Dark Matter

Jimmy

Is it Real?

Bullet Cluster

- Chandra x-ray observatory: the collision of two clusters of galaxies.
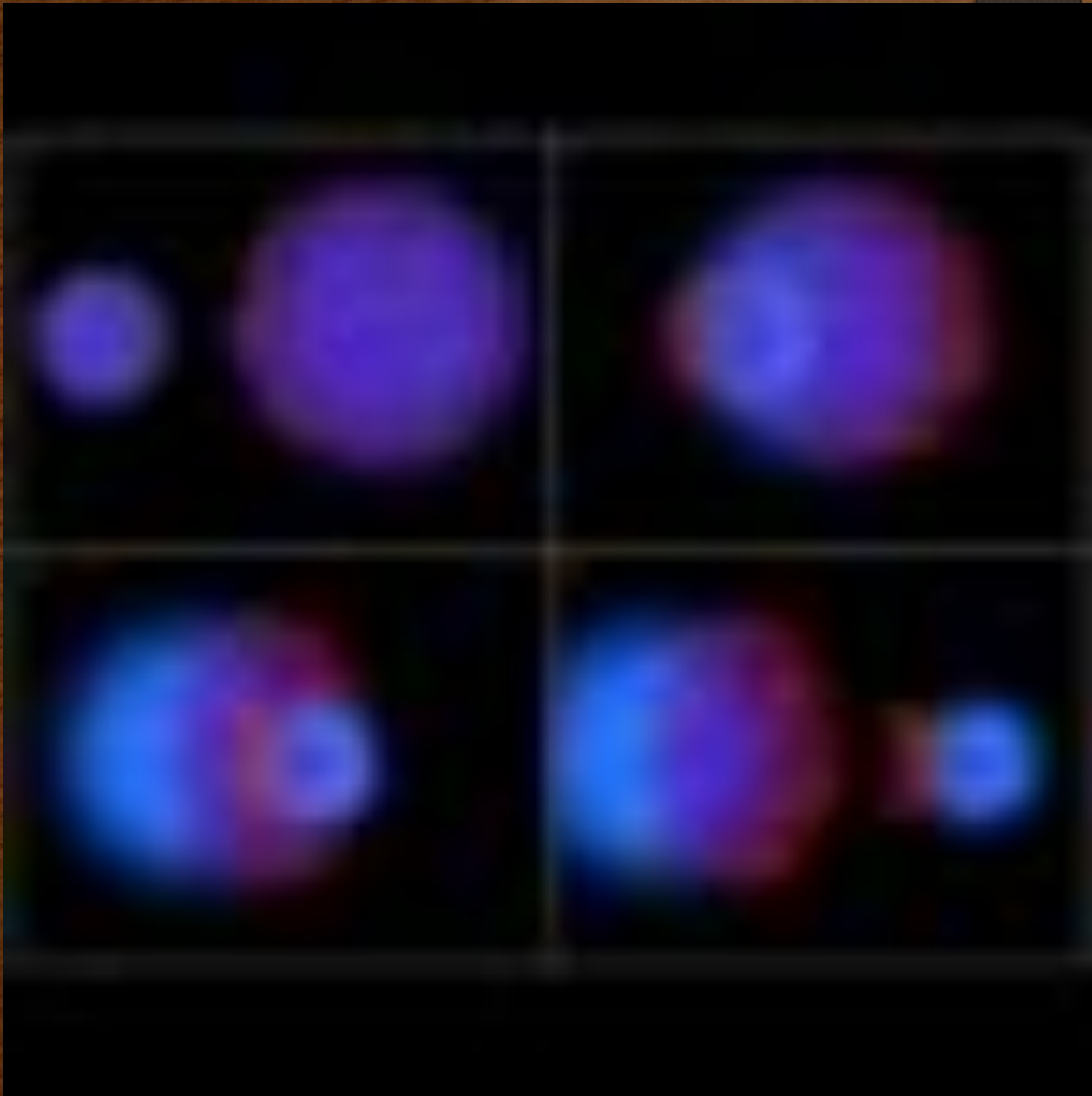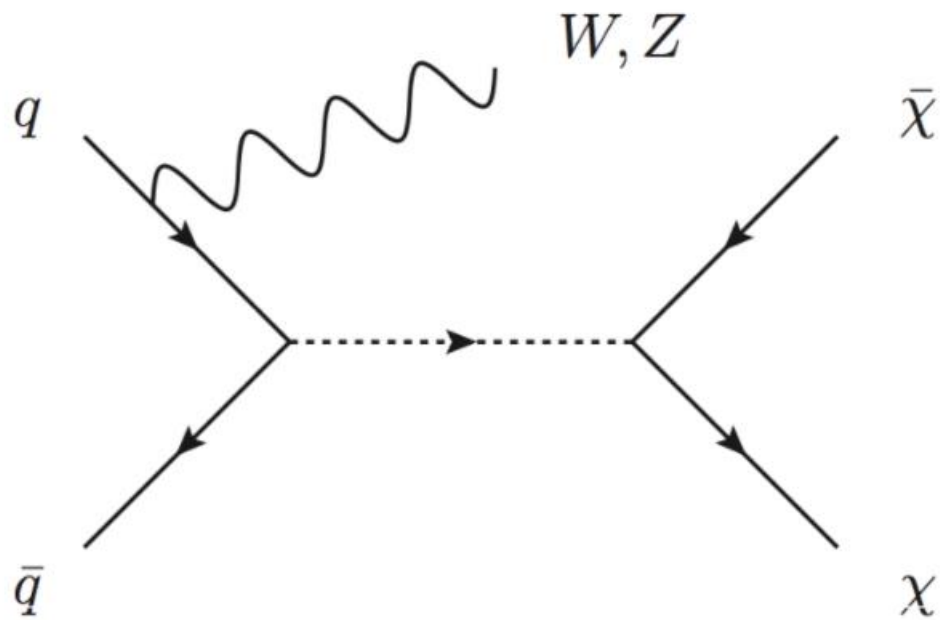
Z' search

- U(1) symmetry model

- Little Higgs model

- Arises in the models because they have a SU(2) group added to them apart from the standard model SU(2) gauge group

- The z' groups and z groups mix from the necessity that the z' couple to weak isospin carrying particles.

- SU(2) x SU(2)' Symmetry is spontaneously broken at the scale of TeV

Production at LO

1) W,Z production by ISR

2) W,Z production by unknown proccess
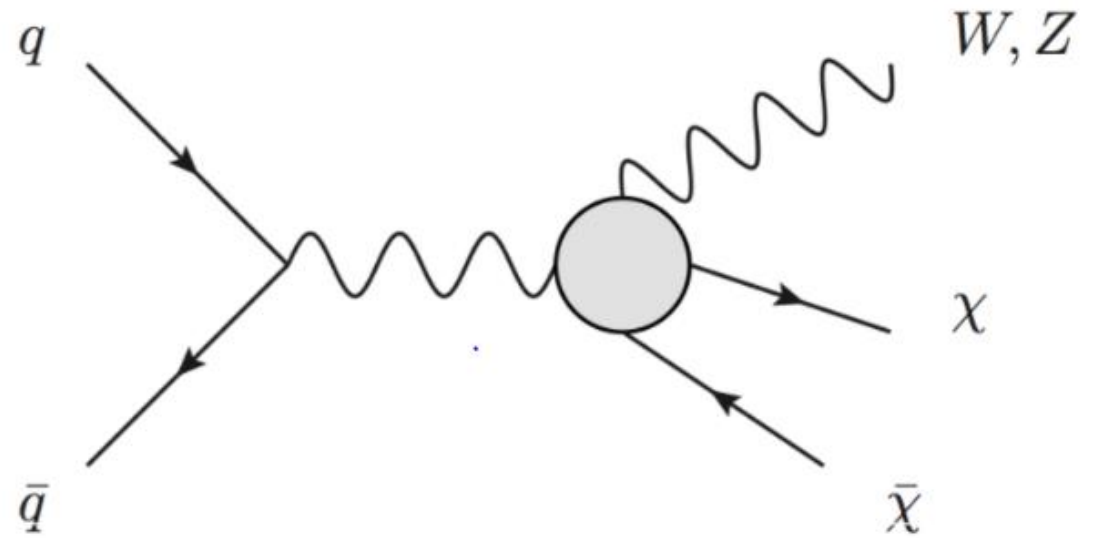
Background

- Z + jets (lepton + jets)
- W + jets
- ttbar

Signal Region

- Jet + Etmiss channel with boosted jets
  - Large-R clustered jets
  - Recoiling dark matter from a boosted vector boson
- No leptons as the vector boson decays to jets

Cross-sections

Interactions of constituents of the colliding protons, the so called partons (quarks, gluons)

proton 1

proton 2

$\vec{p}_{P_1}$

$\vec{p}_{P_2}$
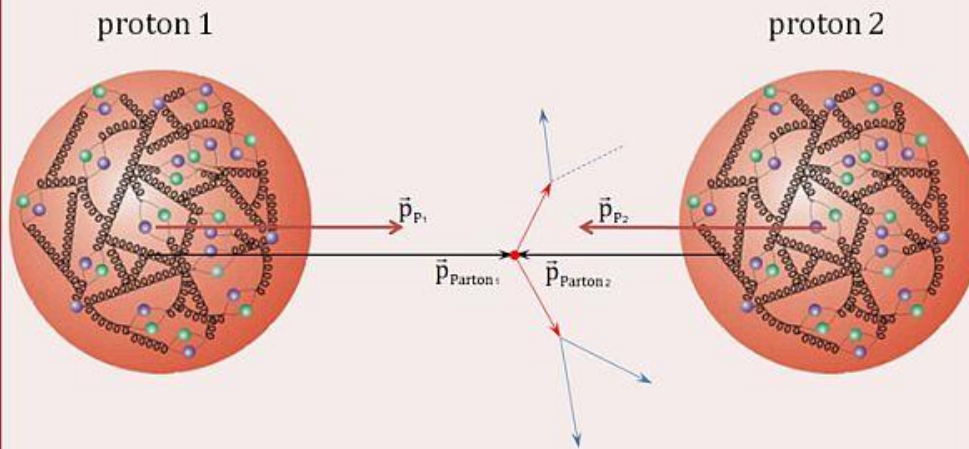
$\vec{p}_{Parton_1}$ $\vec{p}_{Parton_2}$

$\vec{p}_{P_1}$ ... momentum proton 1

$\vec{p}_{P_1}$ ... momentum proton 2

•   interaction vertex

$\vec{p}_{Parton_1}$ ... momentum parton 1

$\vec{p}_{Parton_2}$ ... momentum parton 2

Cross Section for z' (simplified EFT)

Where do the PDFs and Scales come in?

$$\sigma \propto \frac{g_\chi^2 g_q^2}{\left(Q^2 - M^2\right)^2 + M^2 \Gamma^2} \approx \frac{g_\chi^2 g_q^2}{M^4} = \frac{1}{M_\star^4},$$

Things to be Done

- PDF and Scale uncertainties on the acceptance of the signal

- Jet matchng uncertainty

- Pythia8 tune uncertainties

- ISR uncertainties

- Tagger efficiency study at 13 TeV

- Background cut optimization