivalent-photon fluxes accompanying Pb ion beams at the LHC initiate photon-photon and photonuclear interactions which dominate when the colliding nuclei have large impact parameter (ultra-peripheral collisions). These electromagnetically-induced processes are sensitive to the nuclear wave-function and in particular the nuclear modifications of the nucleon parton distribution functions (nPDFs). As such, they are complementary to the ongoing p+A program at RHIC and the LHC, as well as the upcoming electron-ion collider (EIC) program in the US. The absolute rates of single and multiple neutron emission into one or both zero-degree calorimeters (ZDCs) will be presented, to test theoretical predictions for the photon fluxes as well as the photonuclear absorption. High-mass dilepton pair continuum rates have been measured and compared with theoretical predictions to test expectations for two-photon interactions, and good agreement with model calculations is obtained. Finally, evidence for the elastic scattering of photons  $\gamma\gamma\rightarrow\gamma\gamma$  (“light-by-light” scattering) will be presented, a previously unobserved process made possible by the high photon flux and low event pileup provided by the LHC. While of intrinsic interest as a heretofore-unobserved standard model process, it has also been proposed as a clean channel for searches for beyond the standard model (BSM) physics.

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**Session Classification:** WG2 Low x and Diffraction

**Track Classification:** WG2) Low x and Diffraction