



Ultra-peripheral collisions

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September 26, 2019, Děčín

Workshop supported by grant SVK30/19/F4

Druhý miniworkshop difrakce a ultraperiferálních srážek 26-27 September, 2019 Děčín, Česká republika

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log (1/x)

variables: Q² and x





The structure of the proton



H1 and Zeus, Eur.Phys.J. C75 (2015) no.12, 580

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Main contribution to the proton structure at small x in collinear pQCD, comes from the gluon distribution





What parton distribution?



Diehl: Eur. Phys. J. A (2016) 52: 149

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- Interactions at a an impact parameter (b) larger than the sum of radii of the incoming particles, are called **ultra-peripheral** collisions (UPC) and must involve at least one photon.
- LHC experiments are very efficient to determine if the incoming nucleus broke or not. Some interactions that involve at least one photon, do not break the nucleus, e.g. J/ψ exclusive/coherent production.













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$W_{\gamma p} = sqrt(2\omega 2E_p)$

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The rapidity of the vector meson determines the centre-of-mass energy of the photon-target interaction

Kinematics: energy and rapidity





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The -t dependence of vector meson production determines the transverse distribution of matter in the target!





The cross section



In general, there are two contributions. Each contribution is the product of: • the photon flux and • the photon-target cross section.

The cross section



The cross section

• the photon-target cross section.



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One term involves a low energy photon, the other a high energy photon. That is, a large x or a small x interaction

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FDD and MFT will play a role here!





Some events in ALICE







x related to $W\gamma p$ which is related to the rapidity of the vector meson

$A(x,Q^{2},\vec{\Delta})_{T,L} = i \int d\vec{r} \int_{0}^{1} \frac{dz}{4\pi} (\Psi^{*}\Psi_{V})_{T,L} \int d\vec{b} \ e^{-i(\vec{b} - (1-z)\vec{r})\cdot\vec{\Delta}} \frac{d\sigma_{dip}}{d\vec{b}}$

quark energy fraction

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approach, to fluctuations of the proton structure.

Fluctuations

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• Vector meson photoproduction accompanied of proton dissociation can be related, in a Good-Walker

Exclusive and dissociative J/ ψ production

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