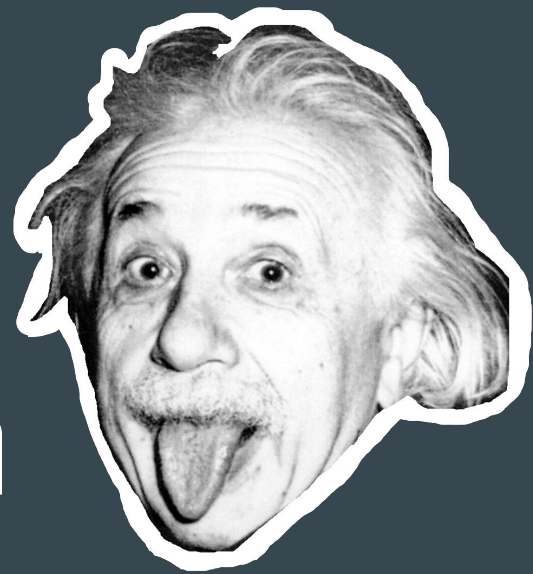




$E = mc^2$ in action

...

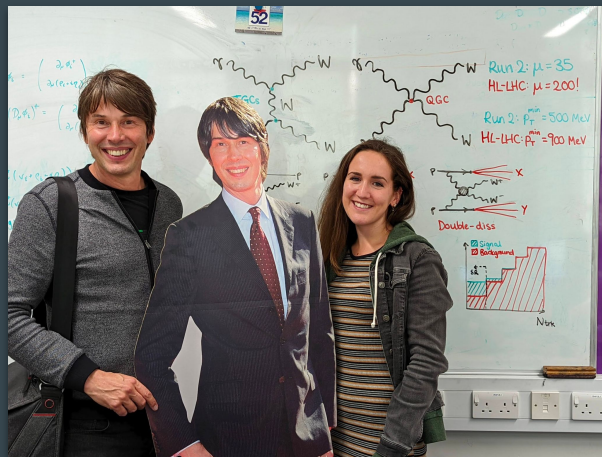
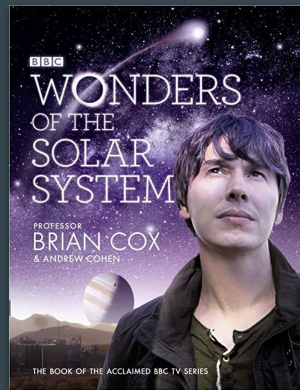
Creating matter from light at the LHC

Savannah Clawson



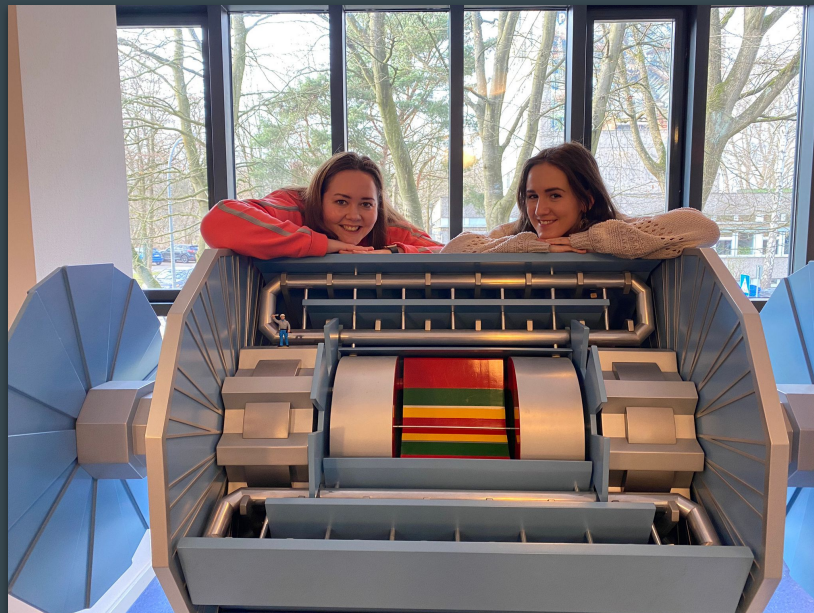
A bit about me

- Degree (MPhys) and PhD from the University of Manchester (UK)
- Supervised by Profs Brian Cox and Andy Pilkington



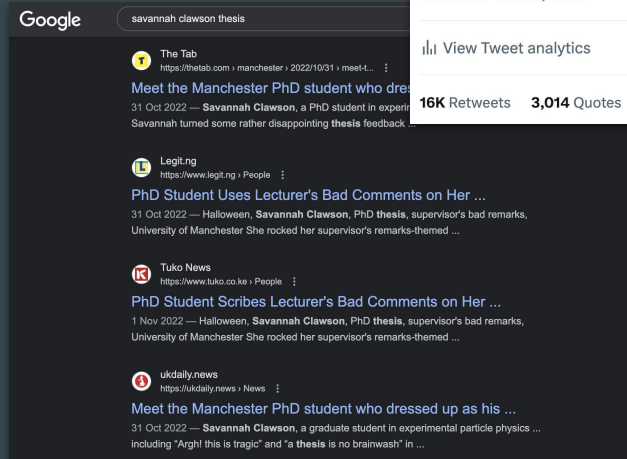
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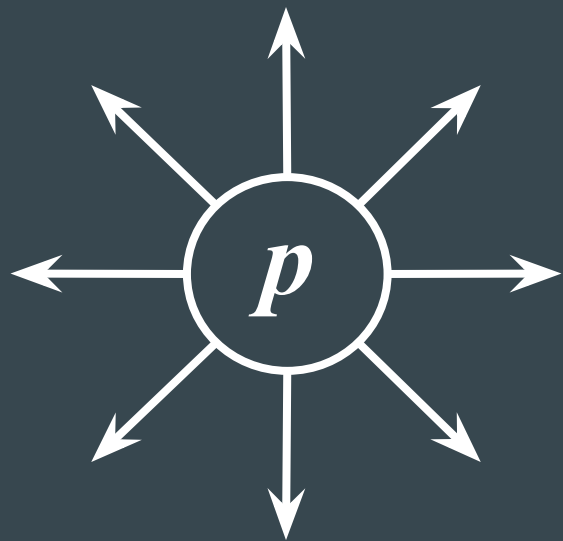


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- Working on photon fusion analyses at the ATLAS experiment
- Twitter (in)famous

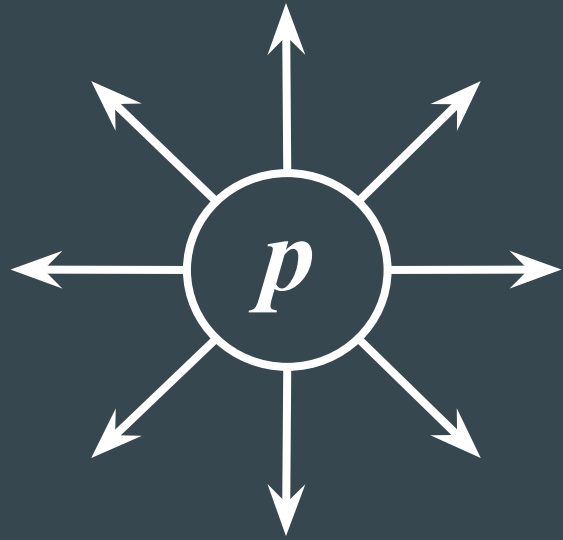


The Large ~~Hadron~~ Photon Collider..?

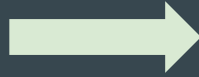


Speed = 0 ms^{-1}

Protons have an electric field



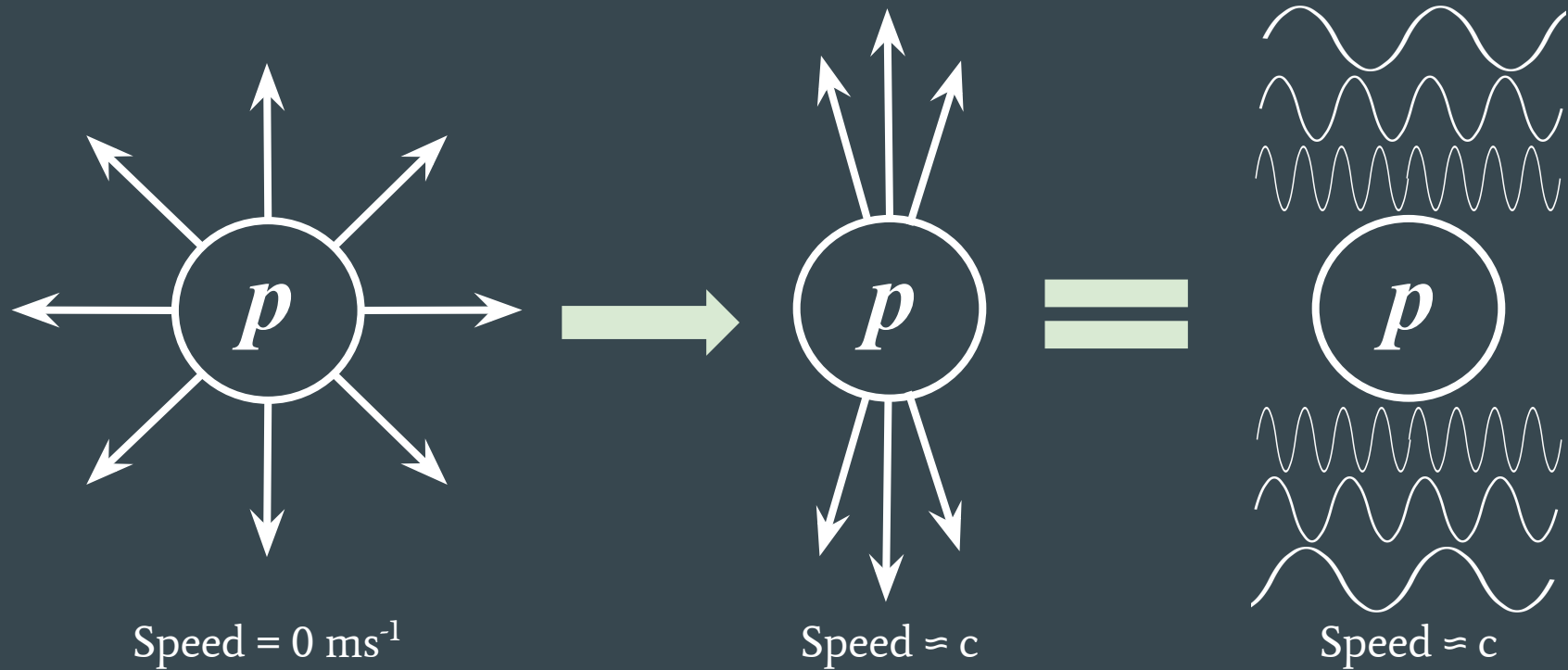
Speed = 0 ms^{-1}



Speed $\approx c$

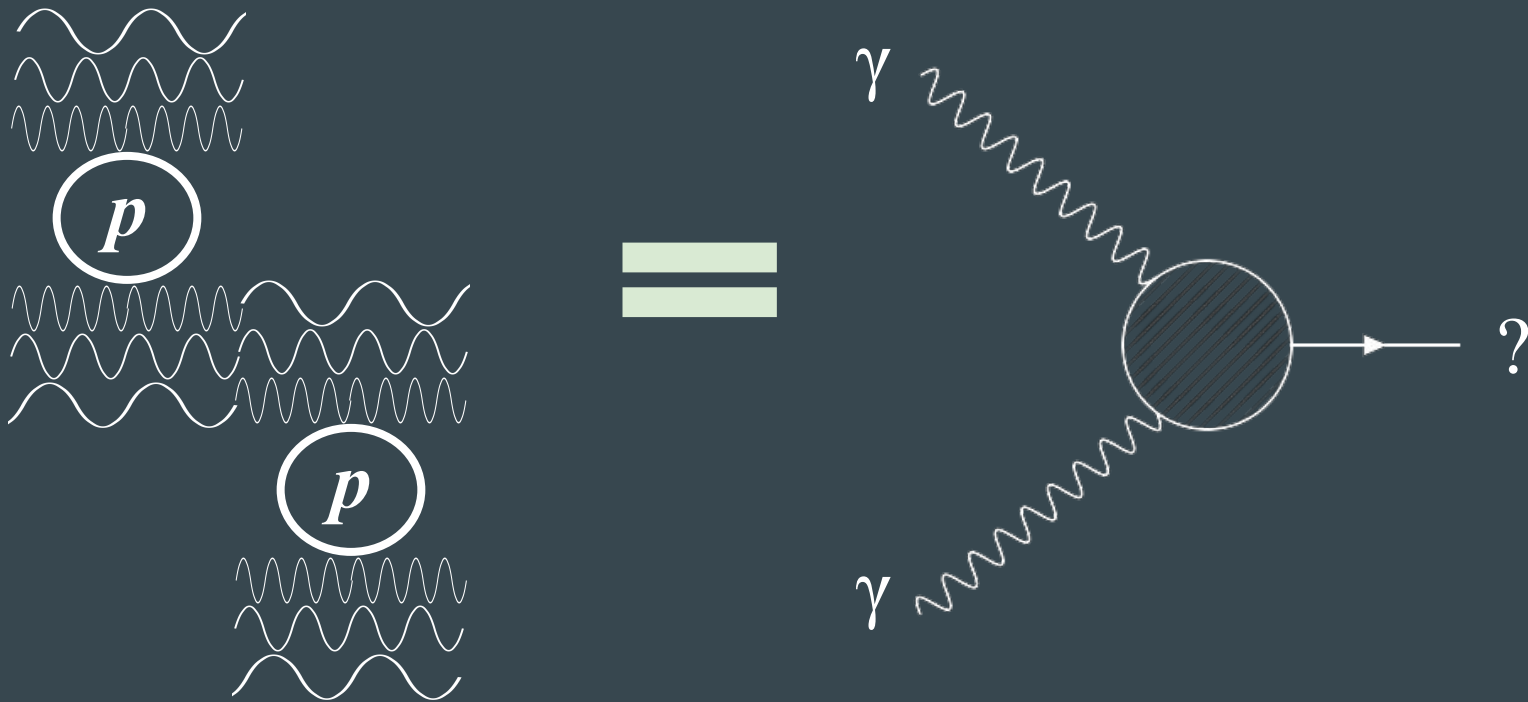
At ultra-relativistic speeds, the field is highly compressed along the direction of motion

We can model this boosted field as a source of coherent high energy photons

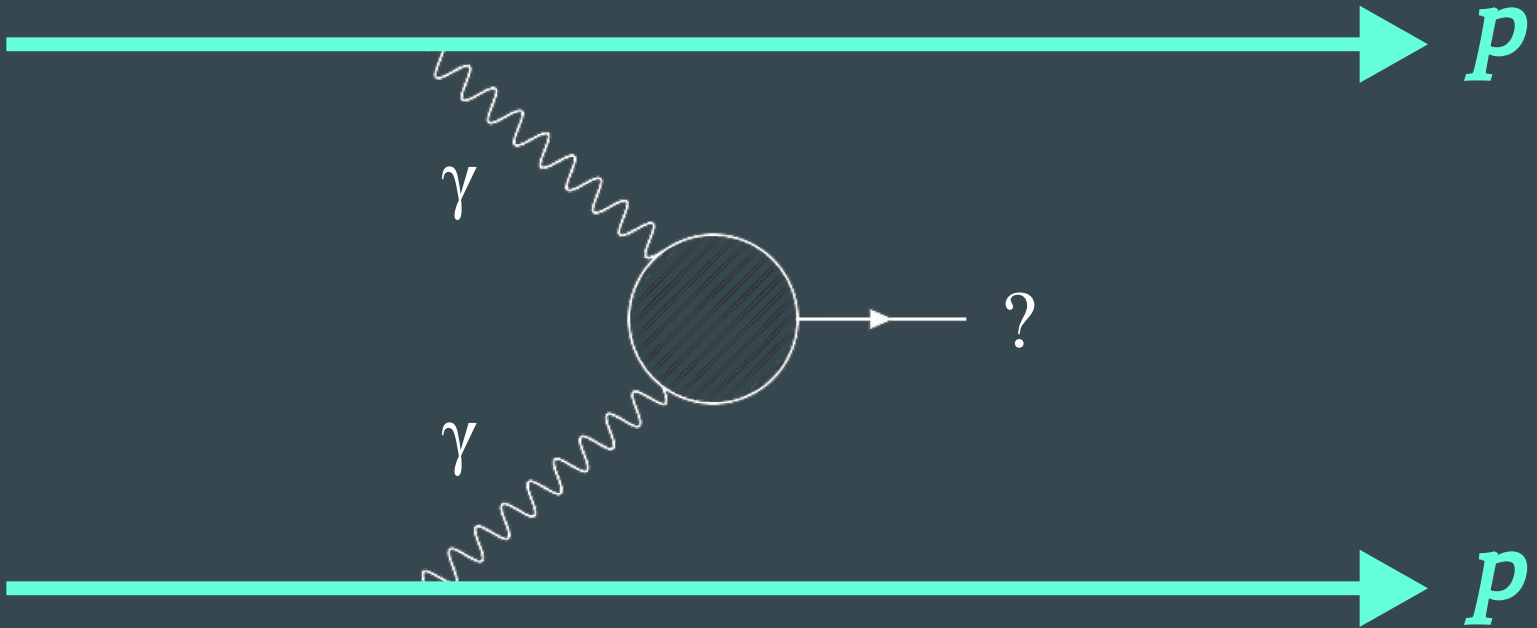


This model is called the Equivalent Photon Approximation (EPA)

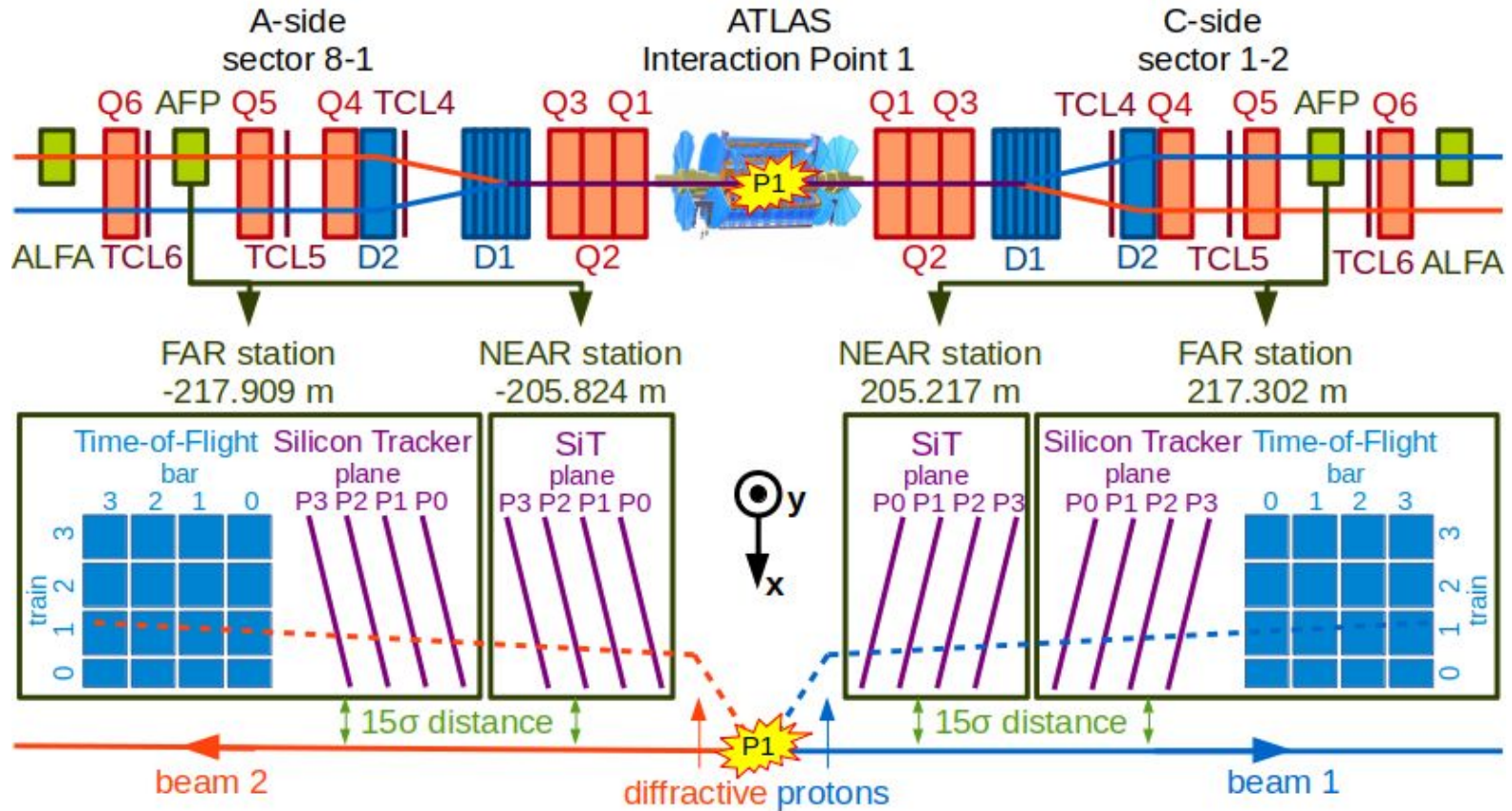
Leading to high energy photon collisions at the LHC!



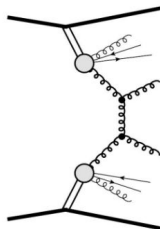
And (often) leaving the protons unscathed



We can detect these “forward” protons with dedicated spectrometers

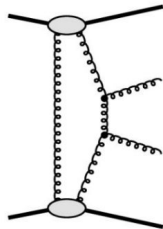


With lots of interesting physics potential



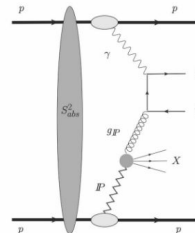
Diffractive jets

ATL-PHYS-PUB-2017-012



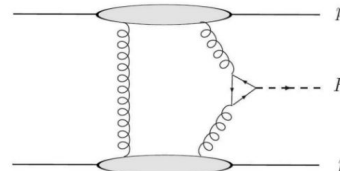
Exclusive jets

Trzebinski et al [1503.00699](#)



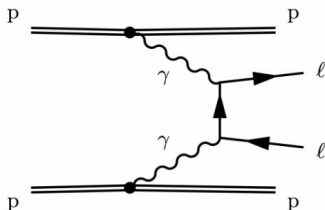
Top quarks

Goncalves et al [2007.04565](#)
Howarth [2008.04249](#)



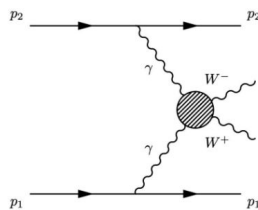
Higgs boson

Cox et al [0709.3035](#)
Heinemeyer et al [0708.3052](#)



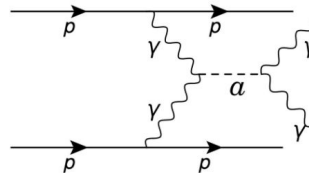
Leptons

CMS [1803.04496](#)
ATLAS [2009.14537](#)



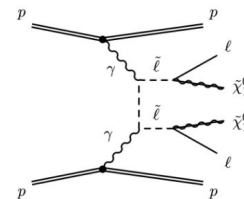
W bosons

Tizchang & Etesami [2004.12203](#)
Baldenegro et al [2009.08331](#)



Axion-like particles

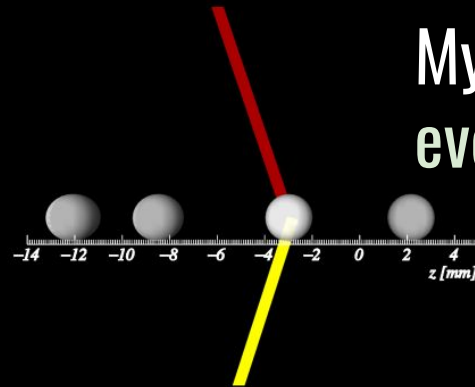
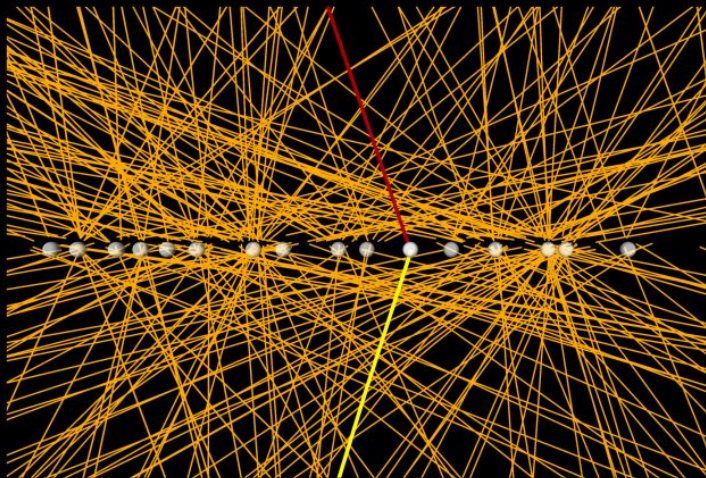
Fichet et al [1312.5153](#)
Baldenegro et al [1803.10835](#)



SUSY dark matter

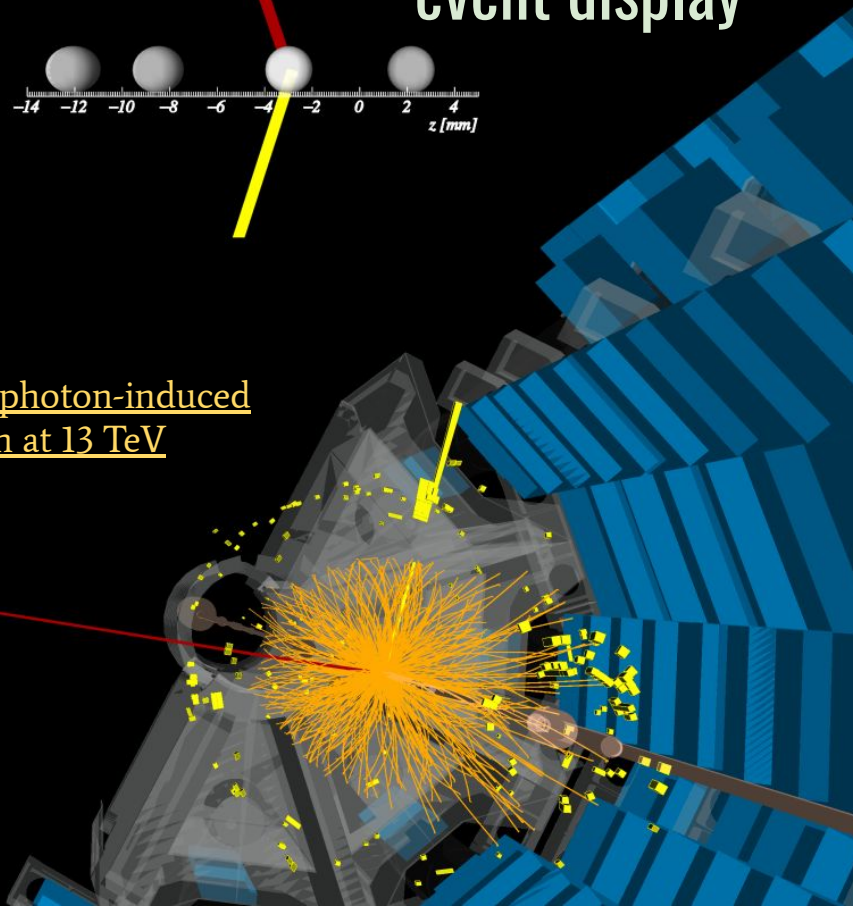
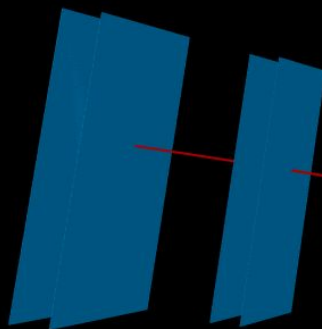
Beresford & JL [1811.06465](#)
Harland-Lang et al [1812.04886](#)

Important probes of nonperturbative QCD & electroweak scale
Interesting searches for physics beyond the Standard Model



My favourite ~~plot~~
event display

Observation of photon-induced
WW production at 13 TeV



ATLAS
EXPERIMENT

Run: 357620
Event: 653219636
2018-08-06 01:08:33 CEST

Questions?

Find out more about me and my work:



savannah.clawson@cern.ch



@savannahclawson

