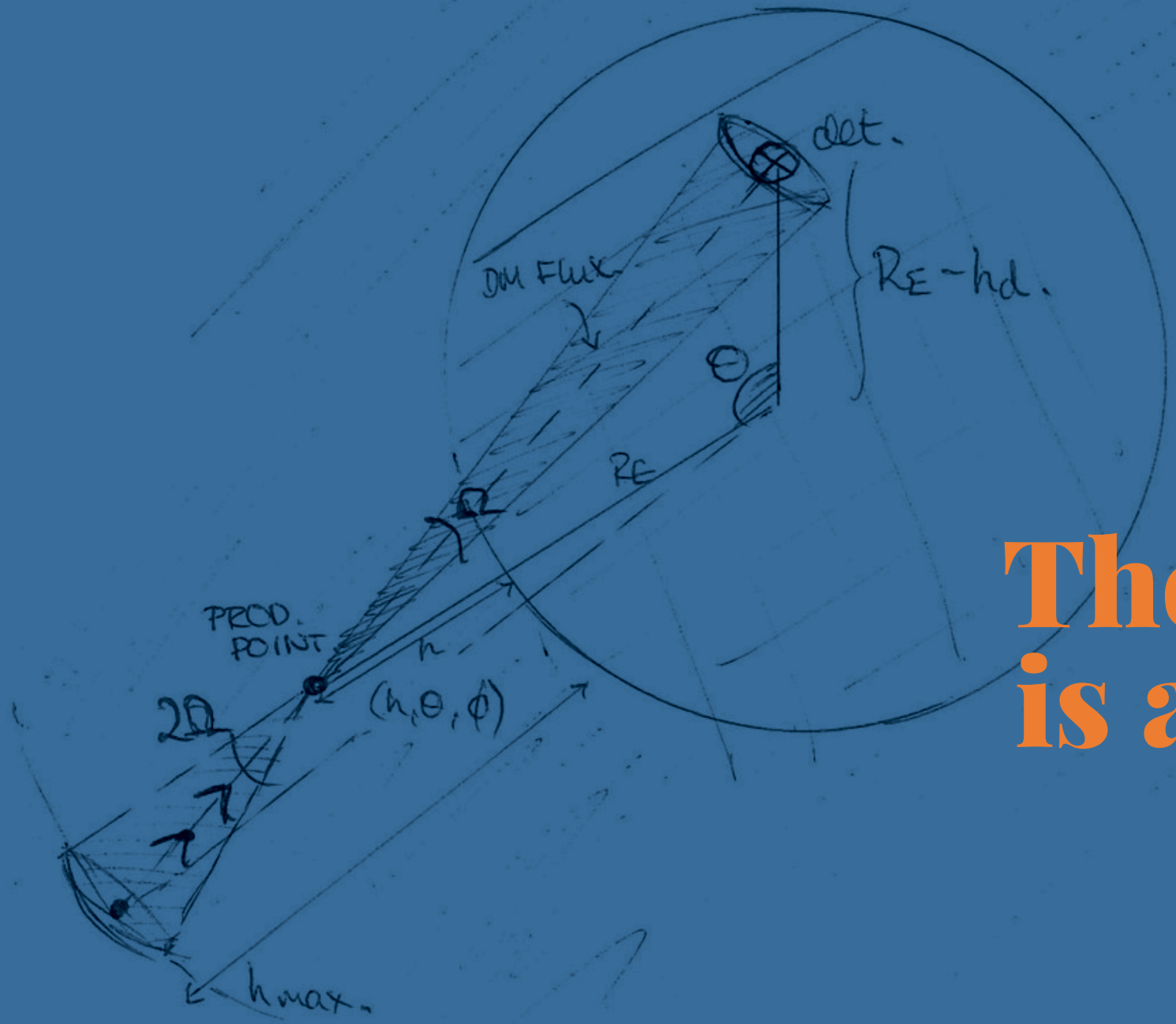
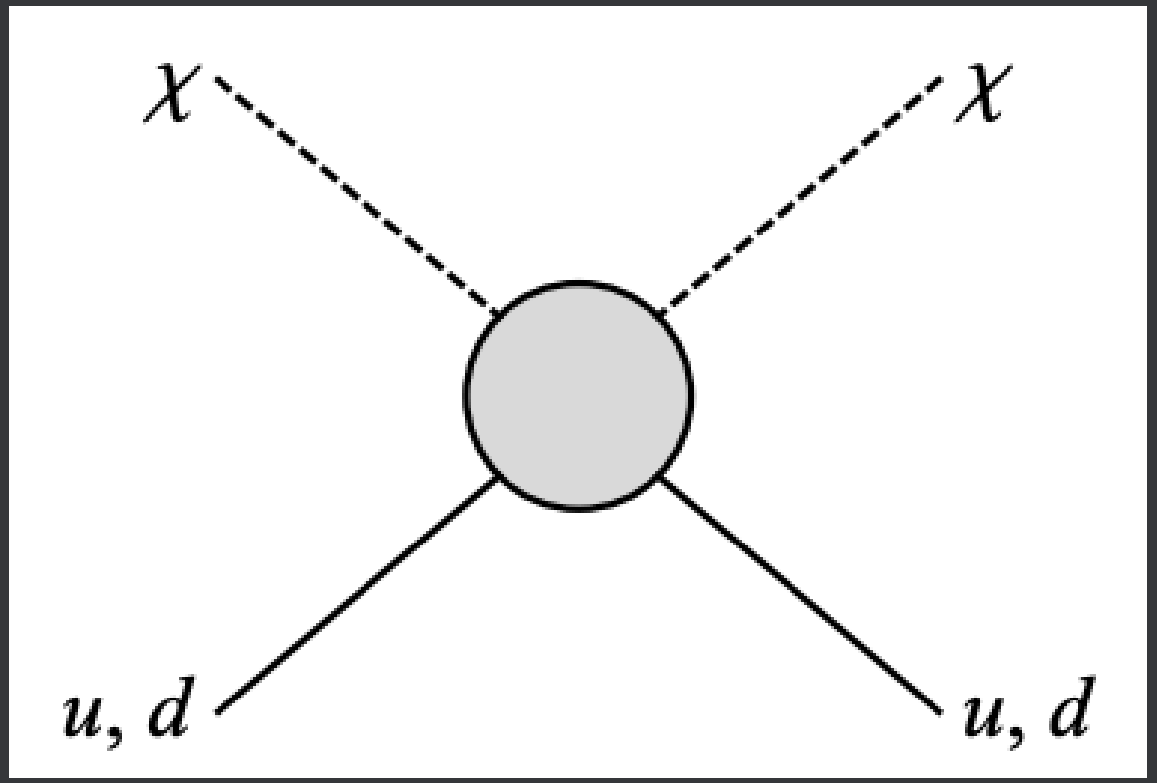
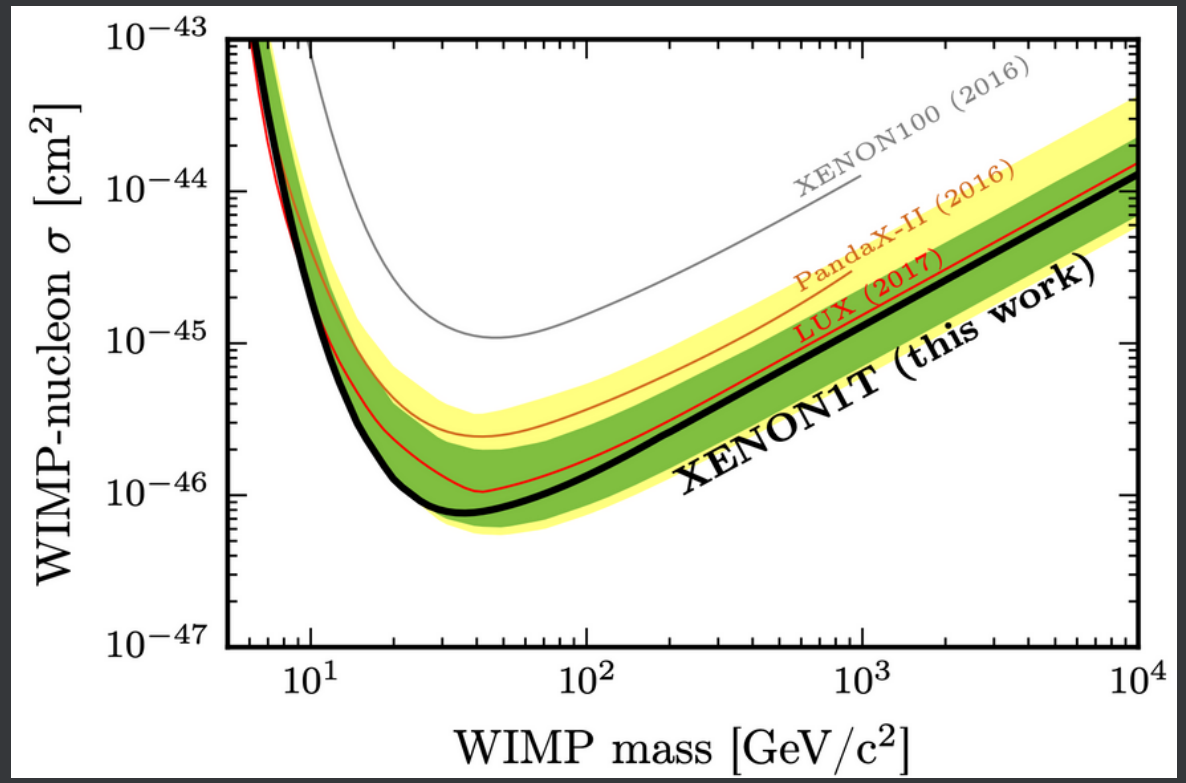


The Atmosphere is a Beam Dump

James Alvey
King's College, London

Based on 1905.05776 in collaboration with M. Campos, M. Fairbairn, and T. You

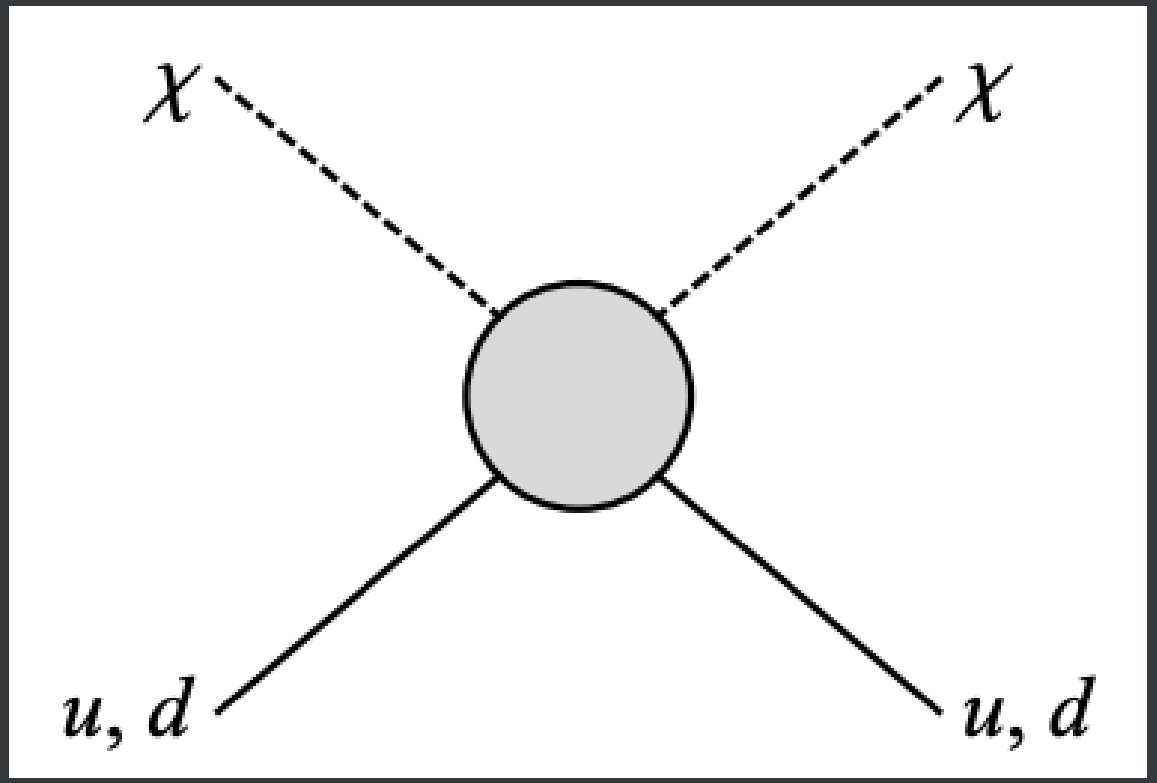


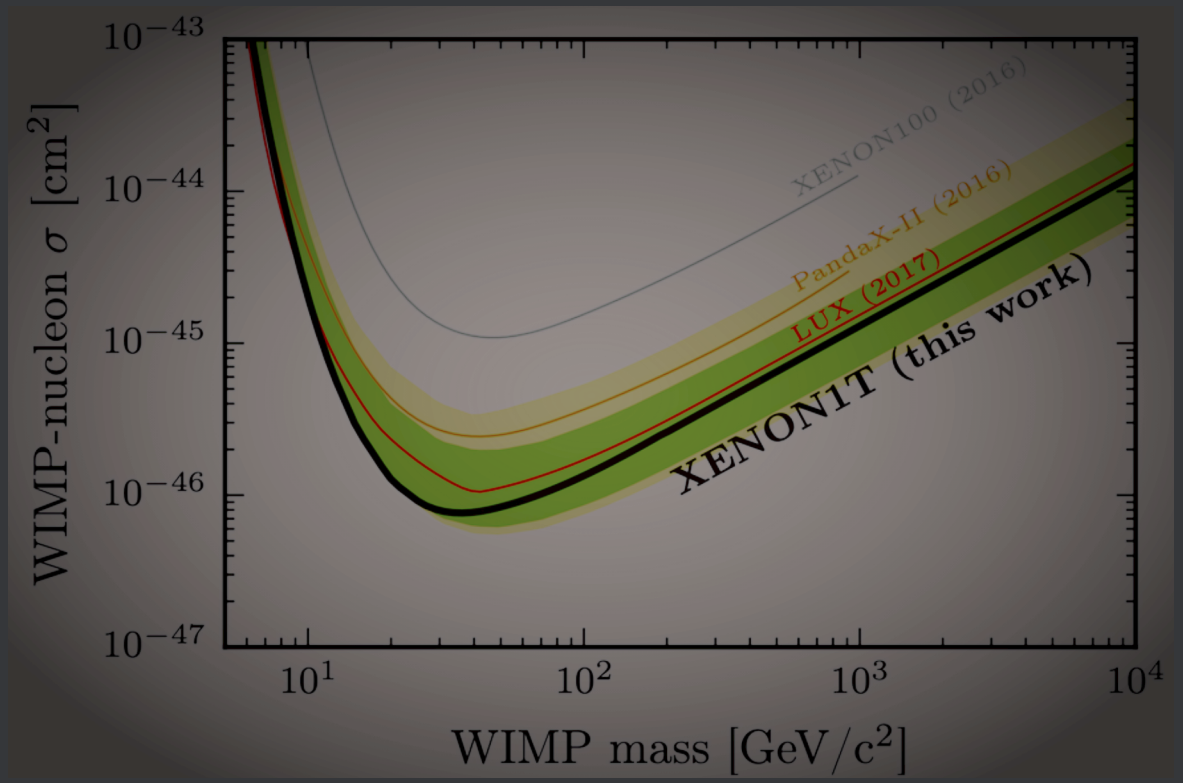


Direct Detection

Experiments **lose sensitivity** at low dark matter masses due to small nuclear recoils

Left: Bateman et al. (2014), **Right:** Xenon Collaboration (2017)





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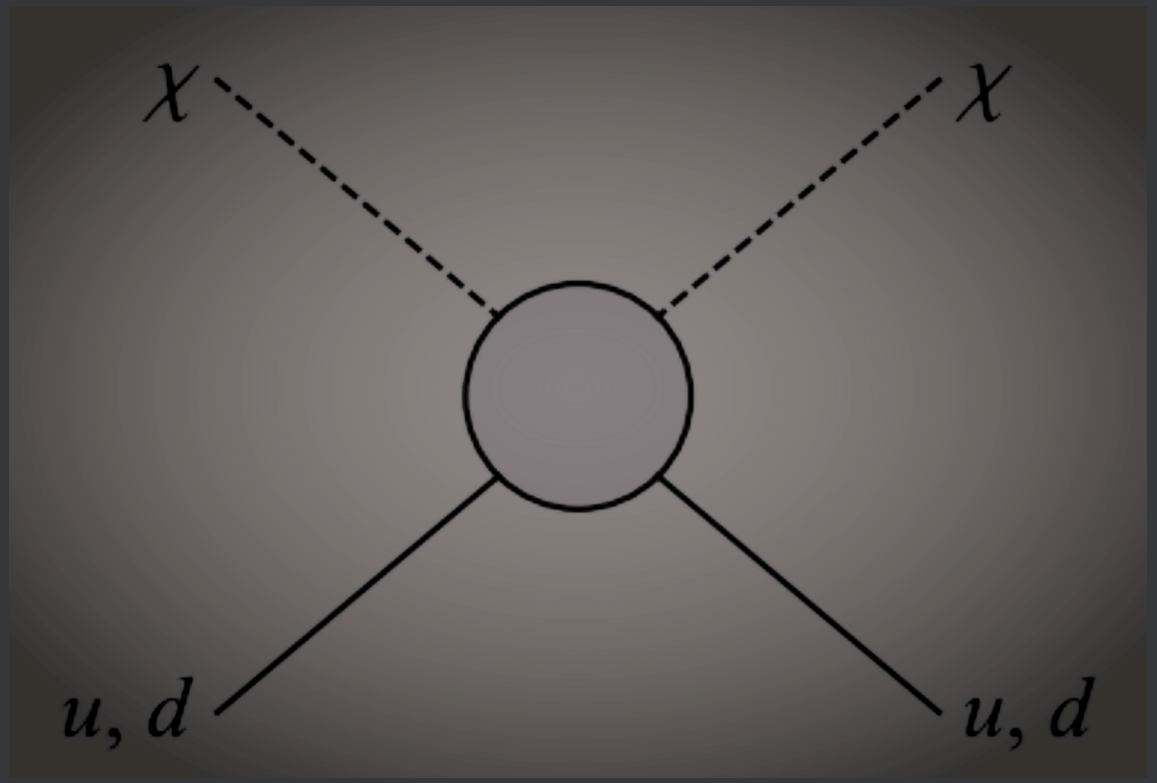

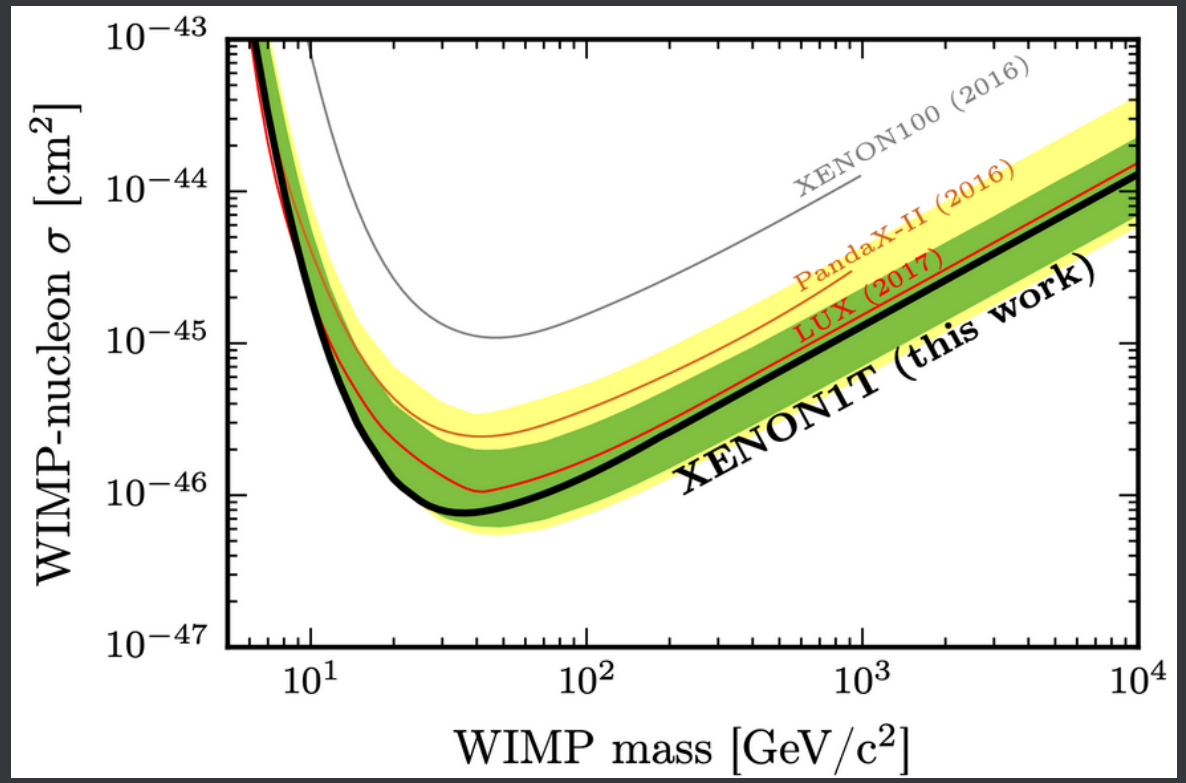

Direct Detection

Experiments **lose sensitivity** at low dark matter masses due to small nuclear recoils

Left: Bateman et al. (2014), **Right:** Xenon Collaboration (2017)

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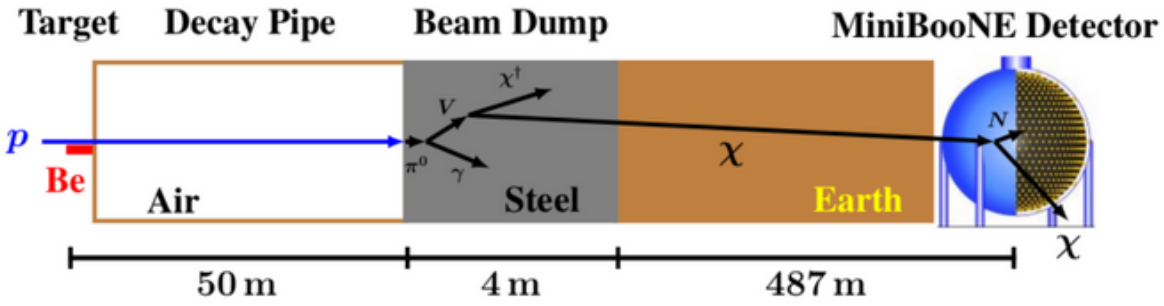
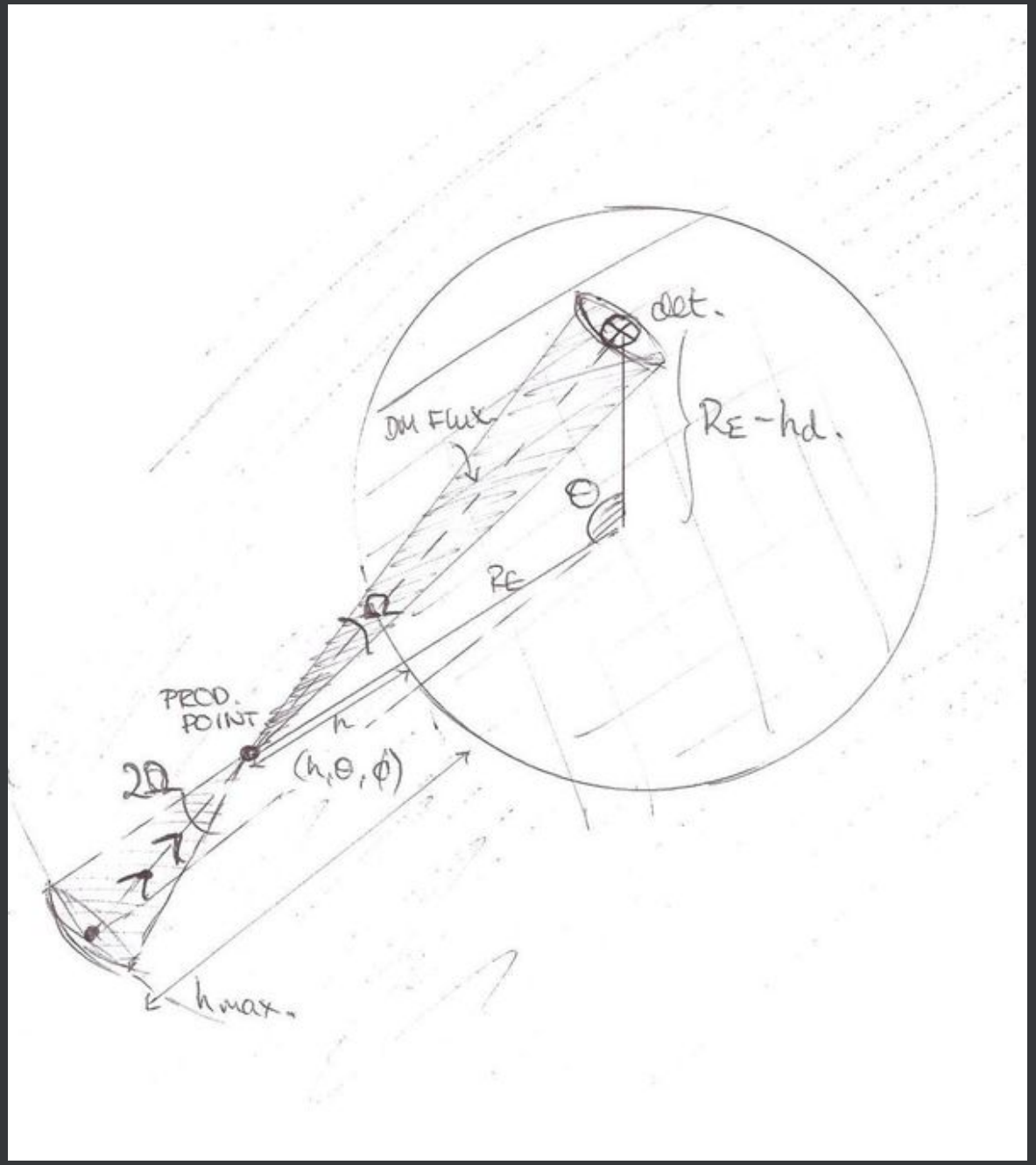
Collider Experiments

In traditional beam dump experiments like **MiniBooNe**, the accelerated protons are directed at a fixed target with a detector collinear with the beam.



Using the Atmosphere

In our scenario, the protons come from **cosmic rays**, the flux of which is measured by balloon experiments like AMS



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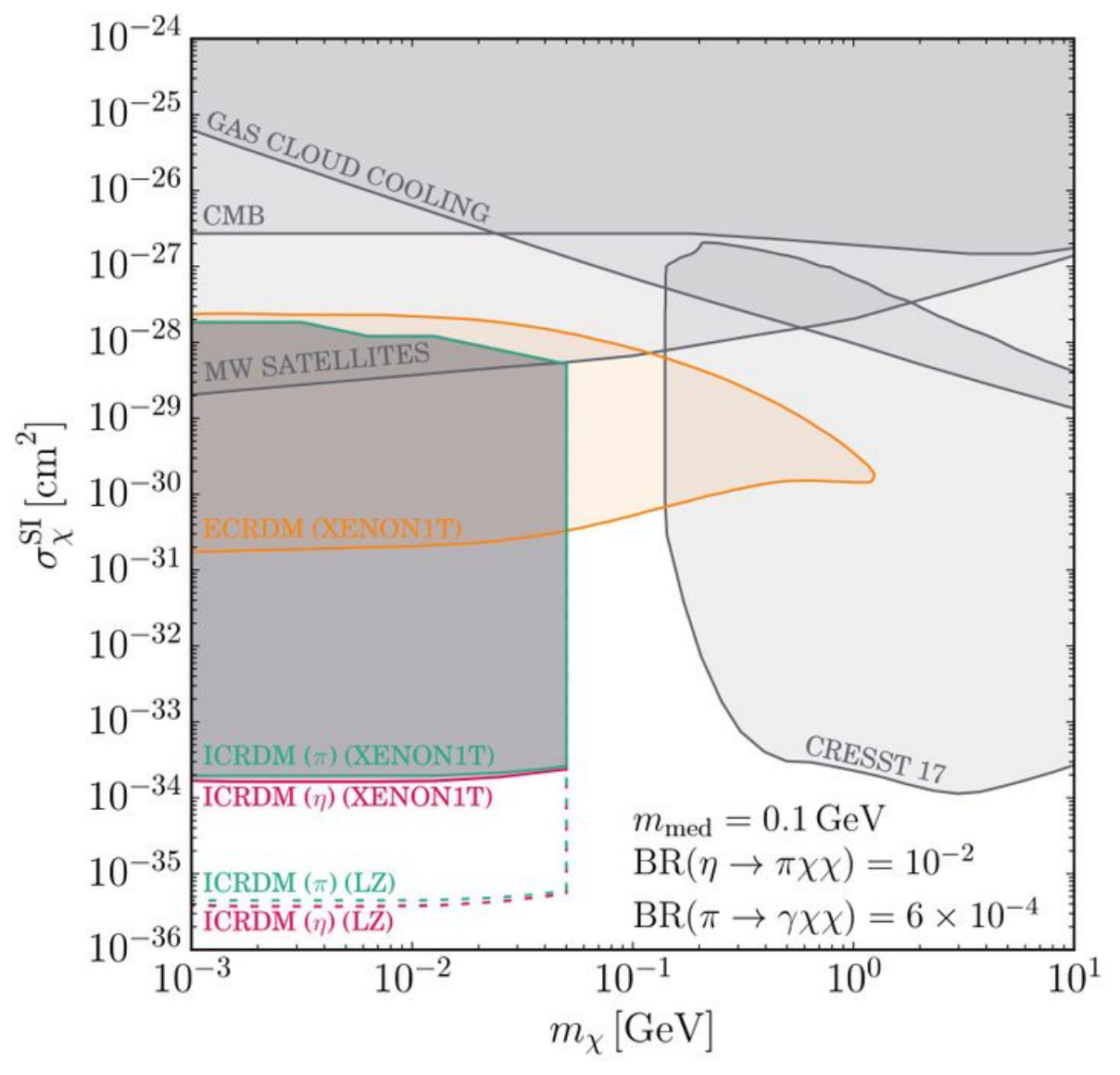
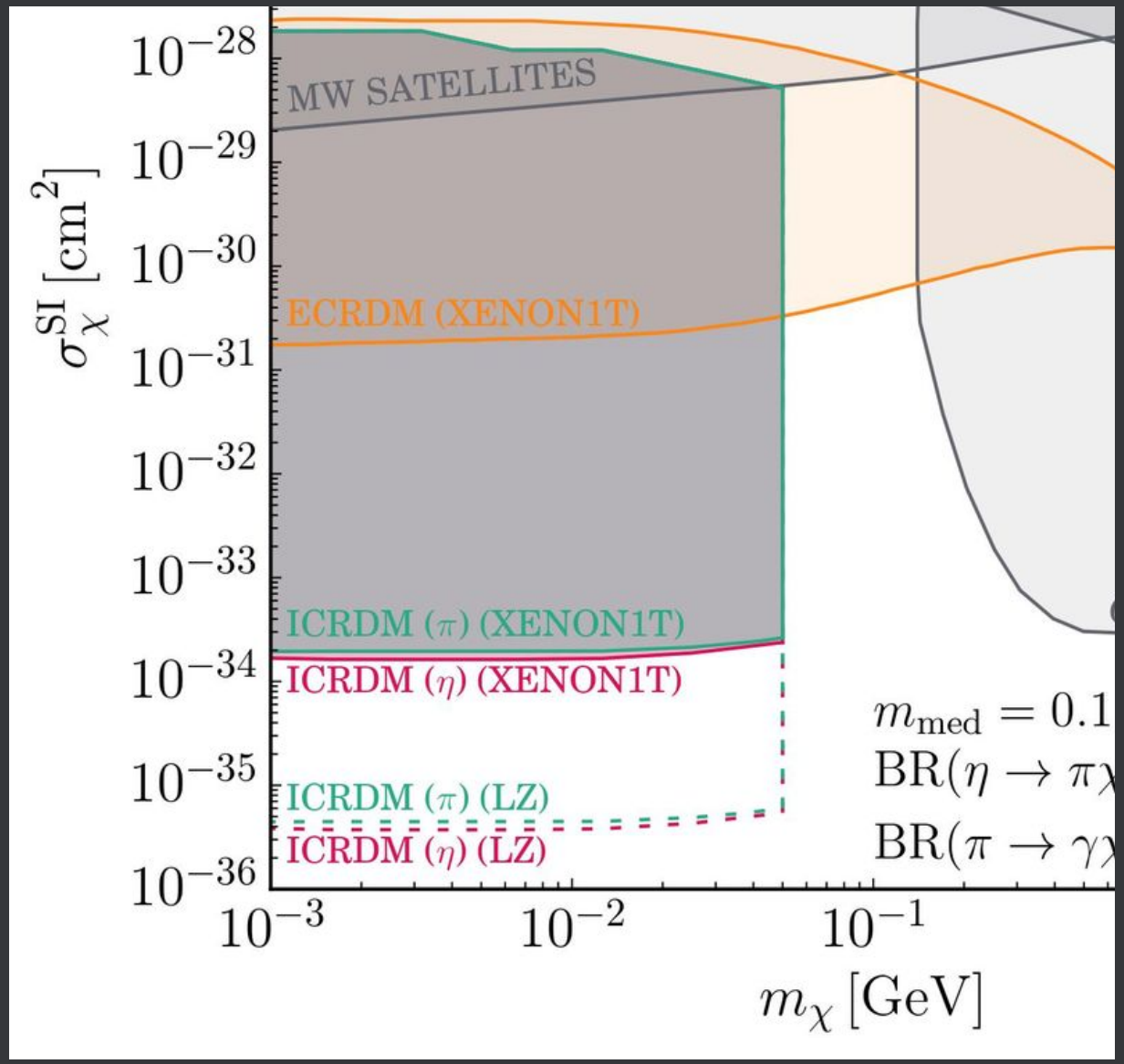


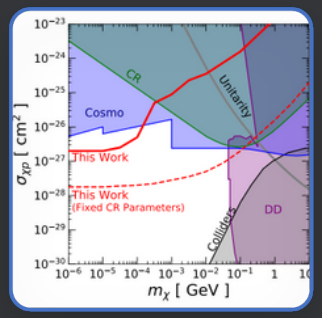
- Consider production of the dark matter from pions and eta mesons
- Opens new low mass window for direct detection experiments



- Consider production of the dark matter from pions and eta mesons
- Opens new low mass window for direct detection experiments

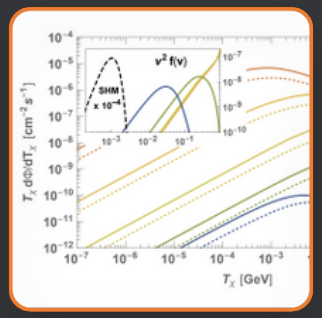
Cosmic Ray Dark Matter (CRDM)

Recently a small sub field has developed exploring these ideas



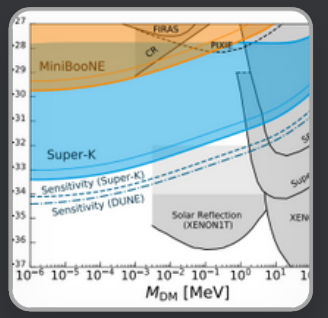
Cappiello et al.

Effect of elastic collisions on CR spectrum



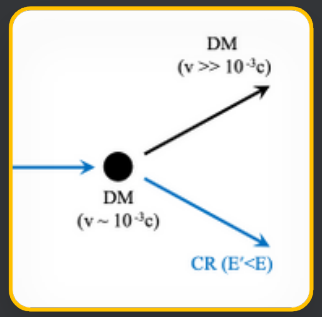
Bringmann et al.

Elastic Proton-DM Collisions



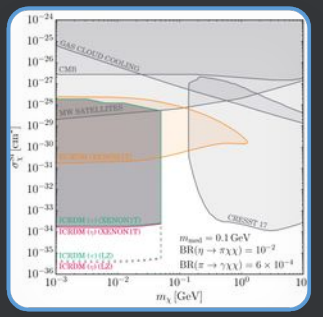
Ema et al.

Elastic collisions of electrons with DM



Cappiello et al.

Elastic CRDM at neutrino experiments



Alvey et al.

Inelastic CRDM production

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