

Direct Detection Signals from Absorption of Fermionic Dark Matter

J. A. Dror, G. Elor, **Robert McGehee**

1905.12635, 1908.XXXXX

DPF 2019, 8/1/2019

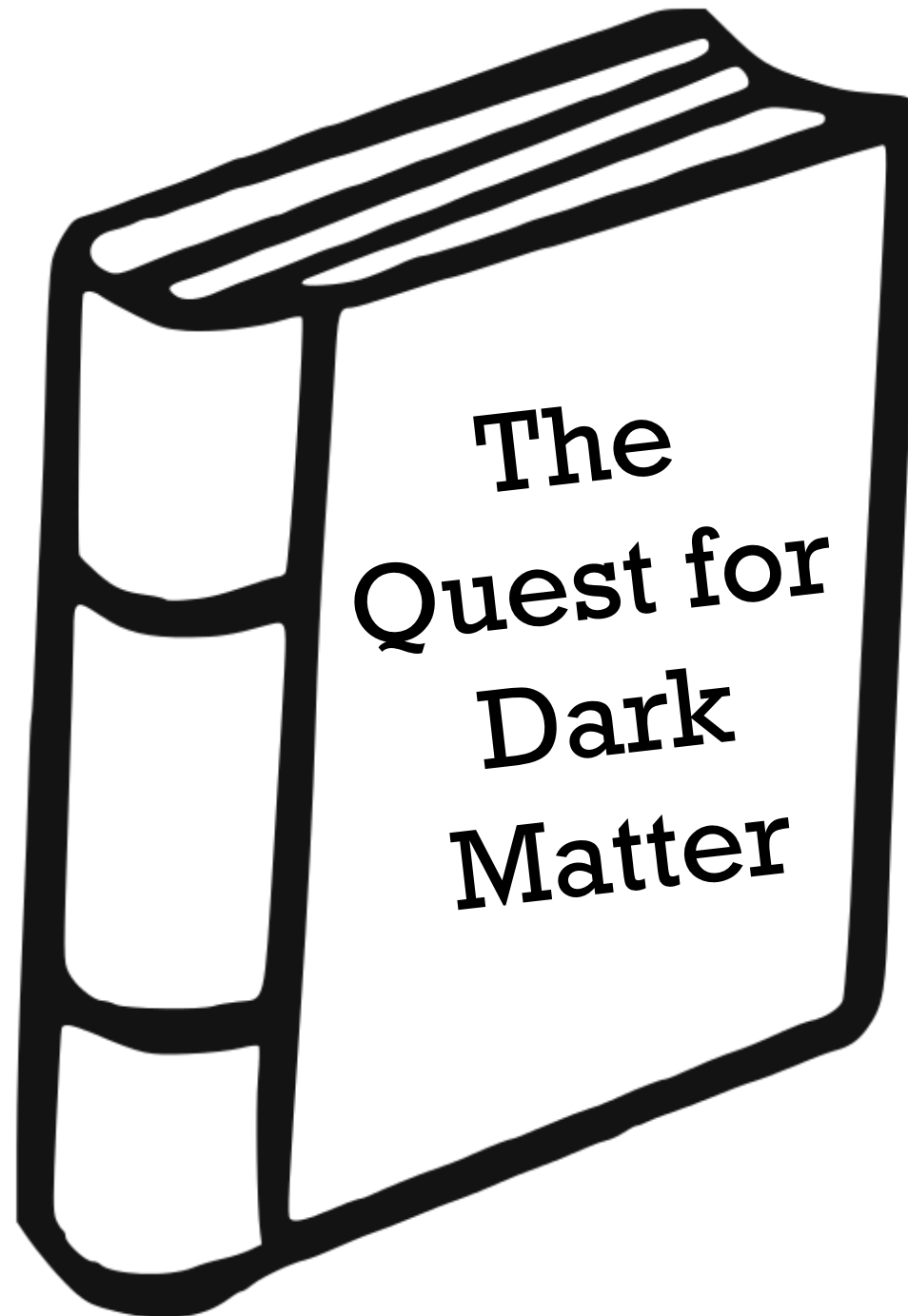


Disclaimer

You're probably tired...it's Day 4, after Lunch...

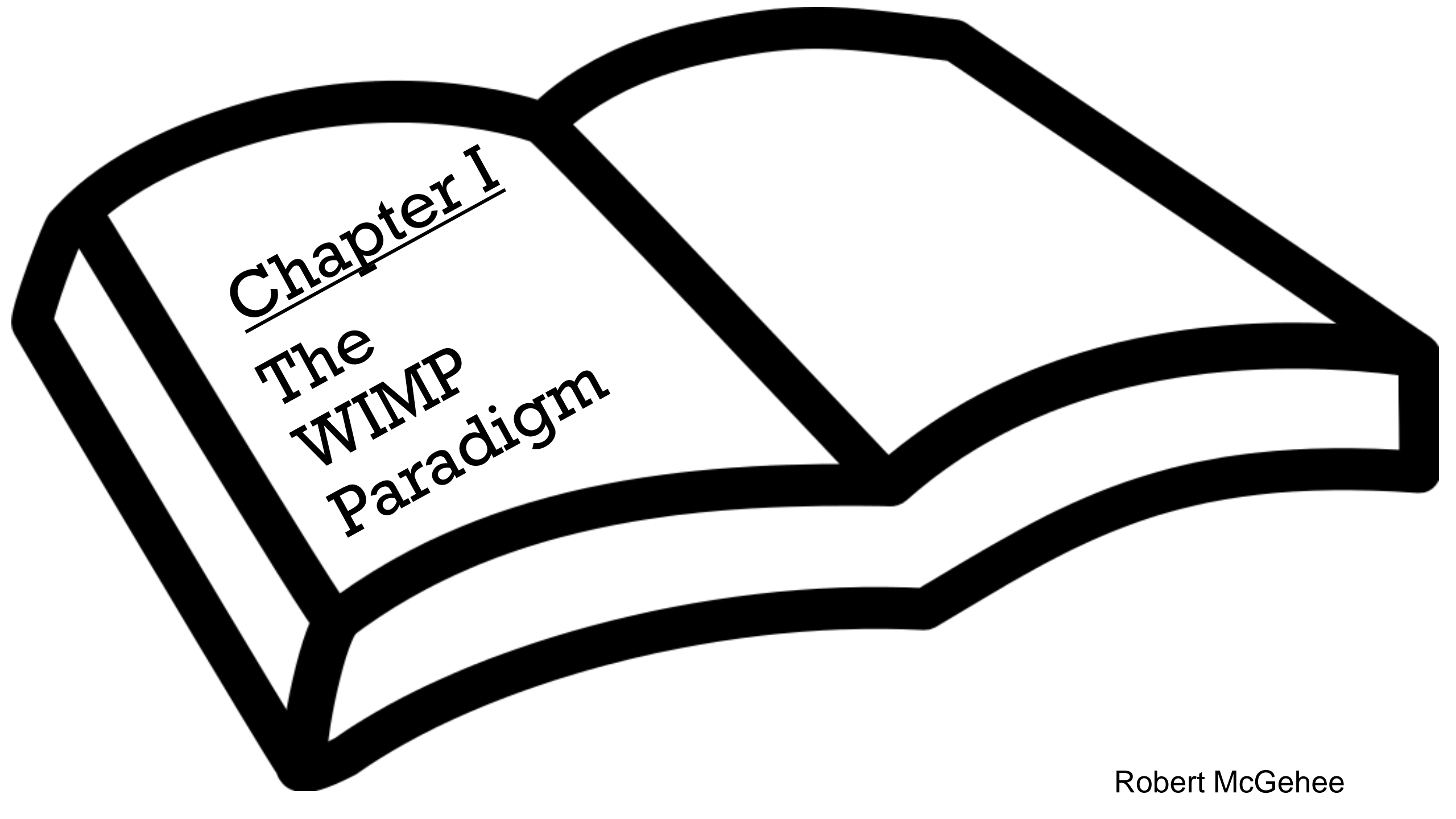
My promises to you:

- This slide has **by far** the most text (besides the summary).
 - I'll start my talk with story time!
 - There's not a single equation!
 - I've hidden a picture of Einstein!



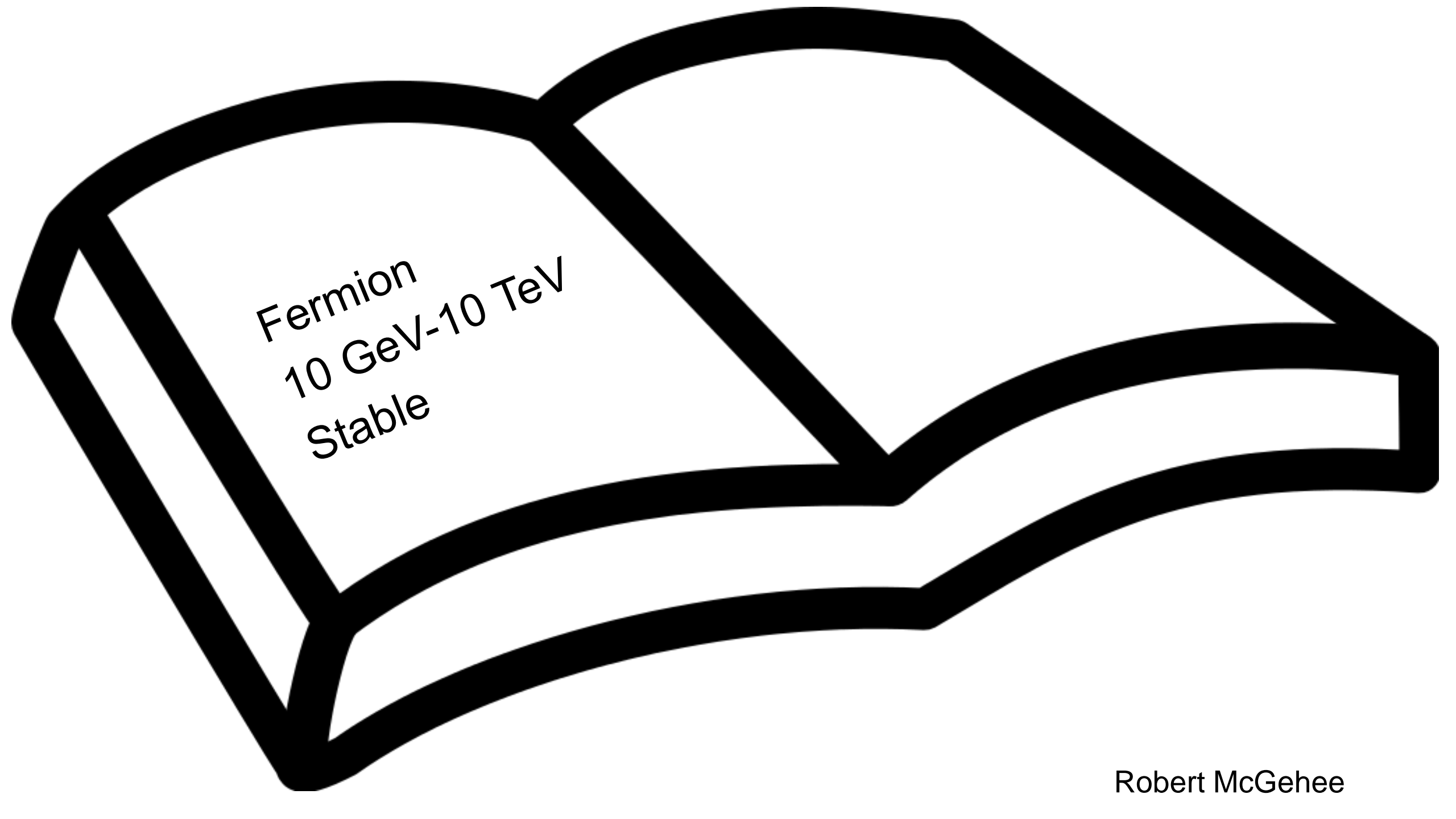
**The
Quest for
Dark
Matter**

Robert McGehee

A stylized black outline of an open book. The left page contains the text 'Chapter I', 'The WIMP', and 'Paradigm'. The right page is blank. The book is shown from a perspective that is slightly angled towards the viewer.

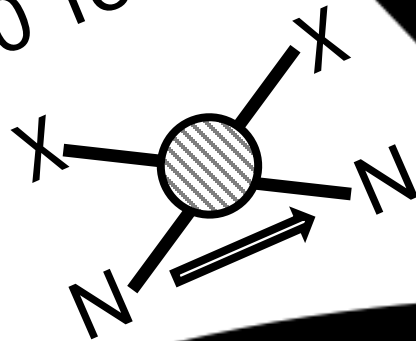
Chapter I

The
WIMP
Paradigm

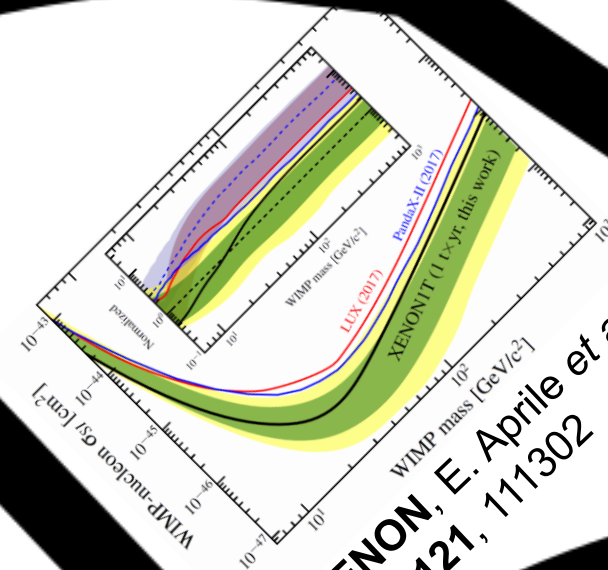
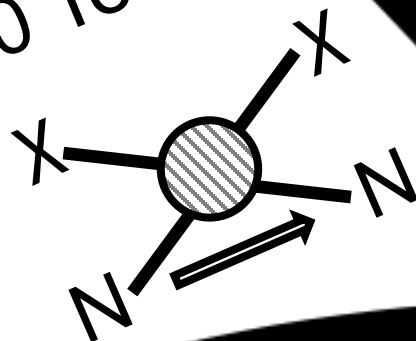
A thick black line drawing of a book, viewed from a three-quarter perspective. The book is open, showing the cover on the left and the pages on the right. The cover has text on it. The pages are represented by several curved lines, suggesting the thickness of the book. The drawing is simple and stylized, using only black lines on a white background.

Fermion
10 GeV-10 TeV
Stable

Fermion
10 GeV-10 TeV
Stable



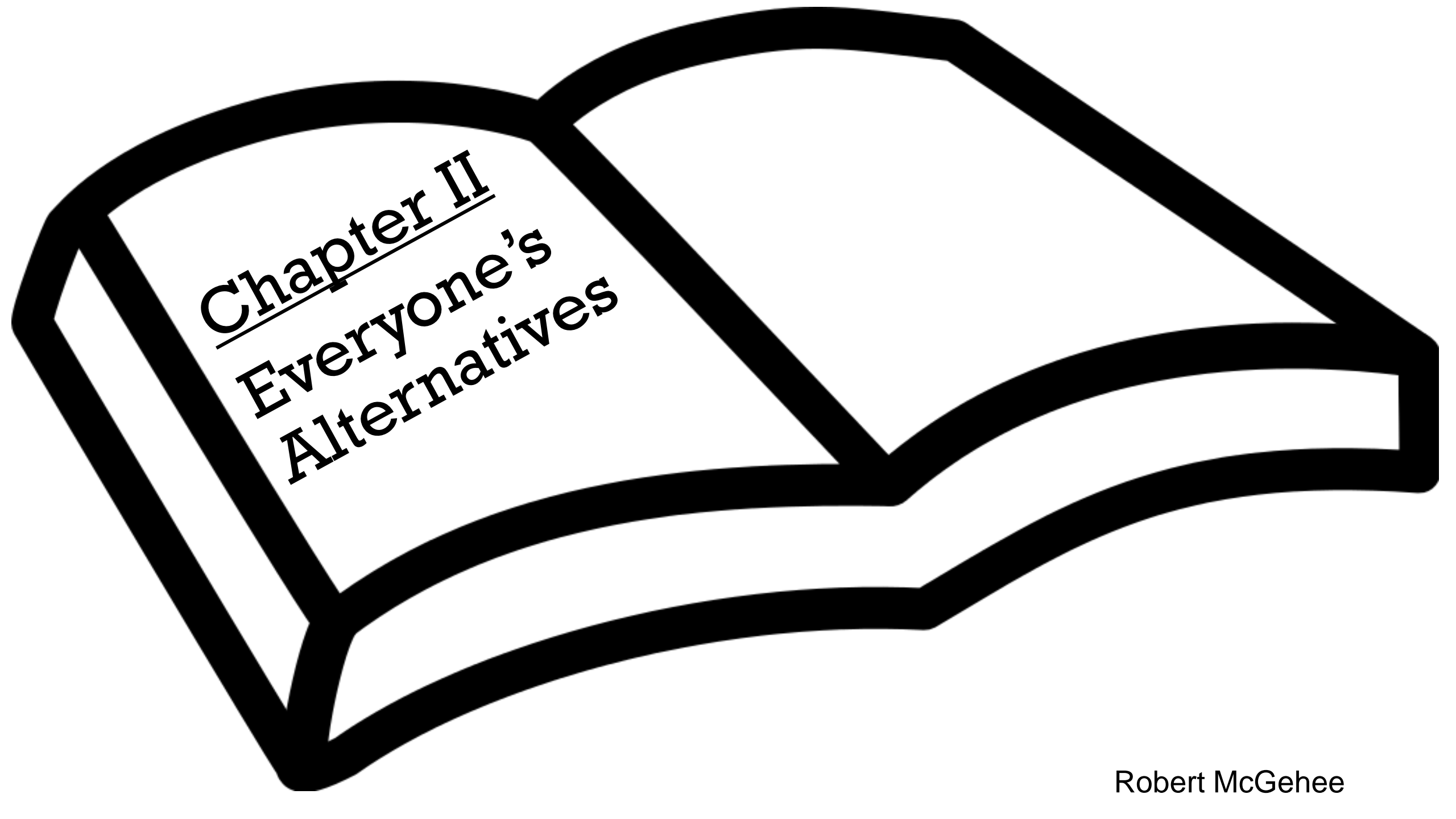
Fermion
10 GeV-10 TeV
Stable



XENON, E. Aprile et al.,
PRL 121, 111302

A decorative border in a light, metallic color frames the page. At the top center is a fleur-de-lis. The border consists of horizontal lines at the top and bottom, and vertical lines on the left and right, all adorned with elegant, flowing scrollwork and leaf-like motifs.

Fin

A stylized black outline of an open book. The left page contains the text 'Chapter II', 'Everyone's', and 'Alternatives'. The right page is blank. The book is shown from a slightly elevated perspective, with the pages curving downwards.

Chapter II
Everyone's
Alternatives

Robert McGehee



Fermion

~~10 GeV - 10 TeV~~

Stable

N. Toro, Tuesday



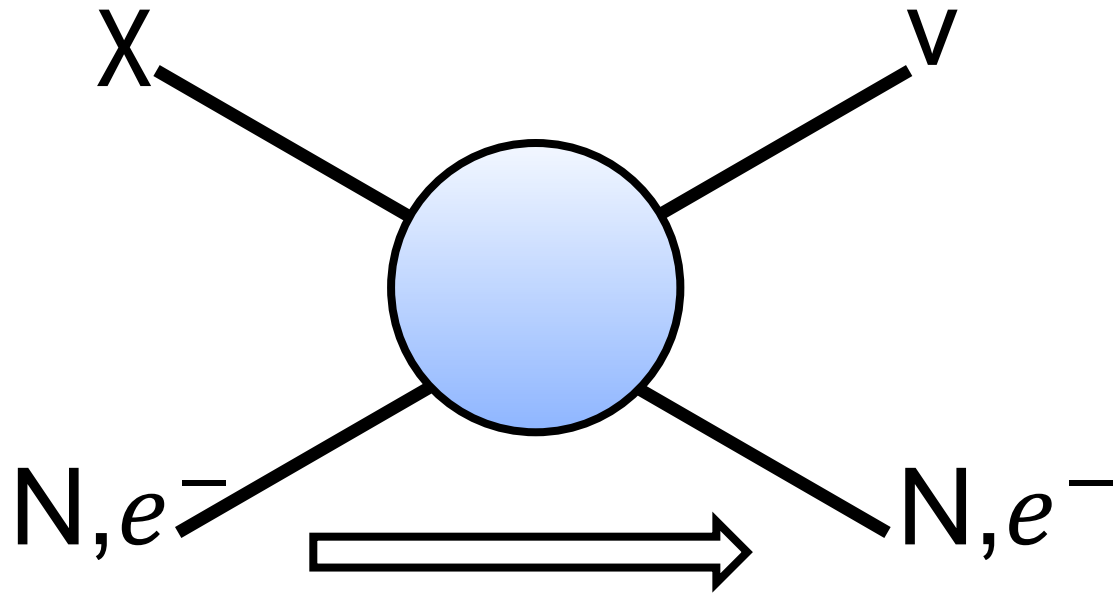
Fermion

~~10 GeV - 10 TeV~~

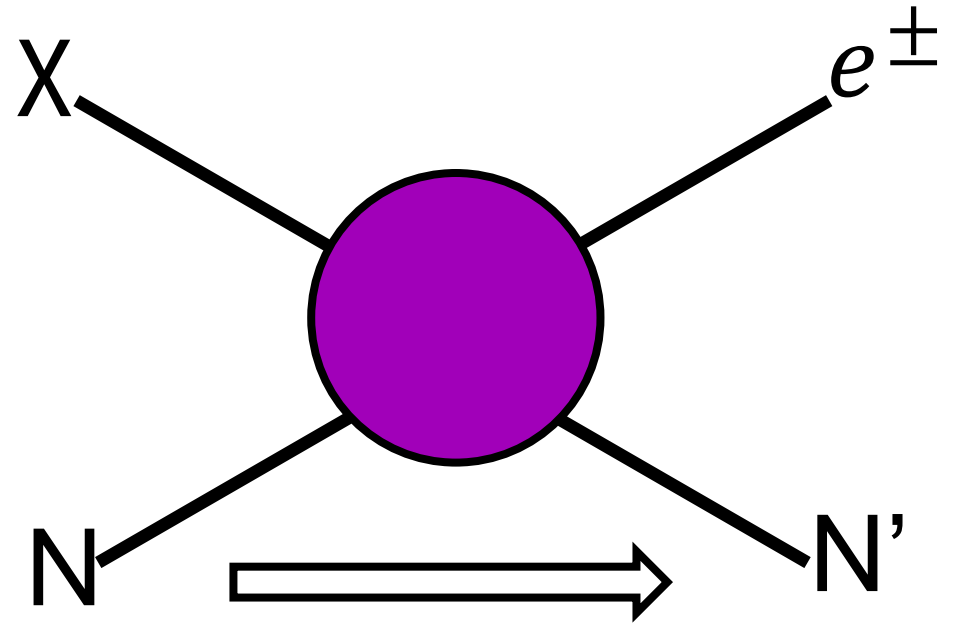
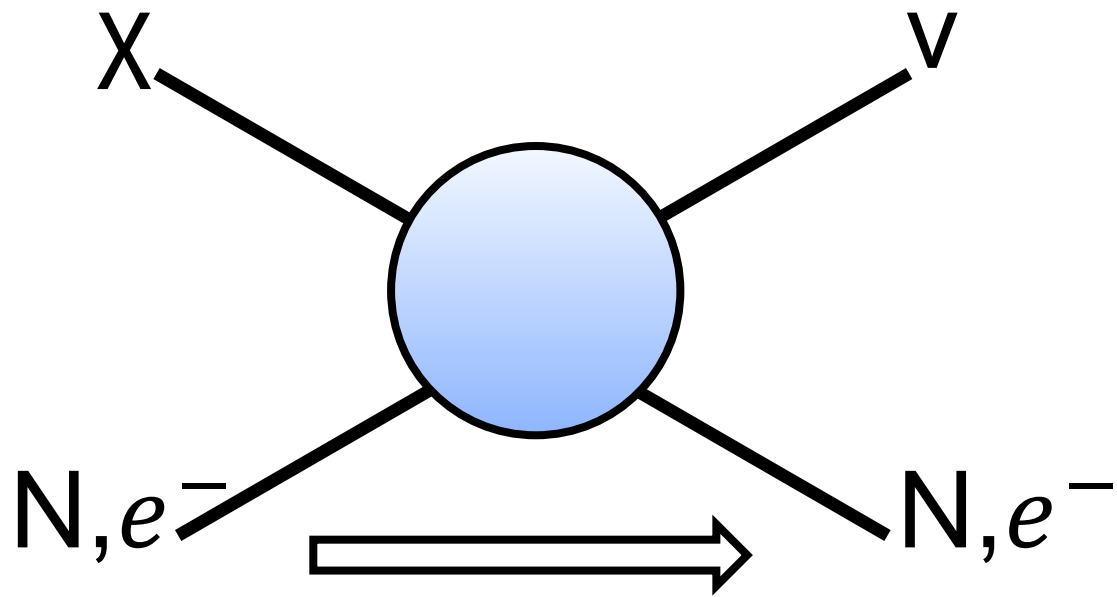
Stable

Me, right now!

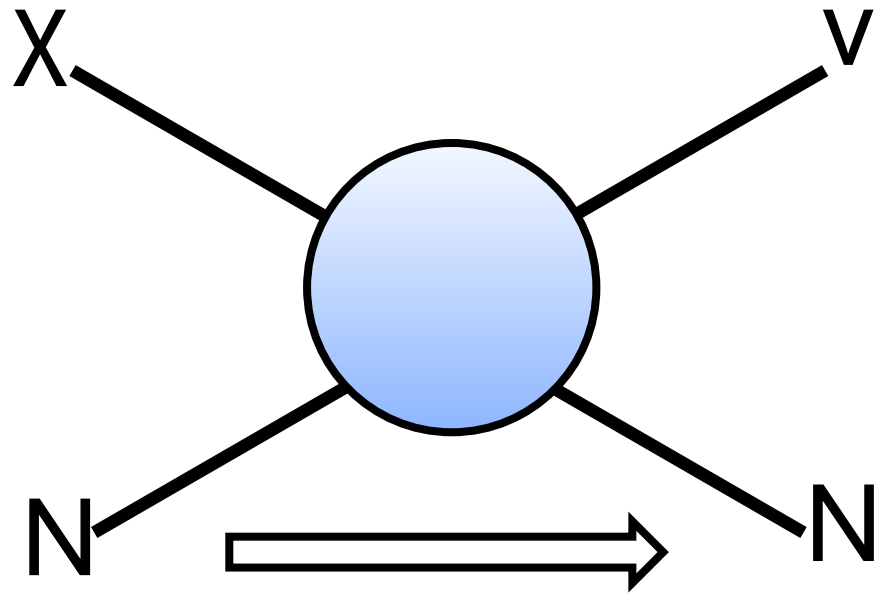
Fermionic “Absorption”



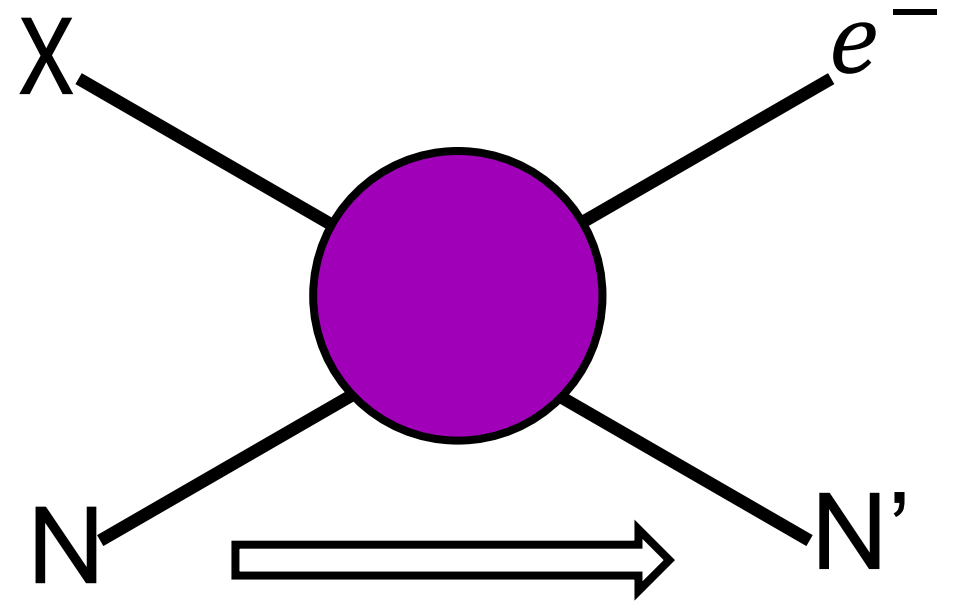
Fermionic “Absorption”



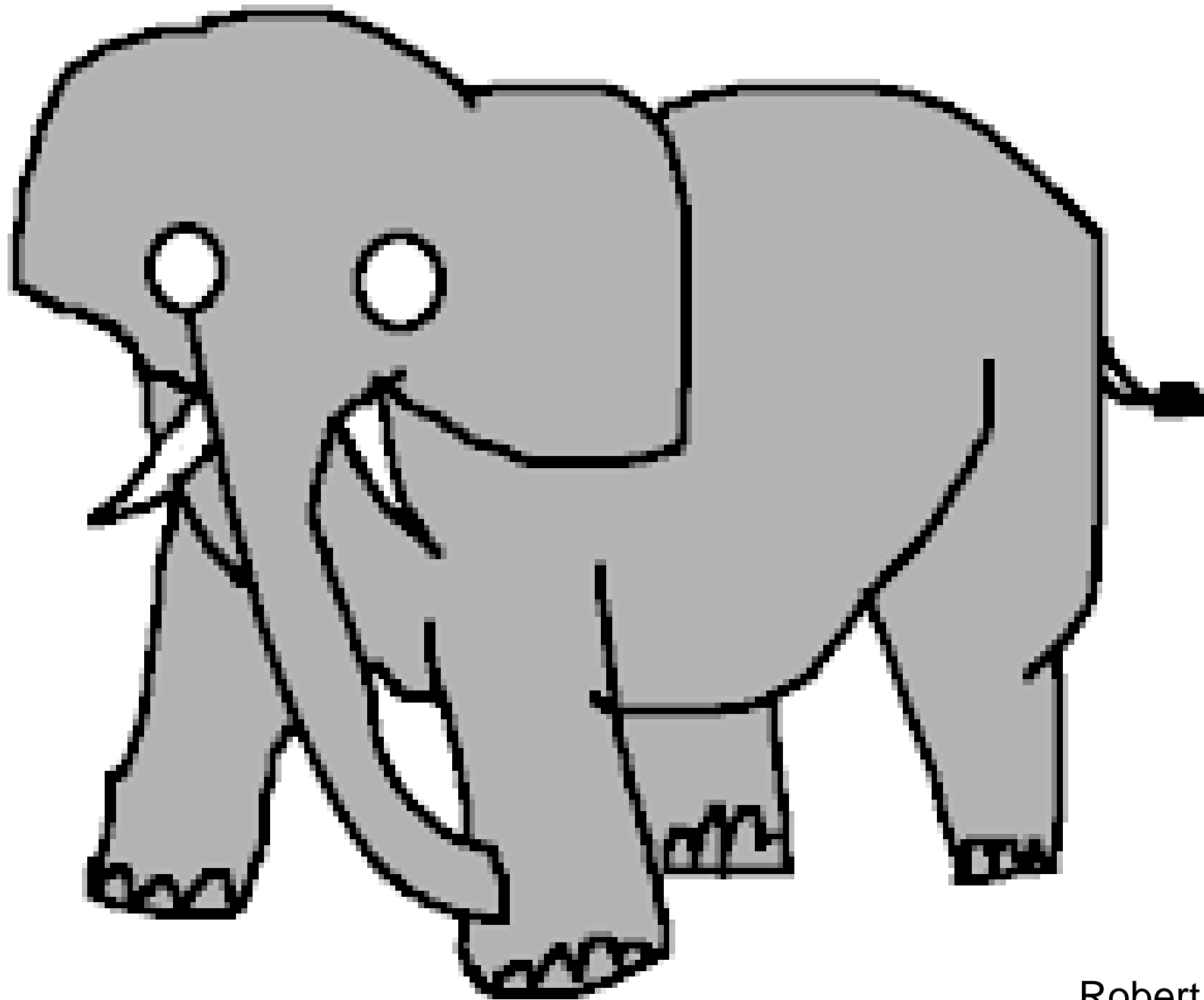
Fermionic “Absorption”



$$\frac{1}{\Lambda^2} [\bar{\chi} \Gamma_{\mu} \nu] [\bar{n} \Gamma^{\mu} n] + \text{h.c.}$$



$$\frac{1}{\Lambda^2} [\bar{\chi} \Gamma_{\mu} e] [\bar{n} \Gamma^{\mu} p] + \text{h.c.}$$

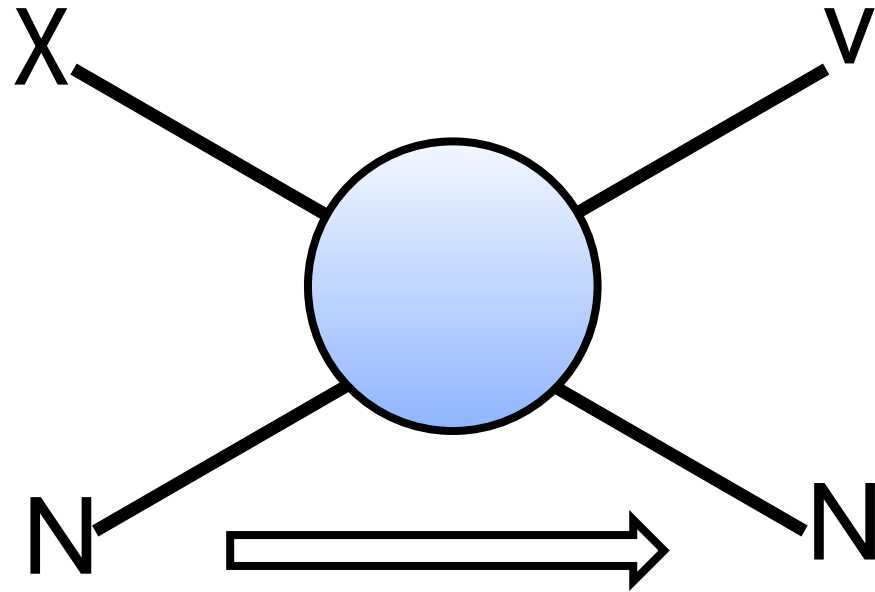


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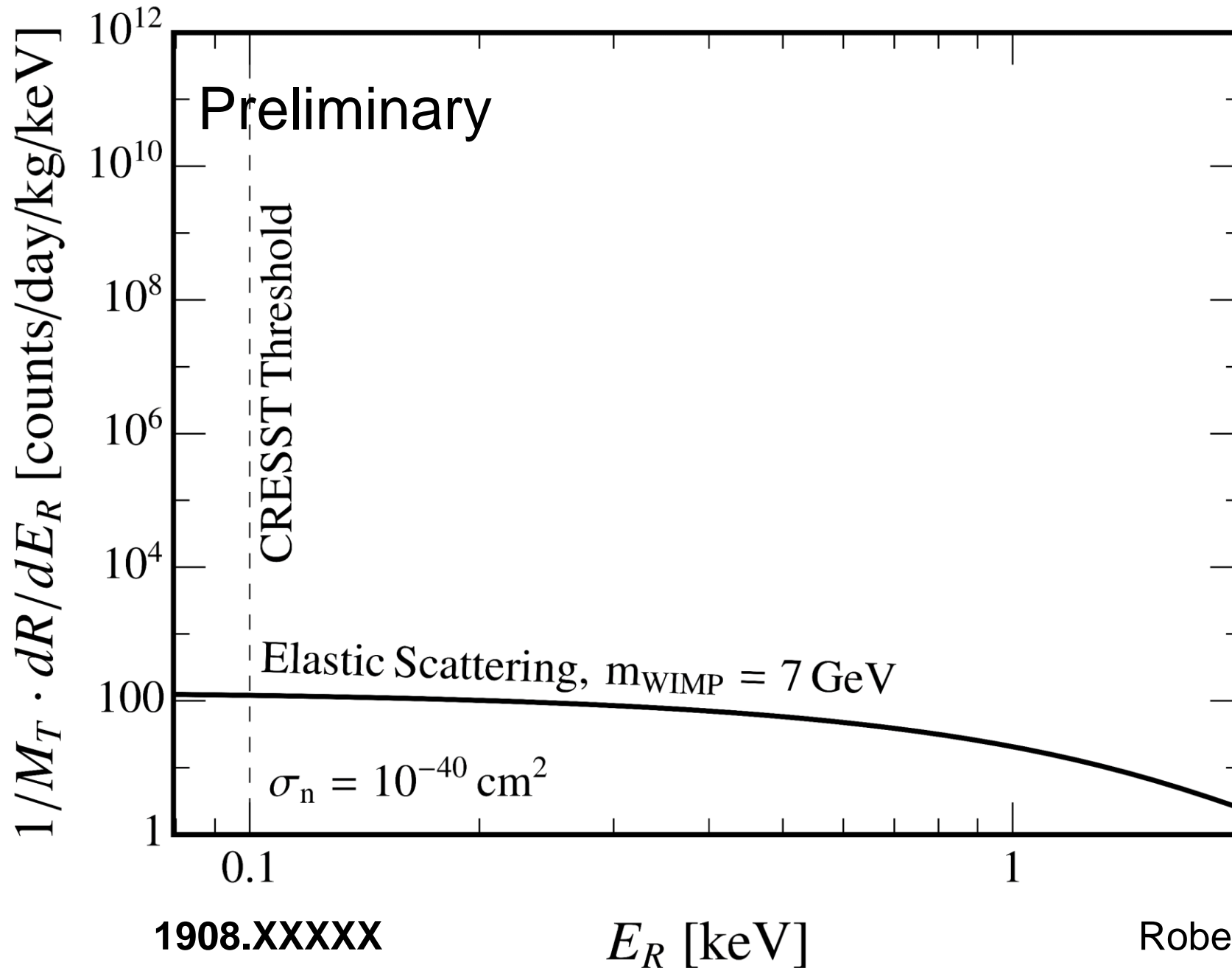
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“Neutral Current” Kinematics



$$q \sim m_\chi \quad E_R \sim \frac{m_\chi^2}{2M_N}$$

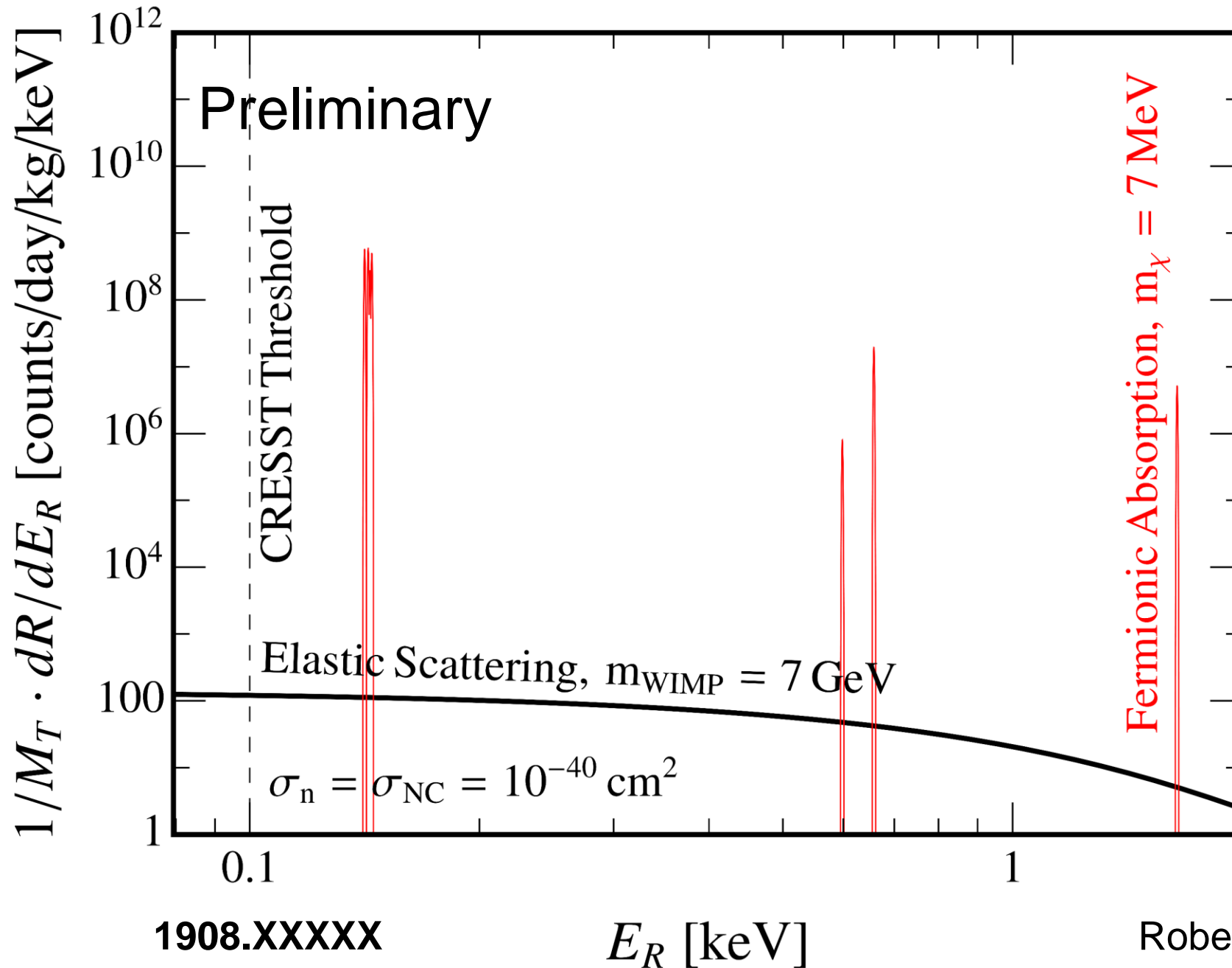
Scattering in CRESST



1908.XXXXX

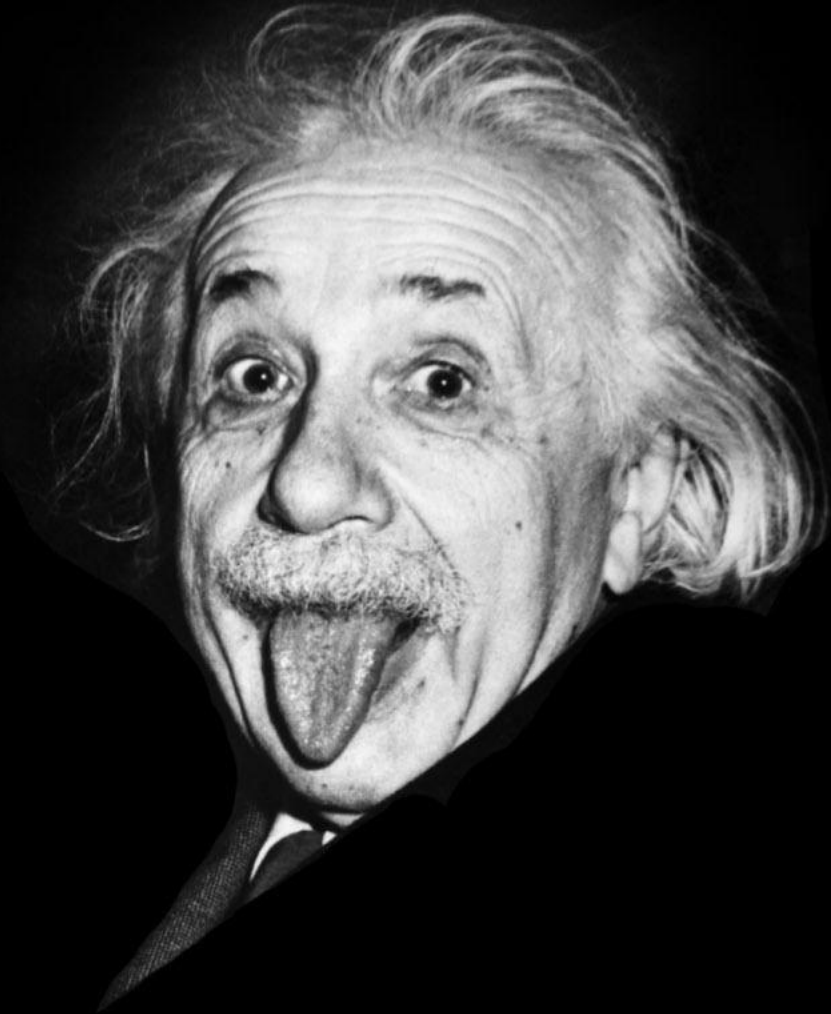
Robert McGehee

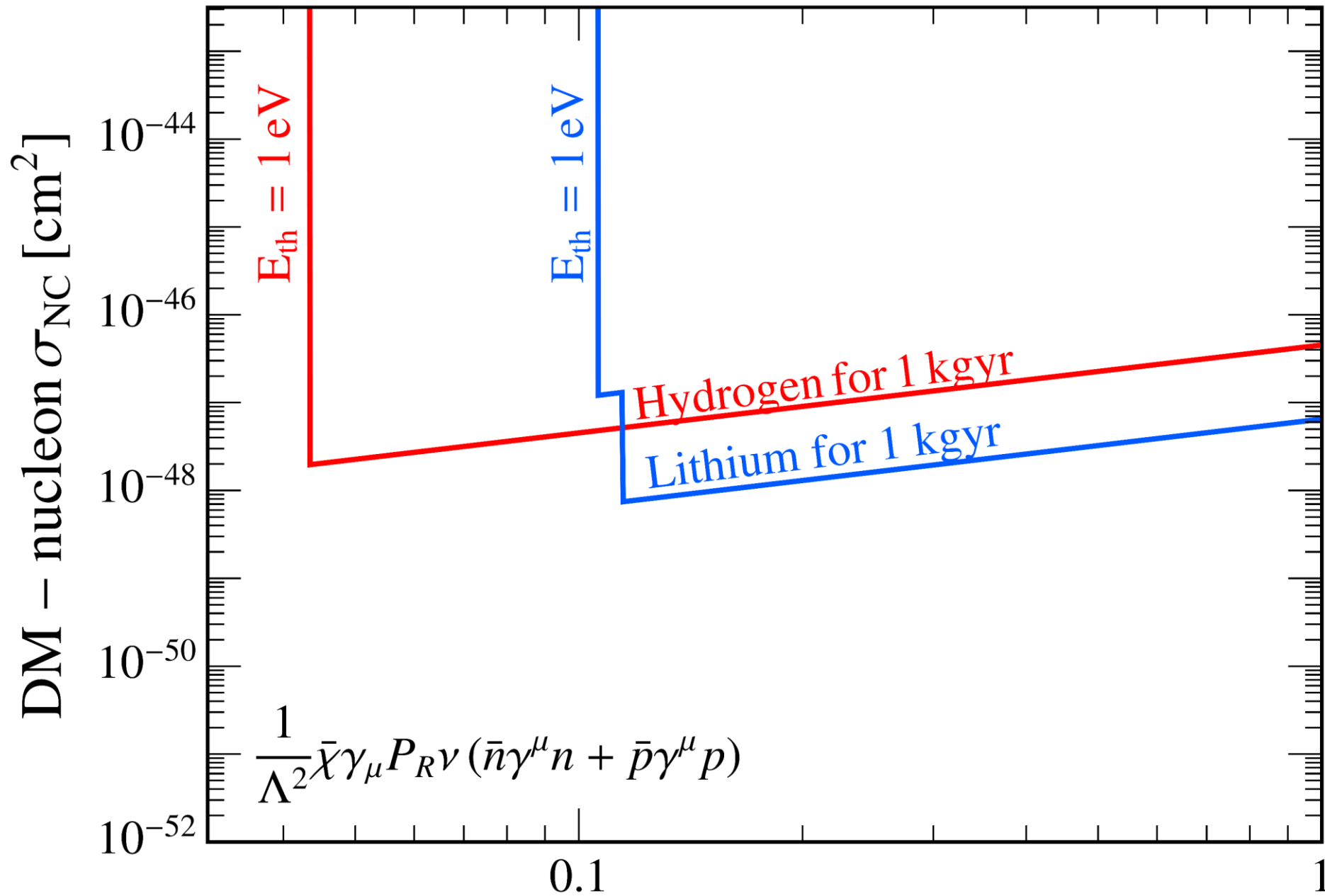
Scattering in CRESST

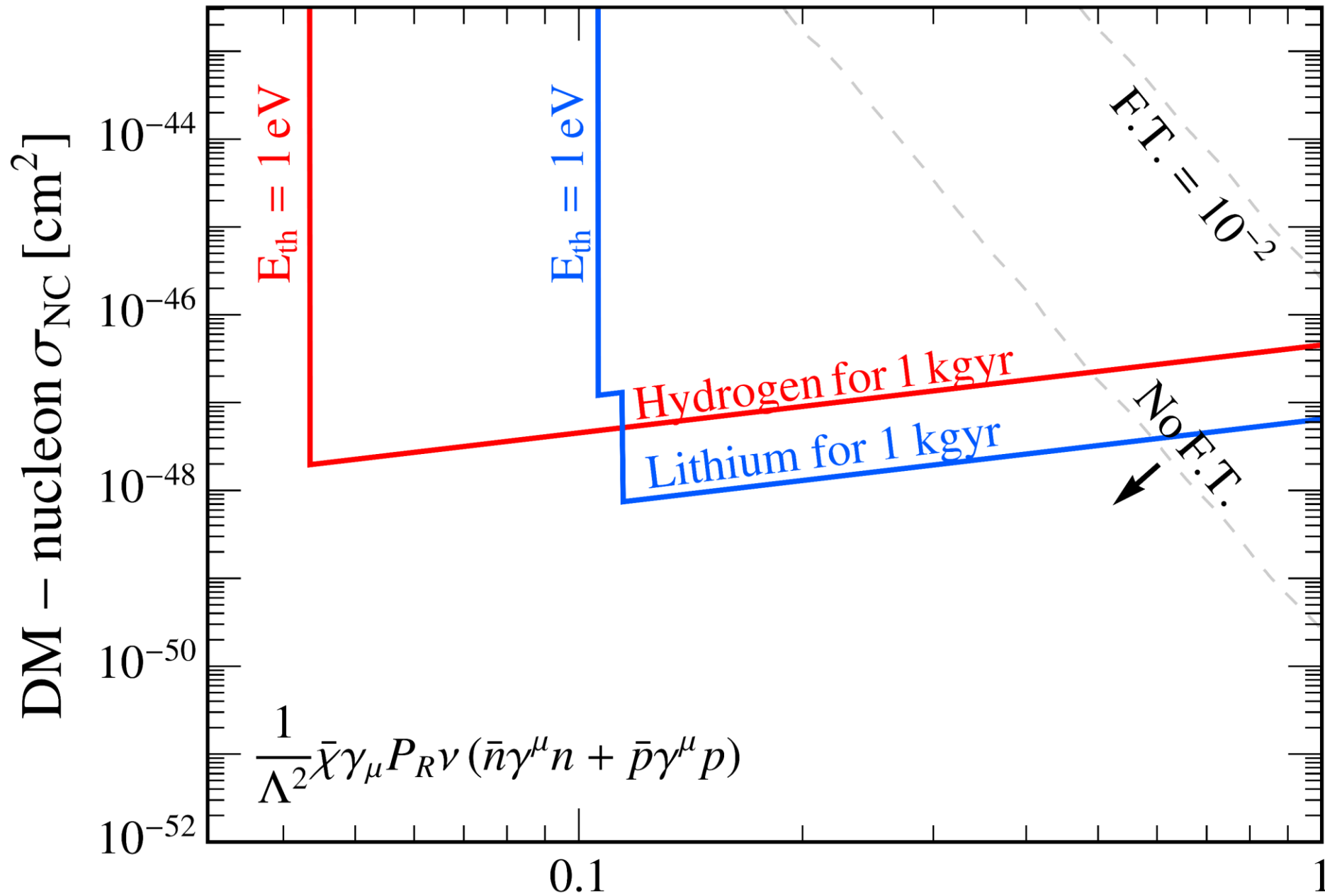


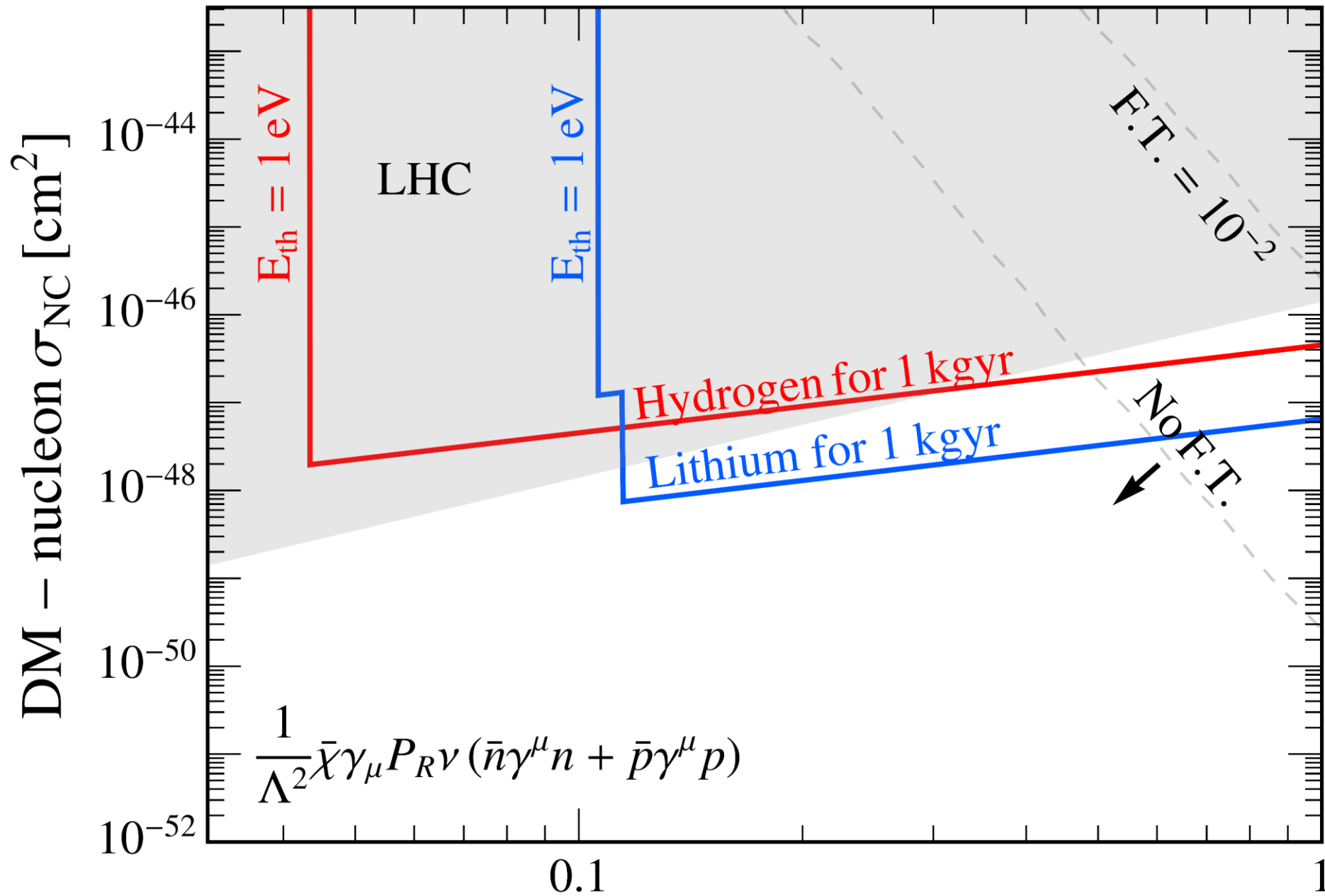
1908.XXXXX

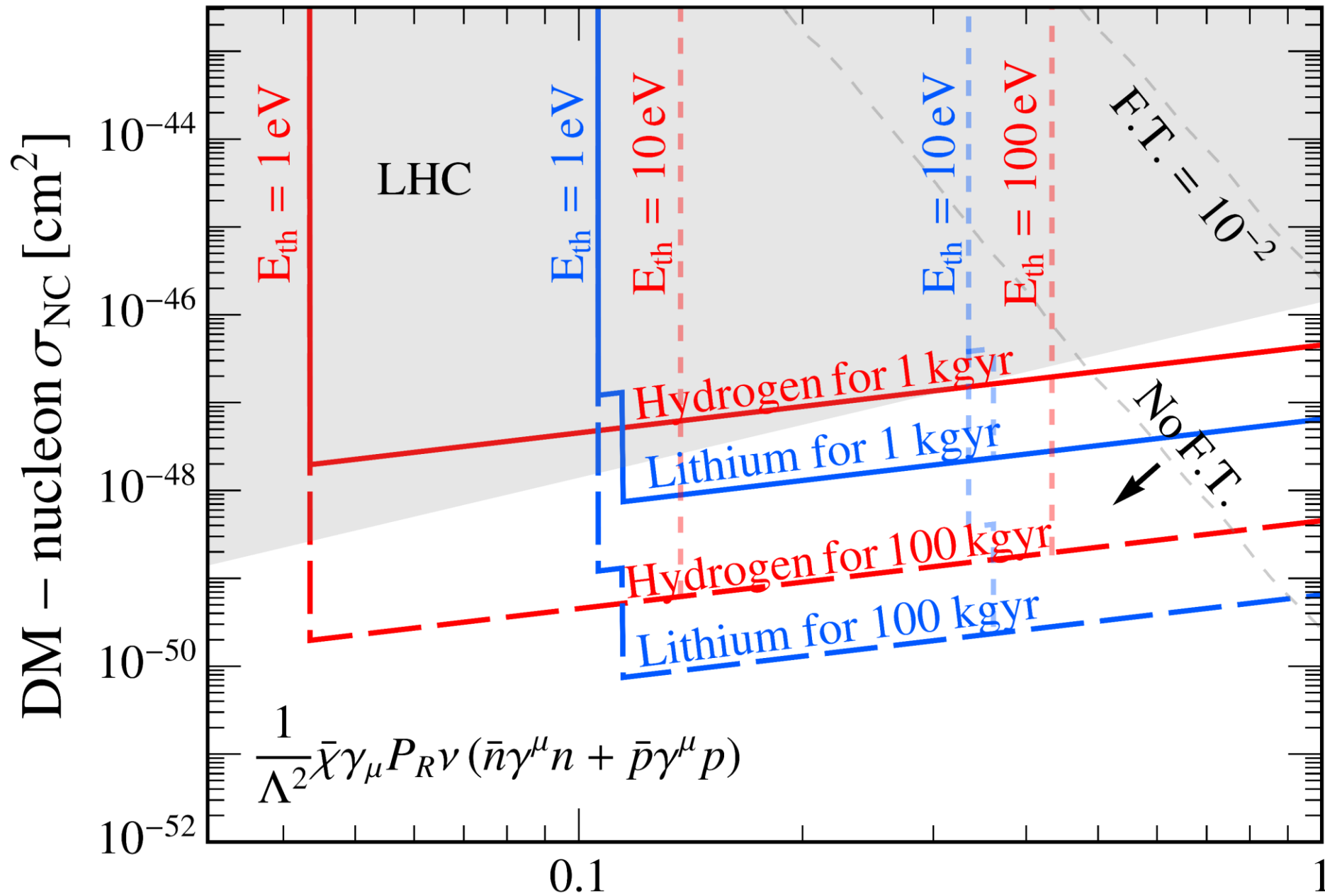
Robert McGehee

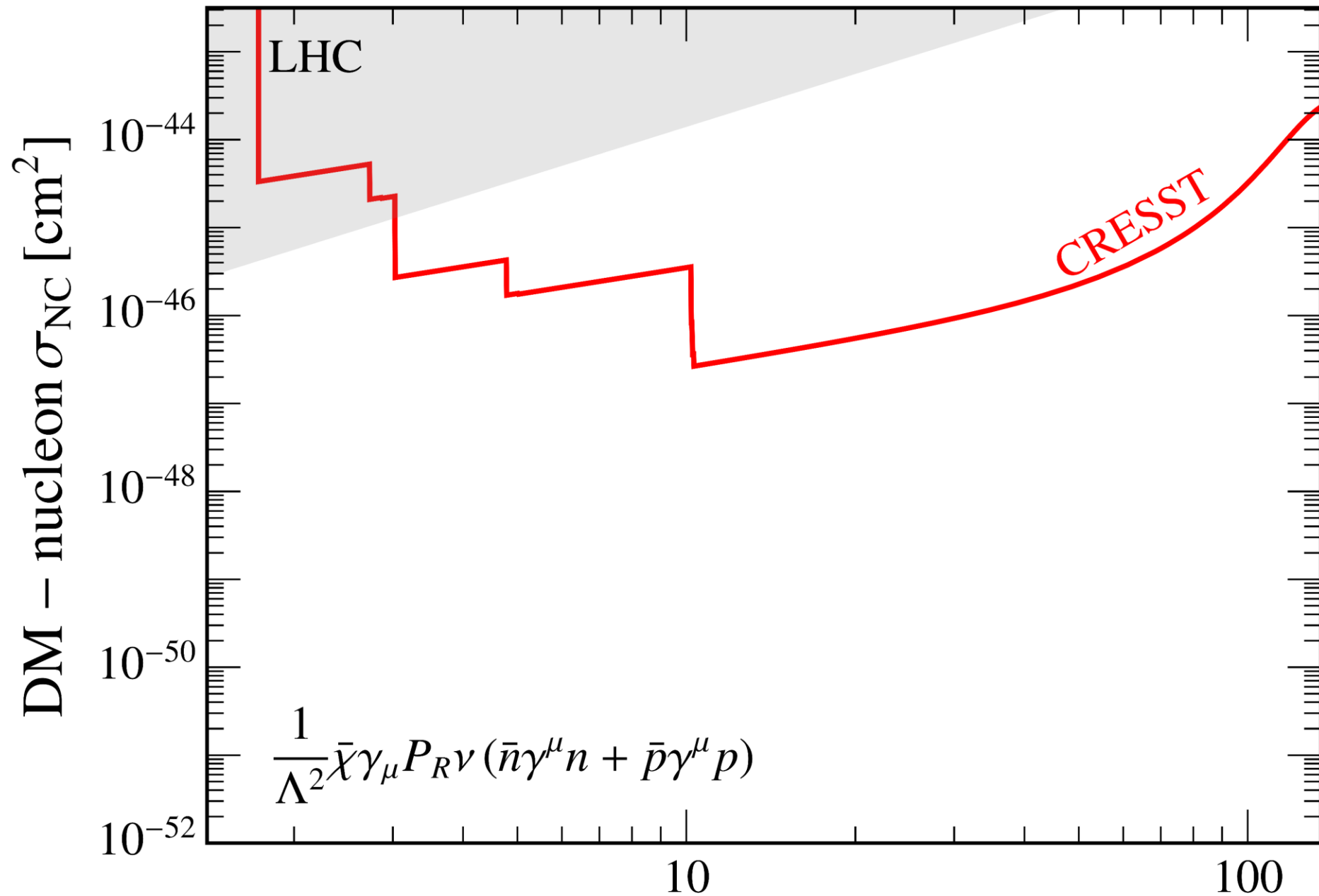


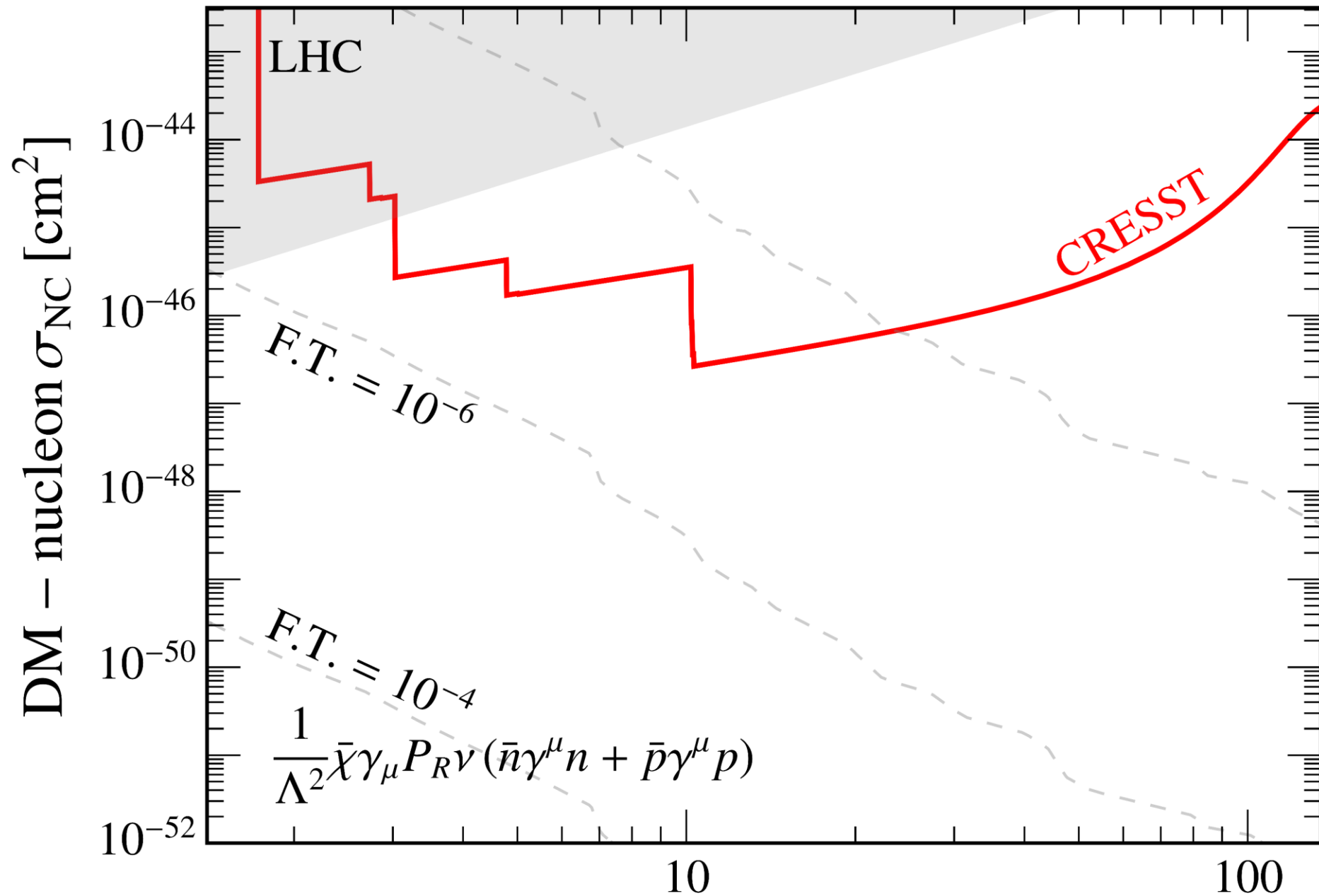


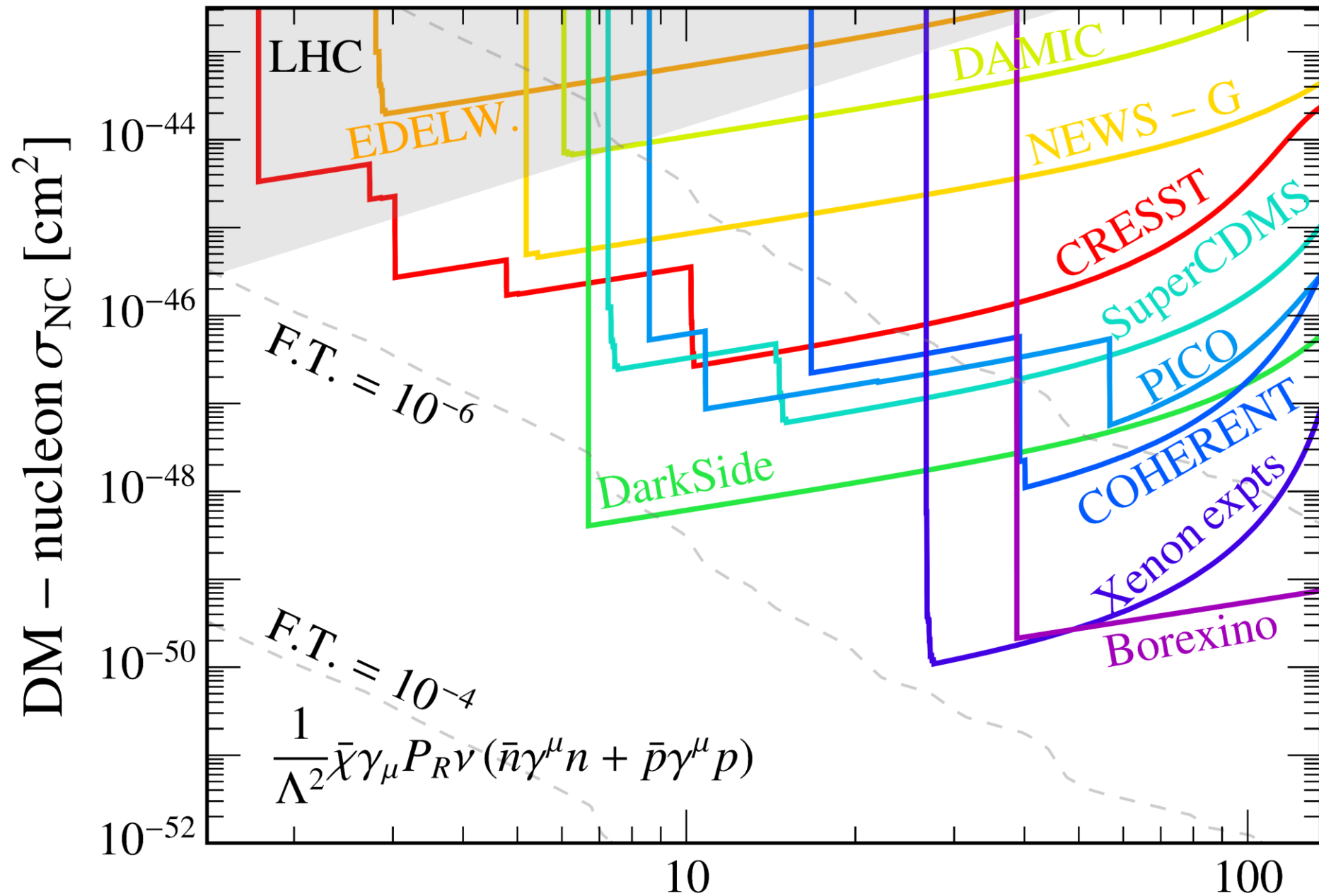




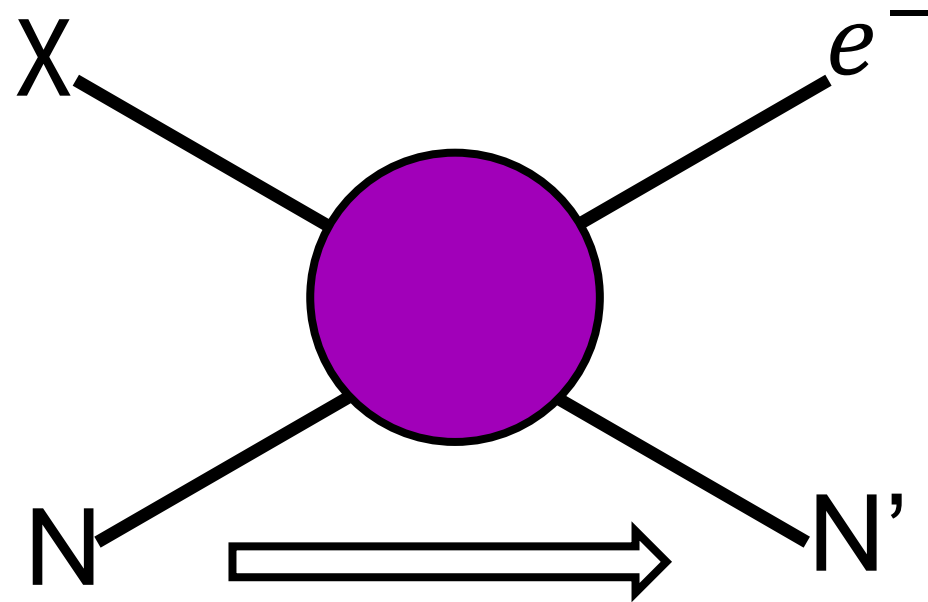








“Charged Current” Induced β^- Decays

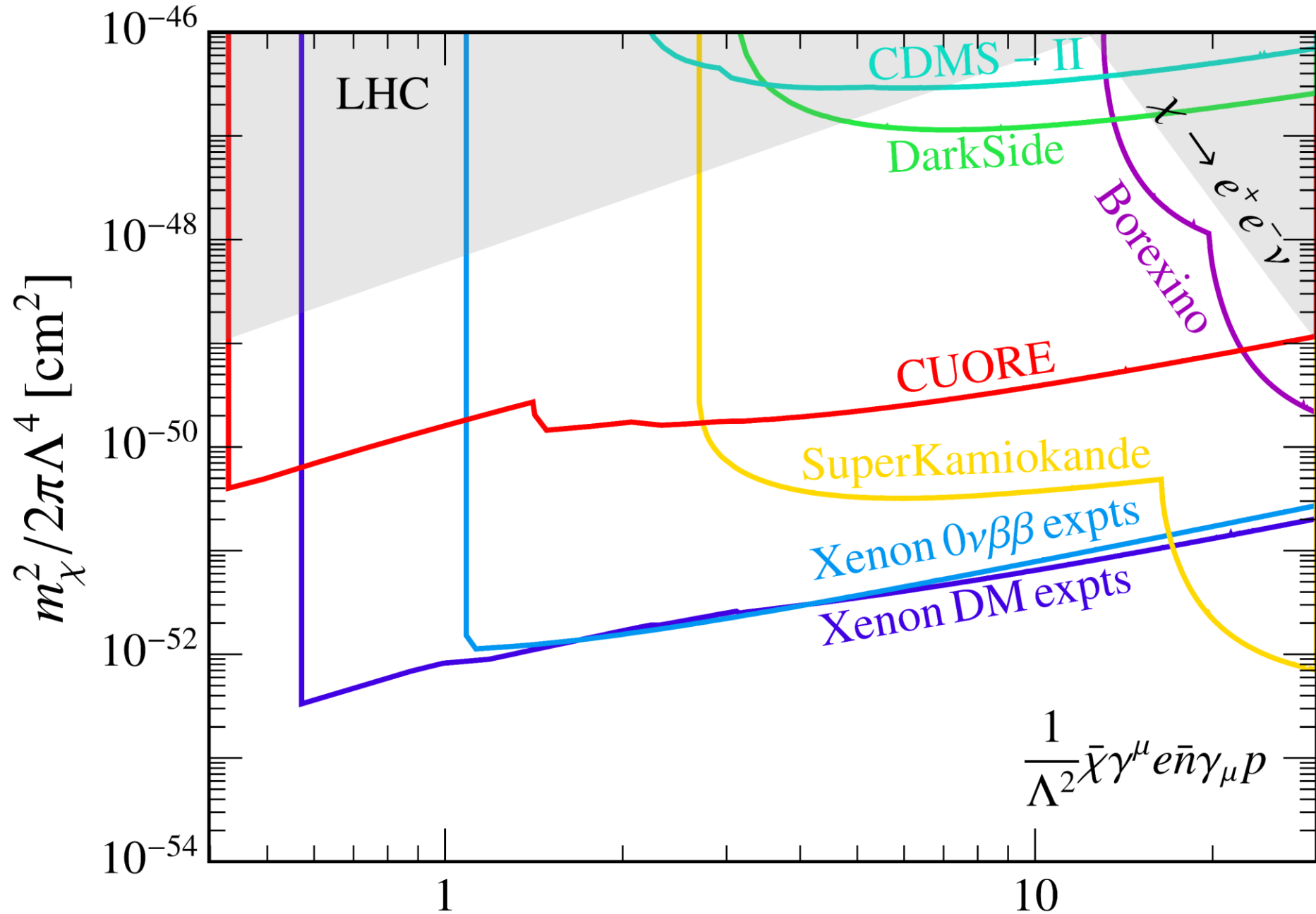


• e^- !

• NR!

• γ !

• N' Decay!



Summary

Relaxing DM stability assumptions allows for novel signals and operators.

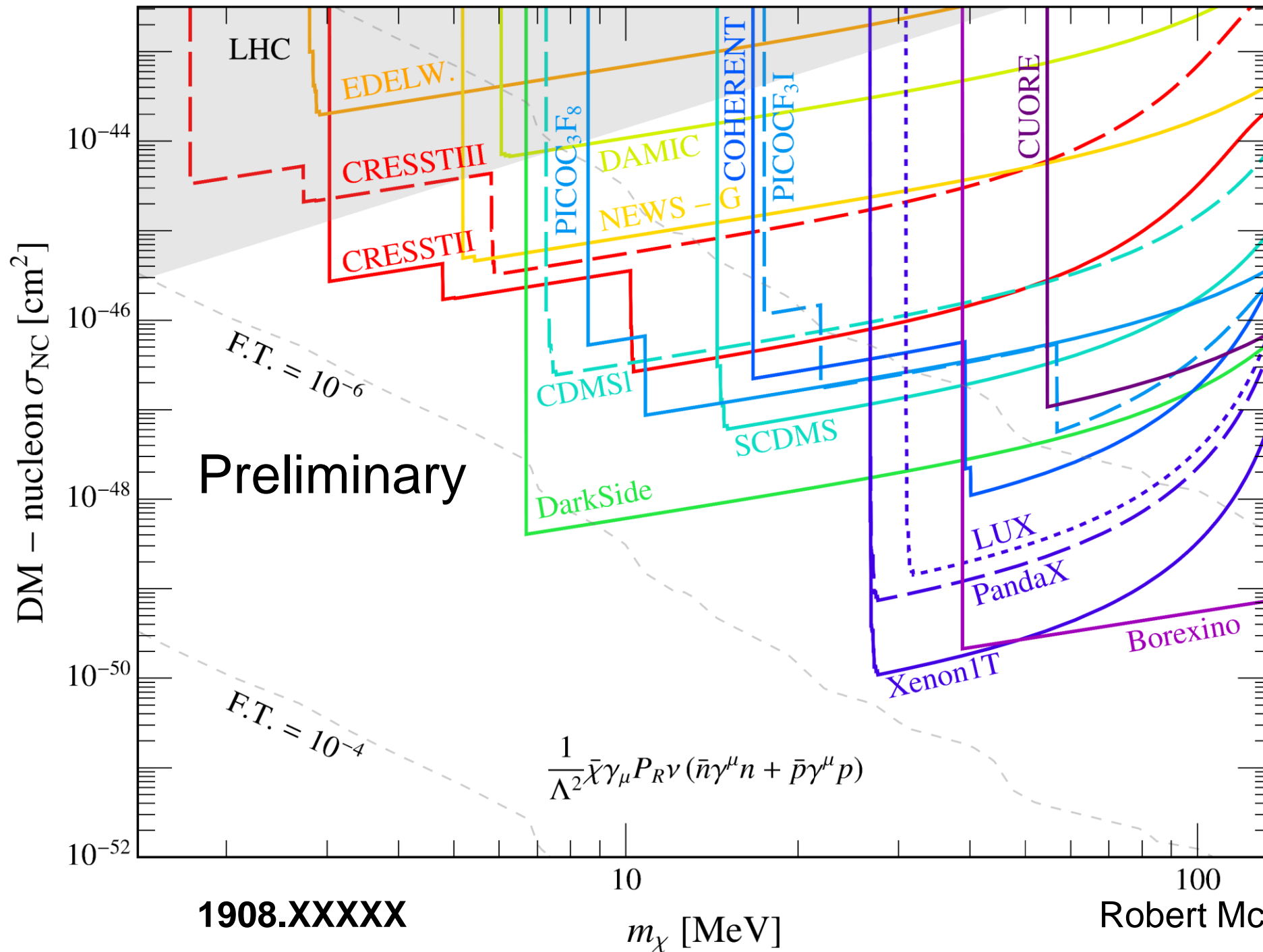
Neutral current operators yield peaked, correlated nuclear recoil (NR) signals.

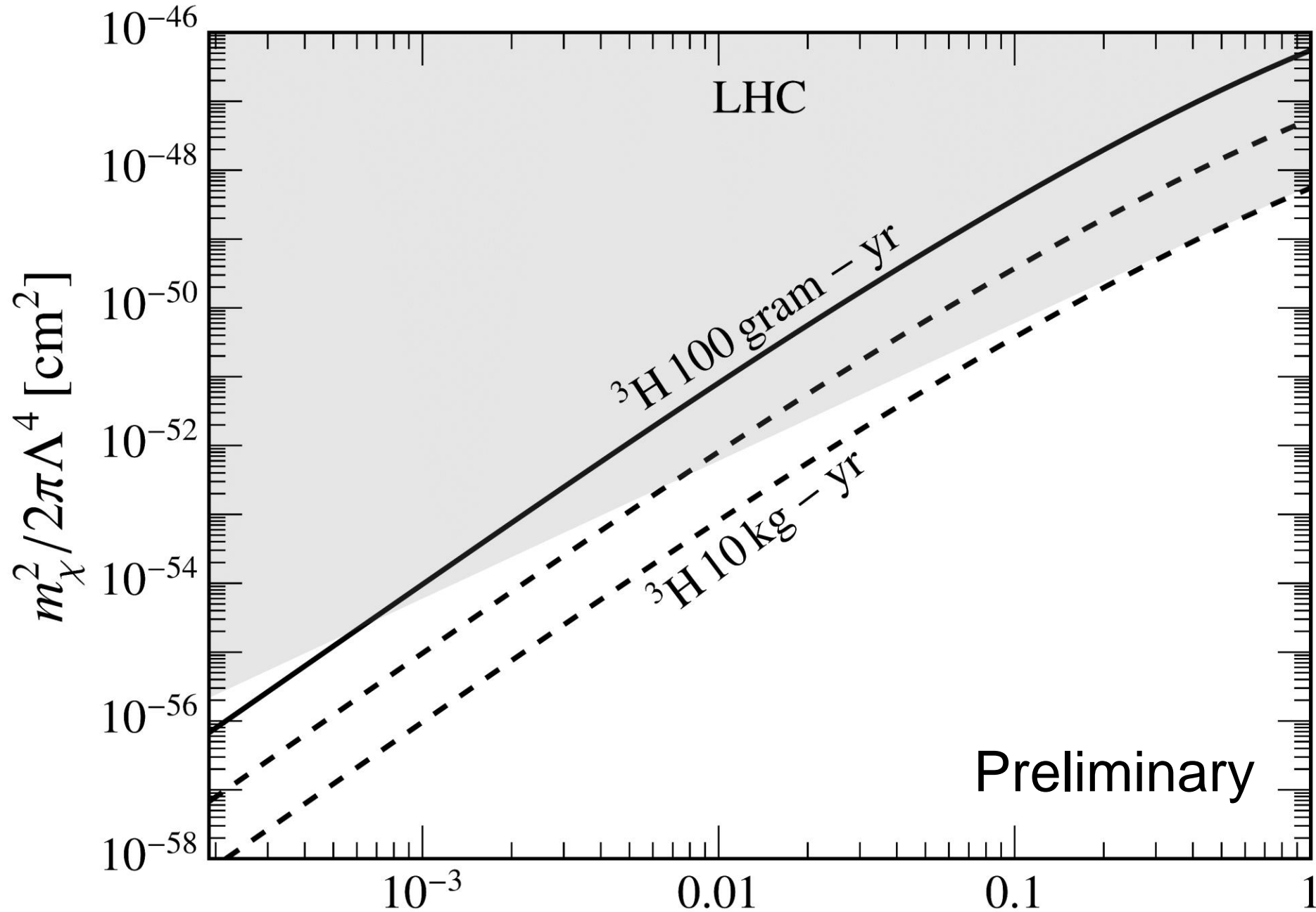
Charged current operators yield β^- , NR, and γ signals.

New searches at existing experiments can probe both neutral and charged current operators.

Fermionic DM absorption is an exciting playground for both experiments and model building!

Backup Slides





Preliminary