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UPC measurements with ALICE

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While HERA taught us that the proton is mainly occupied by gluons for Bjorken x < 10^{−2}, the LHC
gives the possibility to measure the gluonic structure of the proton and nuclei at Bjorken x ~ 10^{−5}.

Measurements of photon-induced reactions in ultra-peripheral collisions (UPCs) of Pb-Pb and p-Pb nuclei at the LHC have been performed with ALICE in the past years. In these reactions, the photon coming from the Pb nucleus is used as a probe to unveil information on parton distributions in the target (proton or Pb nucleus). While Pb-Pb UPCs are a tool to study shadowing at various centre- of-mass energies - hence various Bjorken-x scales - p-Pb UPCs may give hints on the saturation of gluons in the proton, as predicted by the color glass condensate effective field theory. Indeed, whereas the BFKL as well as DGLAP equations are linear and only include parton splitting, non- linear effects (BK/JMWLK evolution) may interfere at very low x.

In 2013, a measurement has been performed down to x ~ 3 × 10^{−5}, corresponding to a factor of two larger than the highest energy studied at HERA. No significant change in the gluon density behaviour of the proton between HERA and LHC energies was found. The data of p-Pb UPCs taken by the ALICE collaboration in 2016 have an enhanced luminosity, and the center-of-mass energy was increased by another factor 2: it should now be possible to reveal new constraints on the gluonic structure of the proton down to x ~ 8 × 10^{−6}.

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