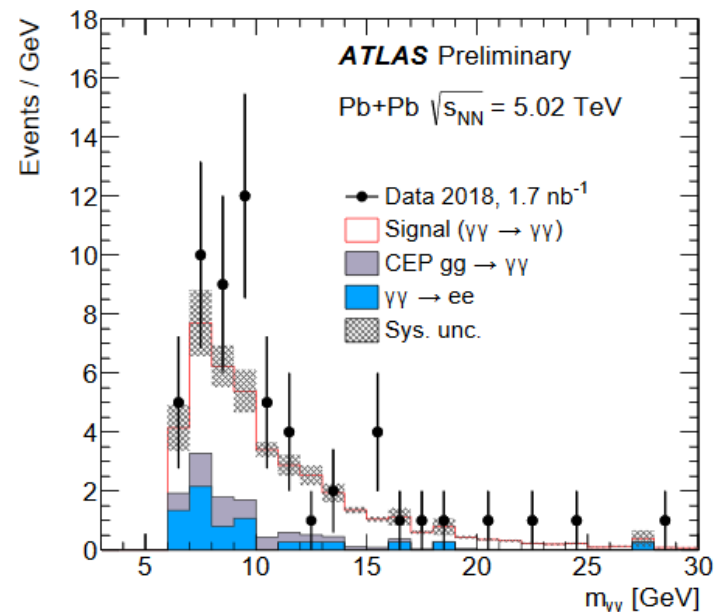
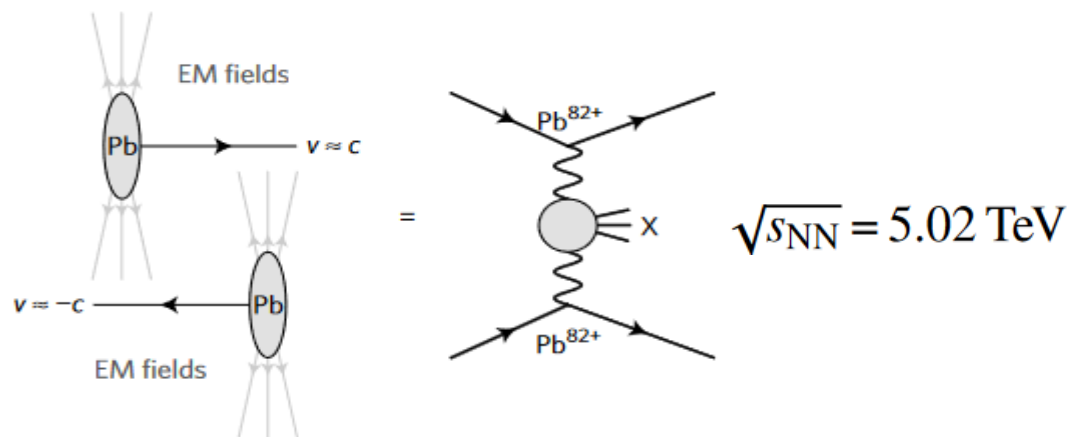


# Quasireal LbL process at the LHC

ultra-peripheral collisions of two lead ions



## ATLAS Collaboration,

Evidence for light-by-light scattering in heavy-ion collisions with the ATLAS detector at the LHC,  
*Nature Physics* 13, 852–858 (2017)

Significance:  $4.4\sigma$  ( $3.8\sigma$ )

$\sigma_{\text{fid}} = 70 \pm 24(\text{stat.}) \pm 17(\text{syst.}) \text{ nb}$

Predicted:  $45 \pm 9 \text{ nb}$ ,  $49 \pm 10 \text{ nb}$

## CMS Collaboration,

Evidence for light-by-light scattering and searches for axion-like particles in ultraperipheral PbPb collisions at  $\sqrt{s_{\text{NN}}} = 5.02 \text{ TeV}$ ,  
*arXiv:1810.04602* (2018)

Significance:  $4.1\sigma$  ( $4.4\sigma$ )

$\sigma_{\text{fid}} = 120 \pm 46(\text{stat.}) \pm 28(\text{syst.}) \pm 4(\text{theo.}) \text{ nb}$

Predicted:  $138 \pm 14 \text{ nb}$

## ATLAS Collaboration,

Observation of light-by-light scattering in ultraperipheral Pb+Pb collisions with the ATLAS detector,  
*arXiv:1904.03536* (2019)

Significance:  $8.2\sigma$  ( $6.2\sigma$ )

$\sigma_{\text{fid}} = 78 \pm 13(\text{stat.}) \pm 7(\text{syst.}) \pm 3(\text{lumi.}) \text{ nb}$

Predicted:  $49 \pm 5 \text{ nb}$ ,  $48 \pm 5 \text{ nb}$