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First measurement of the forward rapidity gap distribution in pPb collisions at $\sqrt{s_{\mathrm{NN}}} = 8.16$ TeV with the CMS experiment

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We present, for the first time at LHC energies, the forward rapidity gap spectra from proton-lead collisions for both pomeron-lead and pomeron-proton topologies. The analysis is performed over 10.4 units of pseudo-rapidity at a nucleon-nucleon center-of-mass energy of 8.16 TeV, i.e. almost 300 times higher than previous measurements of diffractive production in proton-nucleus collisions. For the pomeron-lead topology the EPOS - LHC predictions are a factor of two below the unfolded data but the model does give a reasonable description of the shape of the spectrum. For the pomeron-proton topology the EPOS - LHC , QGSJET II and HIJING generator predictions are all at least a factor of five below the data. This effect can be explained by a significant contribution of ultra-peripheral photoproduction events mimicking the signature of diffractive processes. The obtained data may be of significant help in understanding the high energy limit of QCD and modeling cosmic ray air showers.

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