Inelastic Dark Matter Boosted by Terrestrial Collisions

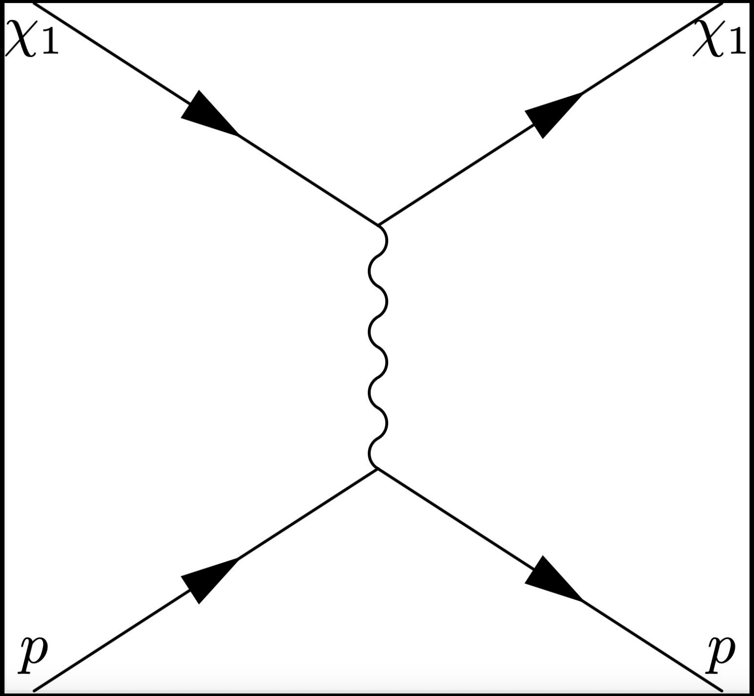
Christopher Cappiello

Based on arXiv: 2510.12791 (Zamiul Alam, **CC**, and Francesc Ferrer)

TeVPA
November 4, 2025

WashU

Inelastic Dark Matter



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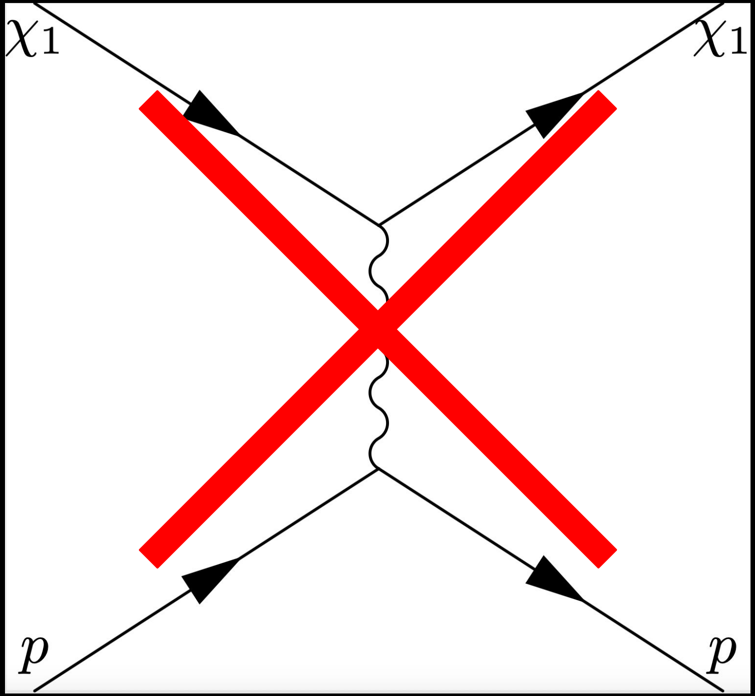

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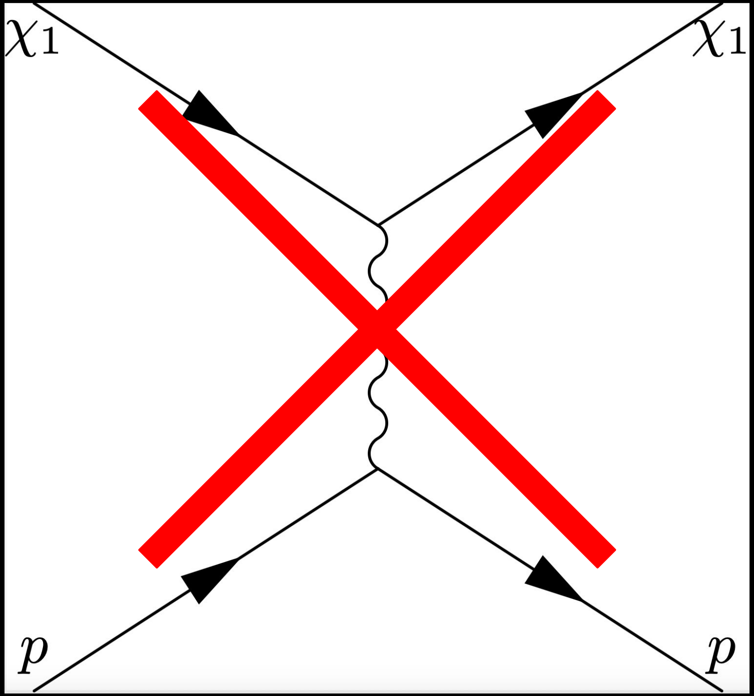
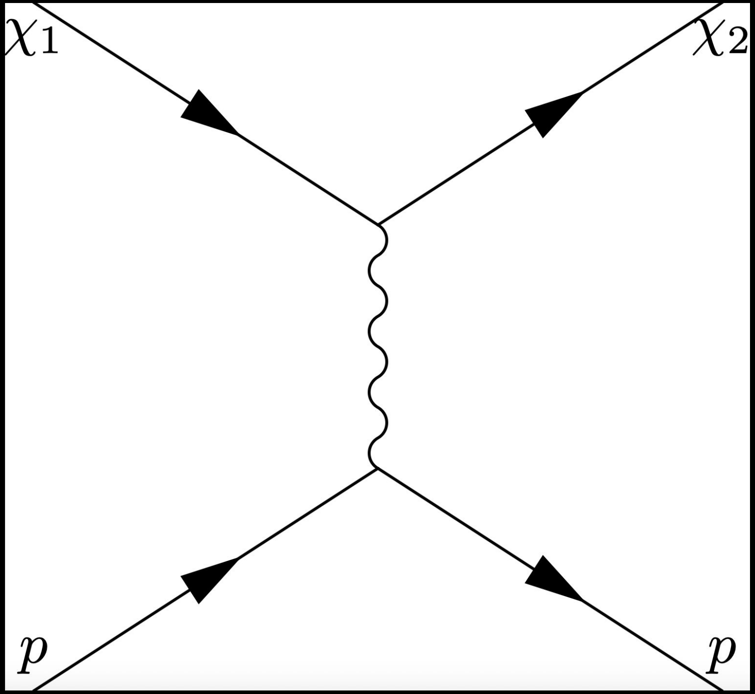
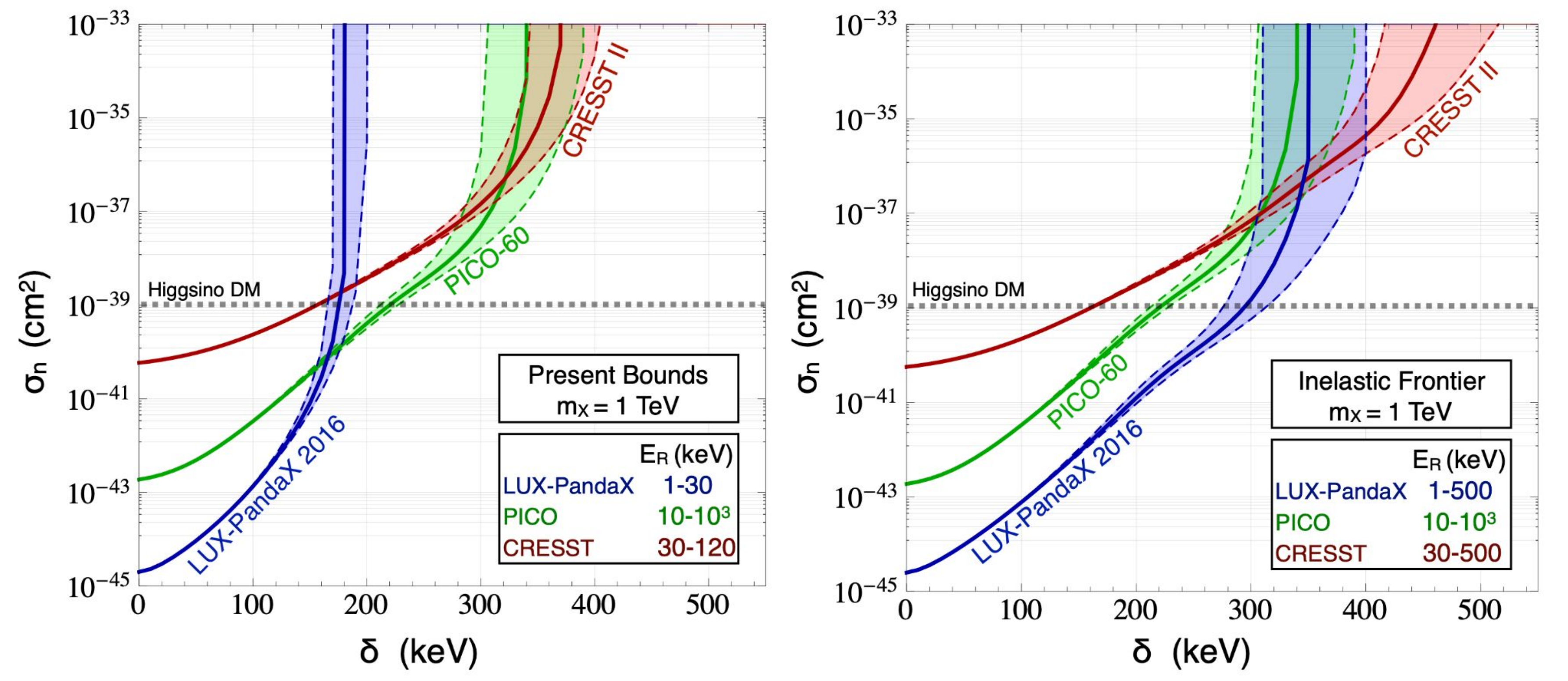


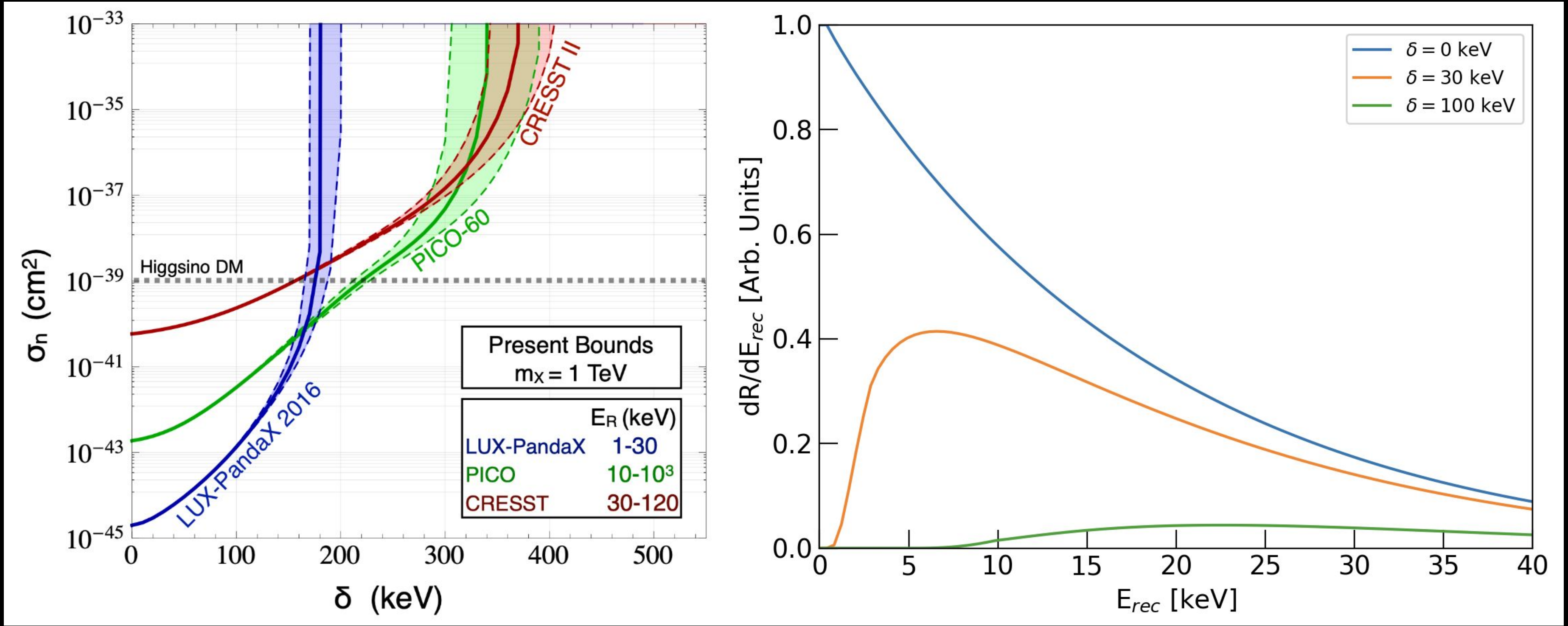


Higgsino Dark Matter



arXiv:1608.02662

Direct Detection



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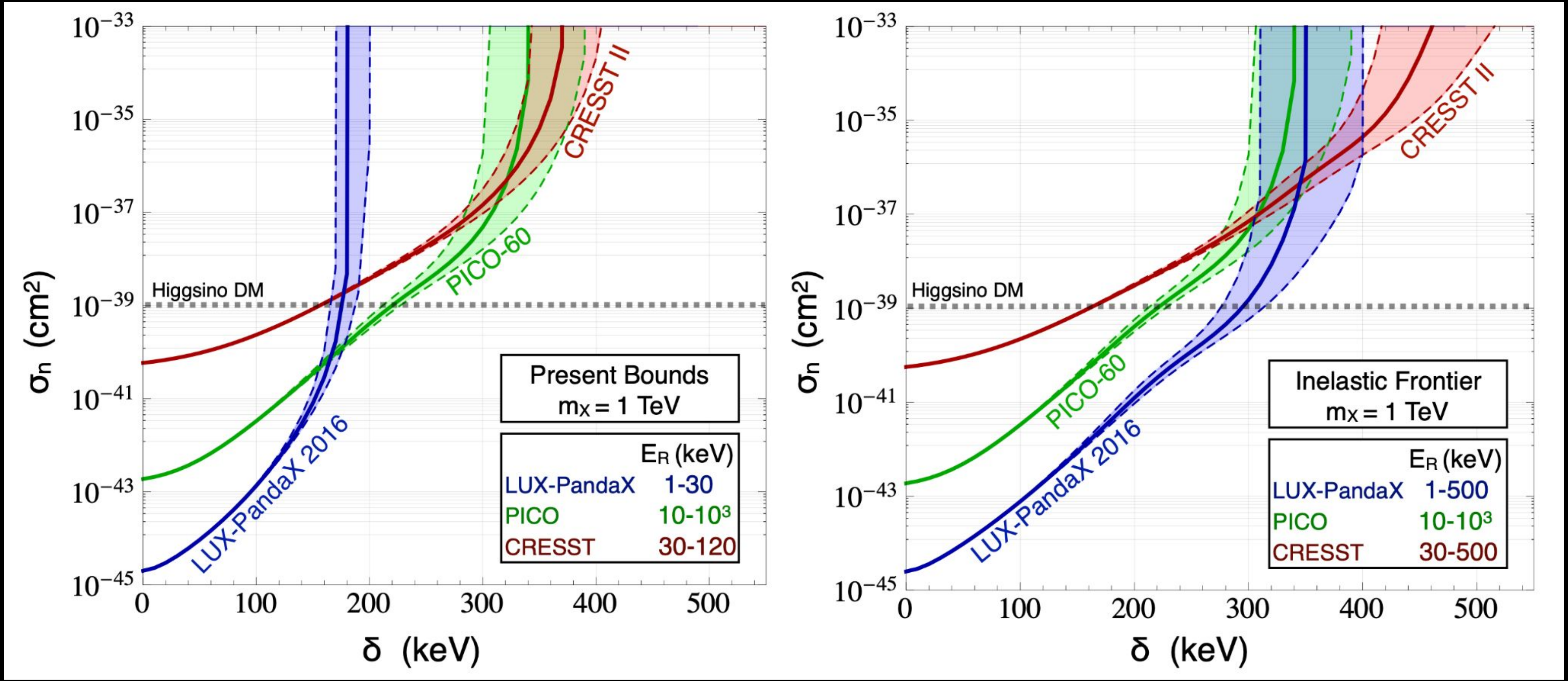

arXiv:1608.02662

Upscattering and Deexcitation

MIT-CTP 4172

Luminous Dark Matter

Brian Feldstein,[1] Peter W. Graham,[2] and Surjeet Rajendran[3]

[1]*Department of Physics, Boston University, Boston, MA 02215*

[2]*Department of Physics, Stanford University, Stanford, California 94305*

[3]*Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, MA 02139, USA*

(Dated: October 26, 2018)

We propose a dark matter model in which the signal in direct detection experiments arises from electromagnetic, not nuclear, energy deposition. This can provide a novel explanation for DAMA while avoiding many direct detection constraints. The dark matter state is taken nearly degenerate with another state. These states are naturally connected by a dipole moment operator, which can give both the dominant scattering and decay modes between the two states. The signal at DAMA then arises from dark matter scattering in the Earth into the excited state and decaying back to the ground state through emission of a single photon in the detector. This model has unique signatures in direct detection experiments. The density and chemical composition of the detector is irrelevant, only the total volume affects the event rate. In addition, the spectrum is a monoenergetic line, which can fit the DAMA signal well. This model is readily testable at experiments such as CDMS and XENON100 if they analyze their low-energy, electronic recoil events.

See also:
Chang et al. (arXiv:1007.4200)
Pospelov et al. (arXiv:1312.1363)
Eby et al. (arXiv:1904.09994)
Bell et al. (arXiv:2006.12461)
Graham et al. (arXiv:2409.07768)

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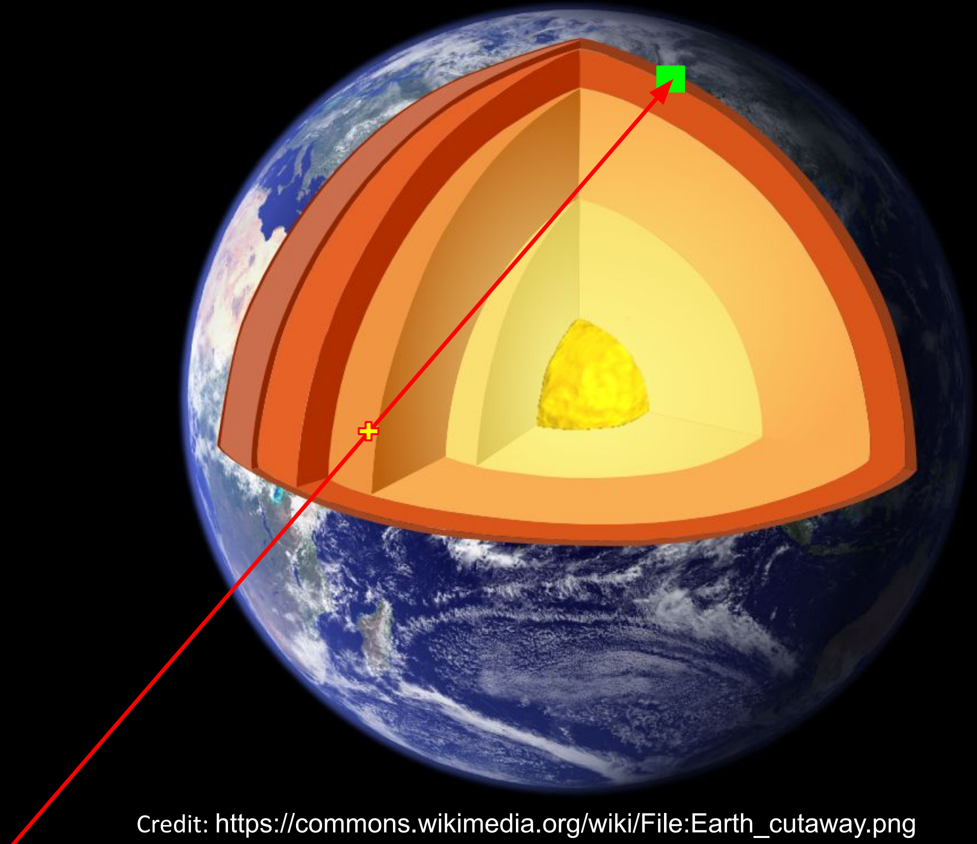
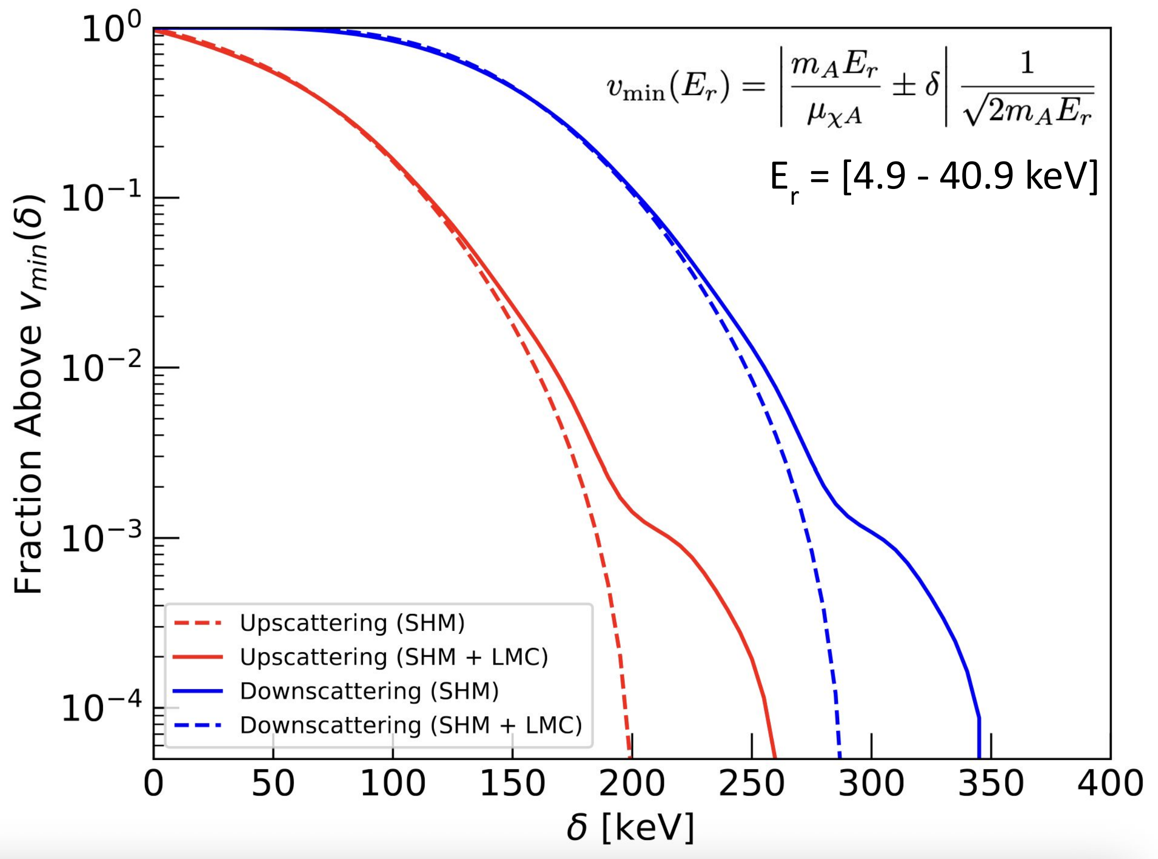
All photon or electron signals

Upscattering and Deexcitation



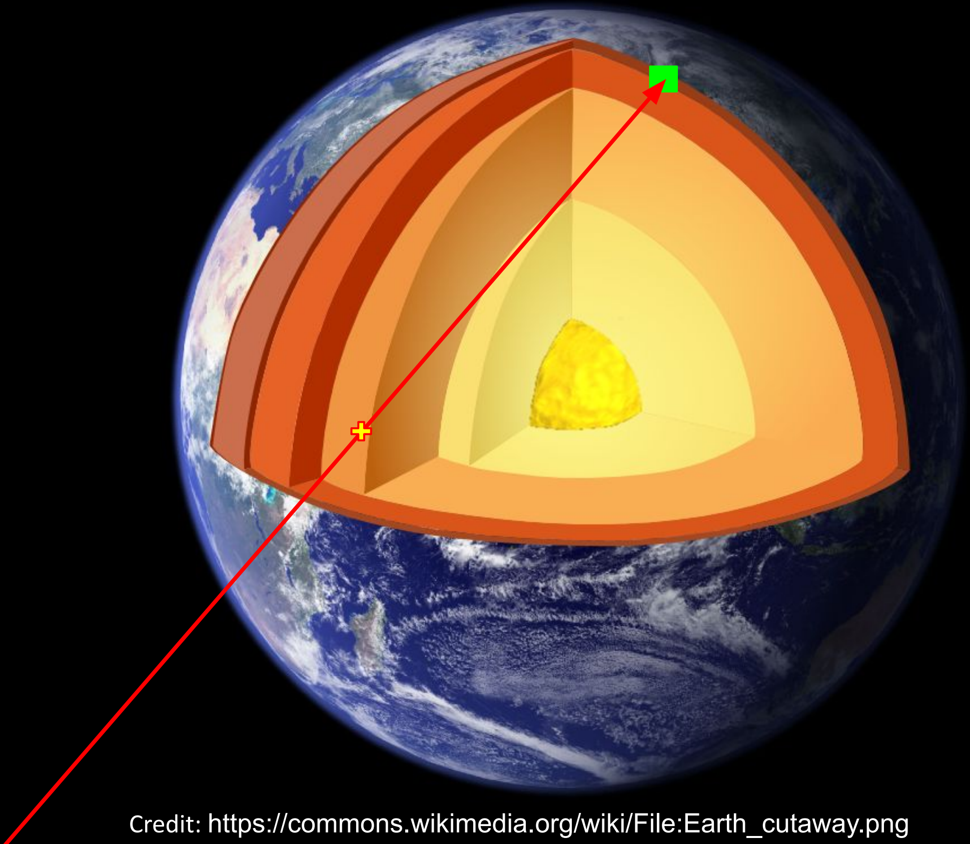
Credit: https://commons.wikimedia.org/wiki/File:Earth_cutaway.png

Upscattering and Deexcitation



See for comparison arXiv:2409.07768

Upscattering and Deexcitation



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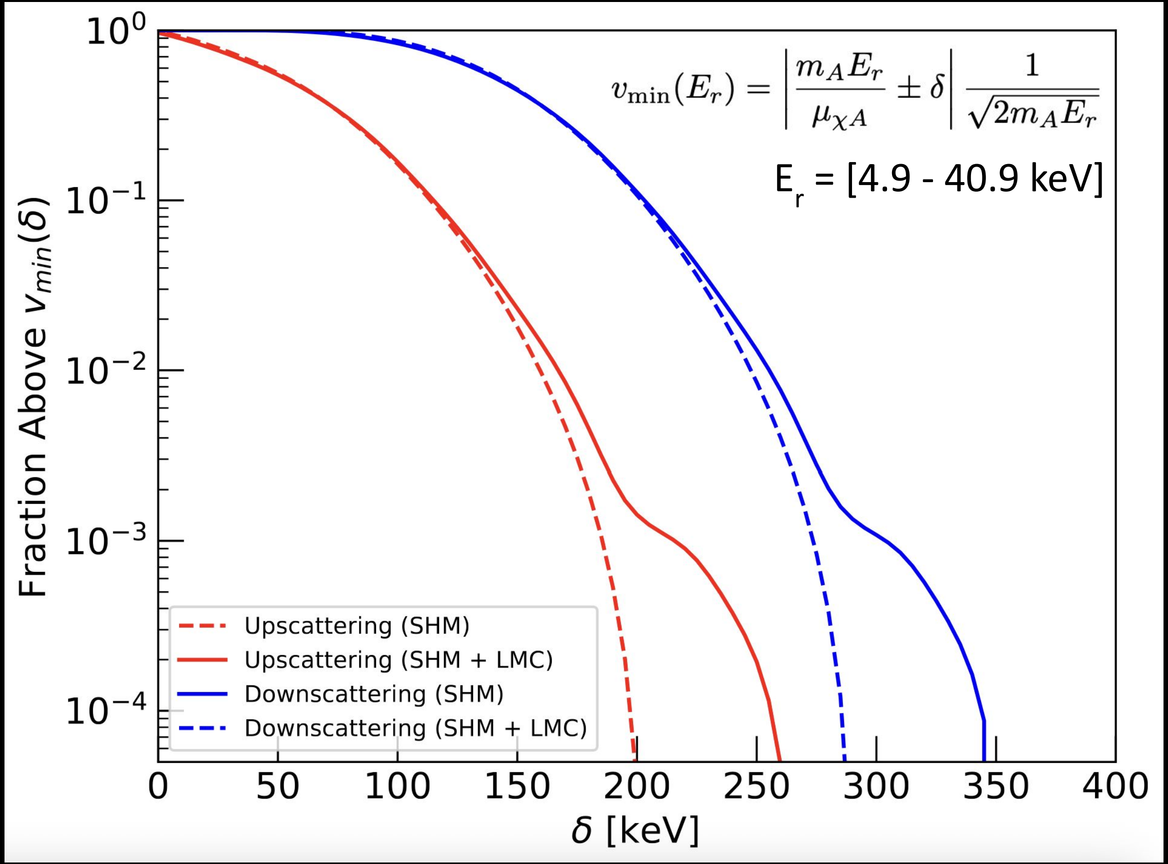
DM From the Large Magellanic Cloud



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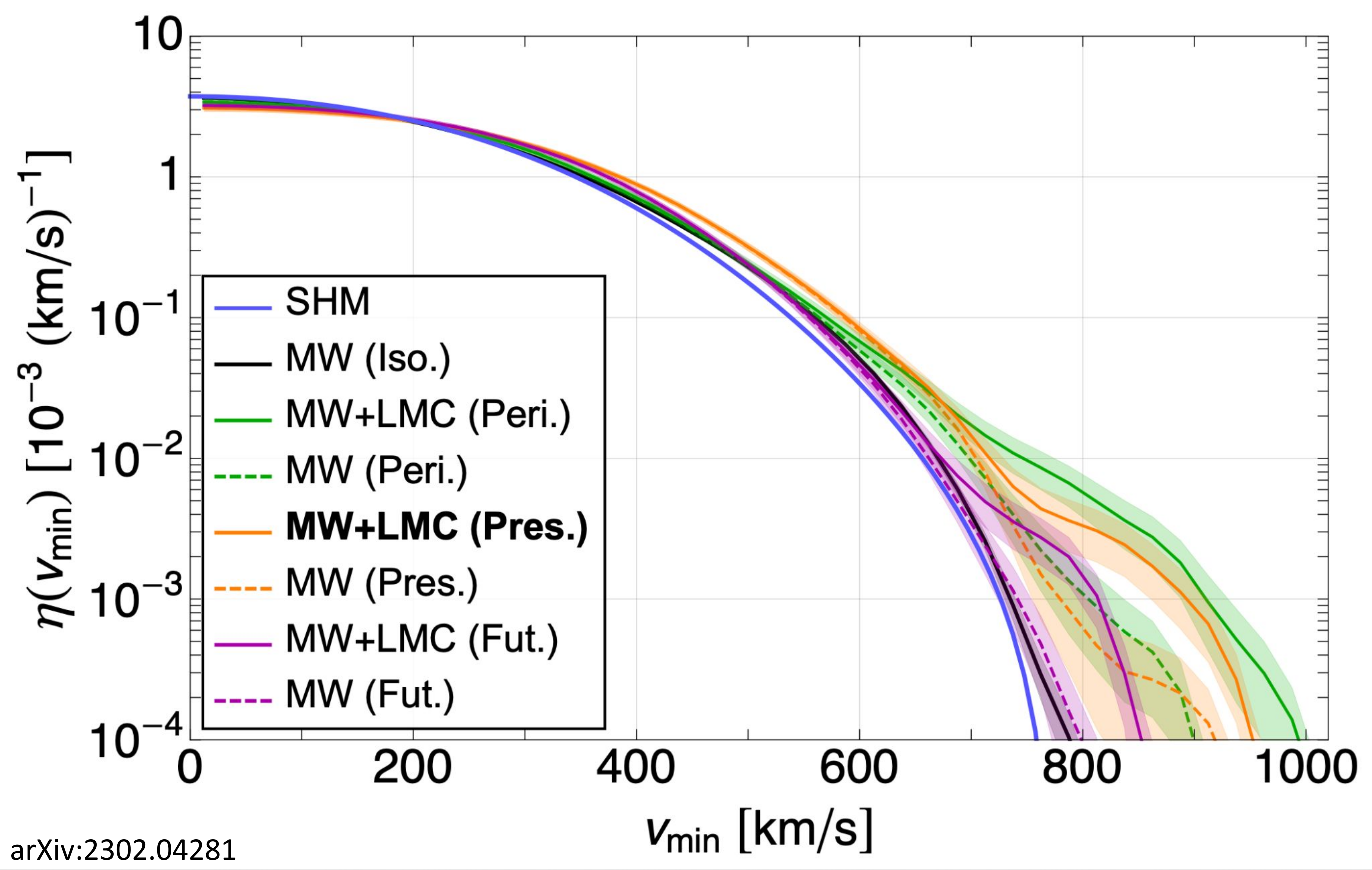
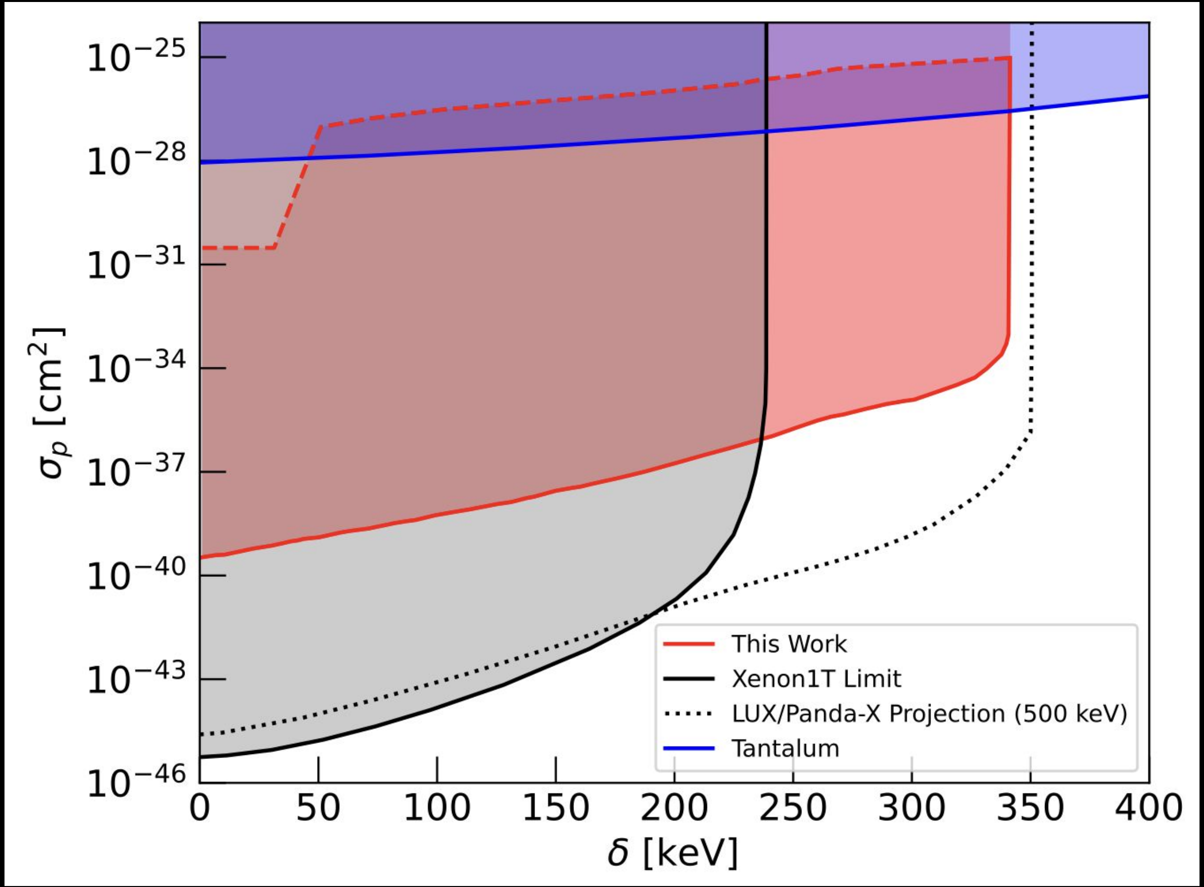


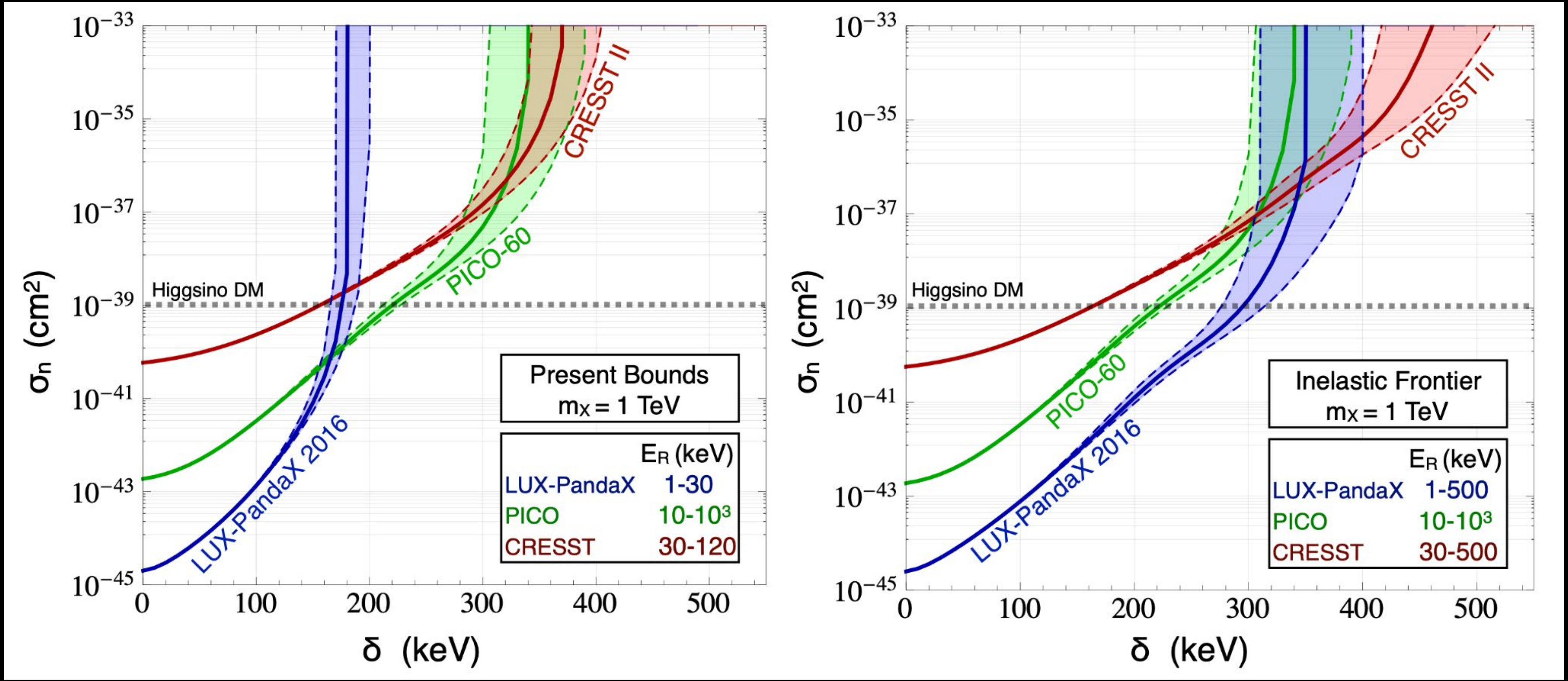
arXiv:2302.04281

See also
arXiv:1902.05089
arXiv:1909.04140
arXiv:2111.15440

Limits from XENON1T

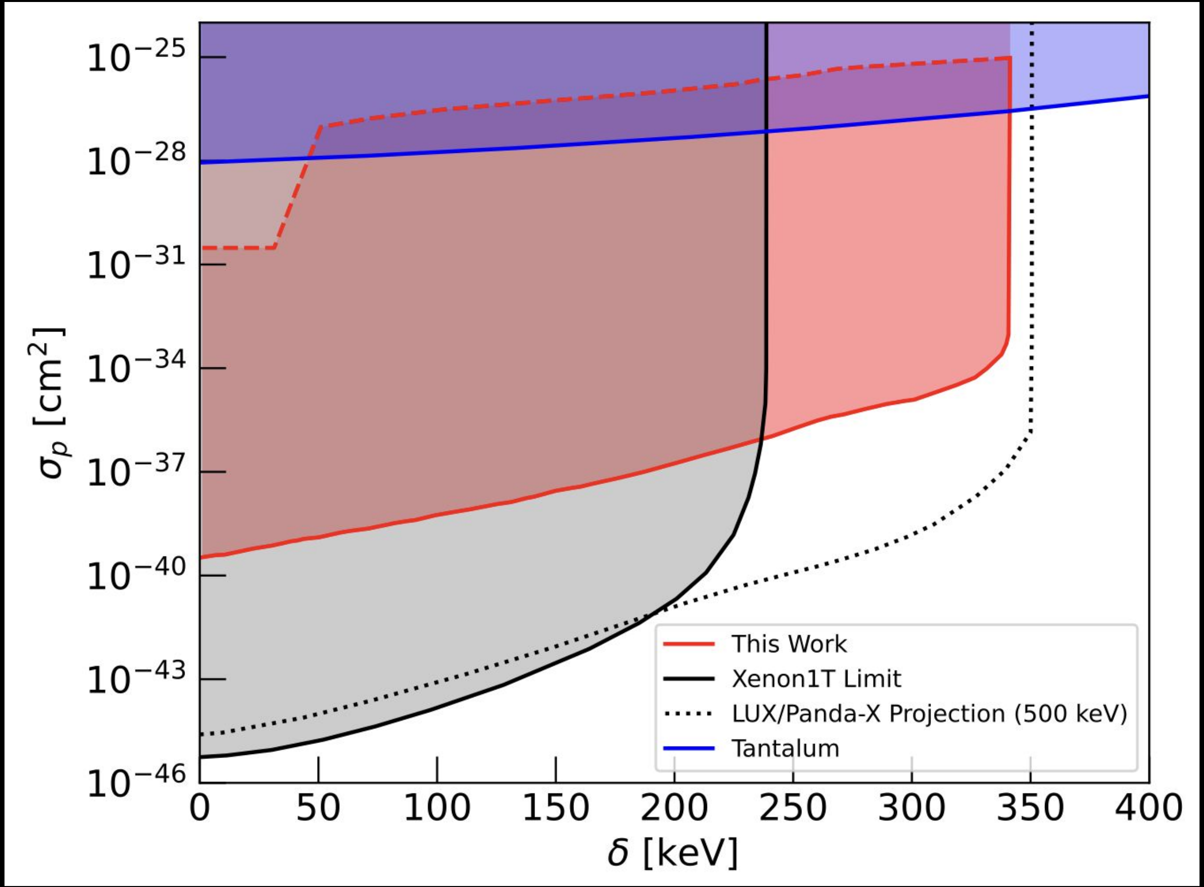


Limits from XENON1T



arXiv:1608.02662

Limits from XENON1T



Limits from XENON100

Effective field theory search for high-energy nuclear recoils using the XENON100 dark matter detector

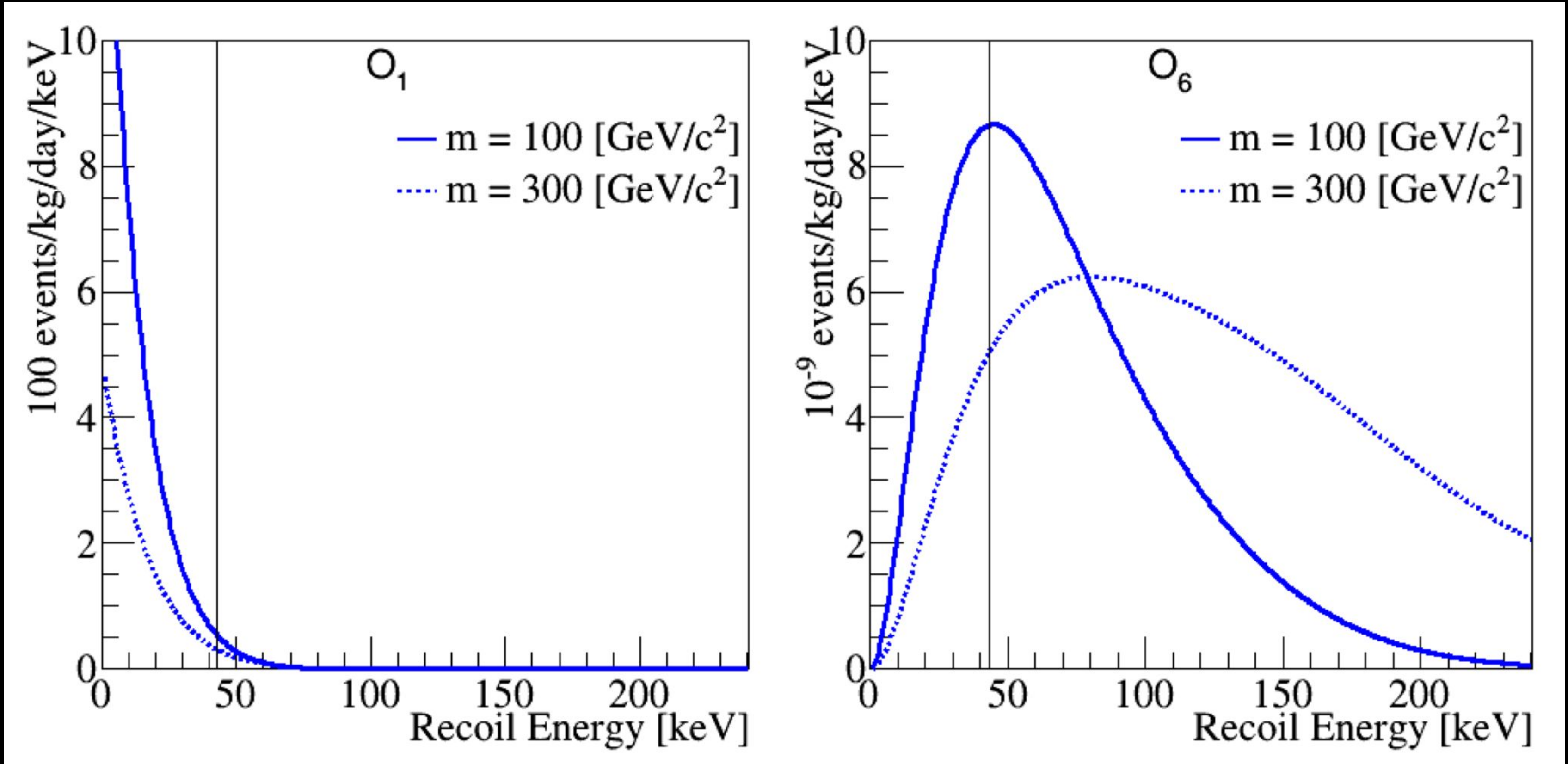
E. Aprile,[1] J. Aalbers,[2] F. Agostini,[3,4] M. Alfonsi,[5] F. D. Amaro,[6] M. Anthony,[1] F. Arneodo,[7] P. Barrow,[8] L. Baudis,[8] B. Bauermeister,[9] M. L. Benabderrahmane,[7] T. Berger,[10] P. A. Breur,[2] A. Brown,[2] E. Brown,[10] S. Bruenner,[11] G. Bruno,[3] R. Budnik,[12] L. Bütikofer,[13,*] J. Calvén,[9] J. M. R. Cardoso,[6] M. Cervantes,[14] D. Cichon,[11] D. Coderre,[13,*] A. P. Colijn,[2] J. Conrad,[9,†] J. P. Cussonneau,[15] M. P. Decowski,[2] P. de Perio,[1] P. Di Gangi,[4] A. Di Giovanni,[7] S. Diglio,[15] G. Eurin,[11] J. Fei,[16] A. D. Ferella,[9] A. Fieguth,[17] W. Fulgione,[3,18] A. Gallo Rosso,[3] M. Galloway,[8] F. Gao,[1] M. Garbini,[4] C. Geis,[5] L. W. Goetzke,[1] Z. Greene,[1] C. Grignon,[5] C. Hasterok,[11] E. Hogenbirk,[2] R. Itay,[12,‡] B. Kaminsky,[13,*] S. Kazama,[8] G. Kessler,[8] A. Kish,[8] H. Landsman,[12] R. F. Lang,[14] D. Lellouch,[12] L. Levinson,[12] Q. Lin,[1] S. Lindemann,[11,13] M. Lindner,[11] F. Lombardi,[16] J. A. M. Lopes,[6,§] A. Manfredini,[12,¶] I. Maris,[7] T. Marrodán Undagoitia,[11] J. Masbou,[15] F. V. Massoli,[4] D. Masson,[14] D. Mayani,[8] M. Messina,[1] K. Micheneau,[15] A. Molinario,[3] K. Morå,[9] M. Murra,[17] J. Naganoma,[19] K. Ni,[16] U. Oberlack,[5] P. Pakarha,[8] B. Pelssers,[9] R. Persiani,[15] F. Piastra,[8] J. Pienaar,[14] V. Pizzella,[11] M.-C. Piro,[10] G. Plante,[1] N. Priel,[12] L. Rauch,[11] S. Reichard,[14] C. Reuter,[14] A. Rizzo,[1] S. Rosendahl,[17] N. Rupp,[11] J. M. F. dos Santos,[6] G. Sartorelli,[4] M. Scheibelhut,[5] S. Schindler,[5] J. Schreiner,[11] M. Schumann,[13] L. Scotto Lavina,[20] M. Selvi,[4] P. Shagin,[19] M. Silva,[6] H. Simgen,[11] M. v. Sivers,[13,*] A. Stein,[21] D. Thers,[15] A. Tiseni,[2] G. Trinchero,[18] C. Tunnell,[2,22] M. Vargas,[17] H. Wang,[21] Z. Wang,[3] Y. Wei,[8] C. Weinheimer,[17] J. Wulf,[8] J. Ye,[16] and Y. Zhang.[1]

(XENON Collaboration)[‖]

B. Farmer[9,**]

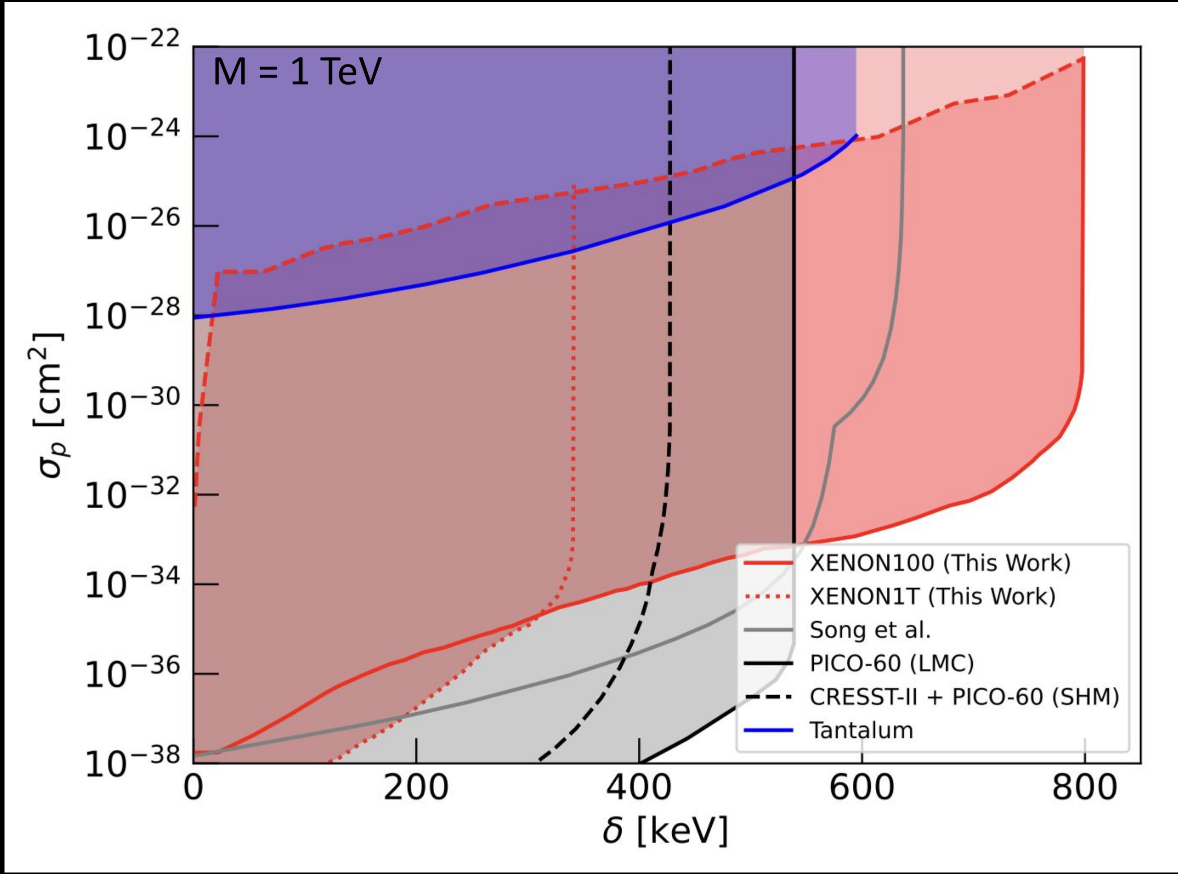
arXiv:1705.02614

Limits from XENON100



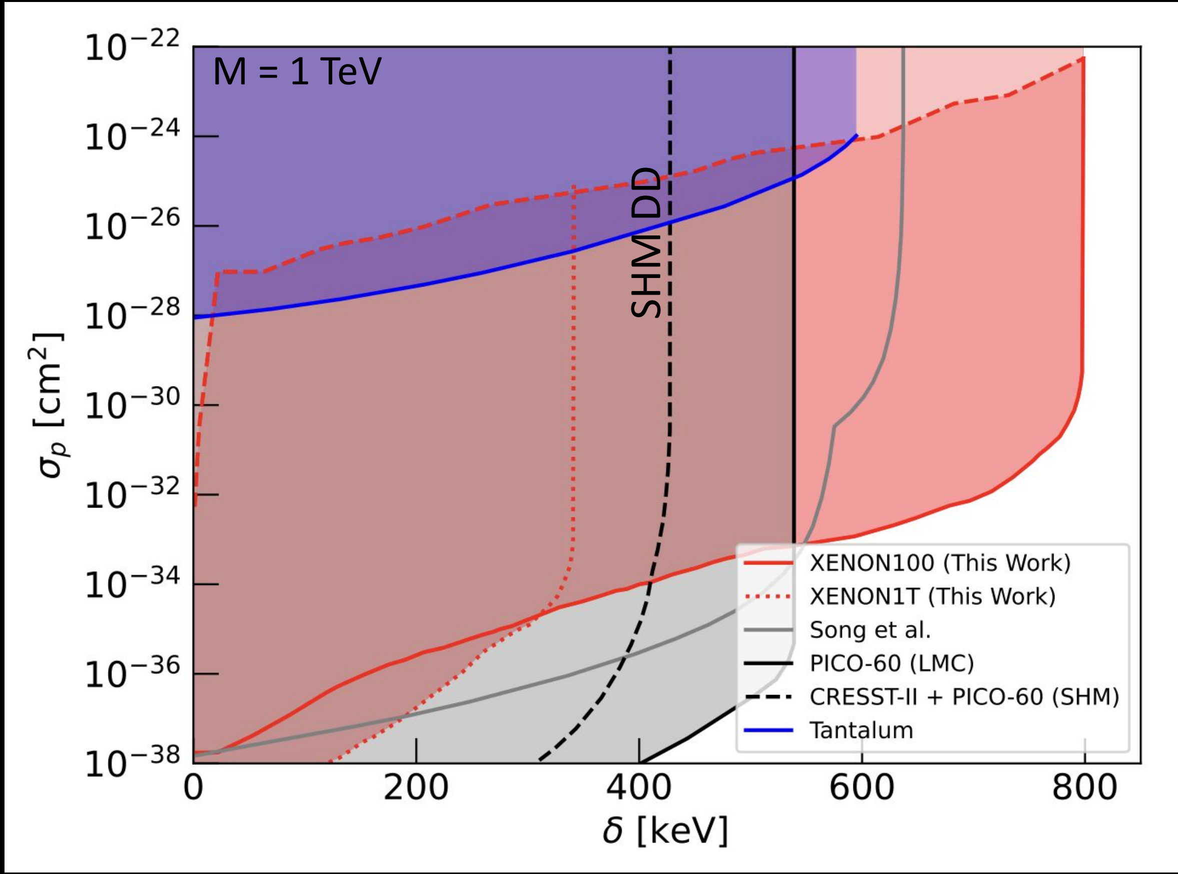
arXiv:1705.02614

Limits from XENON100



Previous limits from arXiv:1911.07865, arXiv:2104.09517, arXiv:2409.07768

Limits from XENON100



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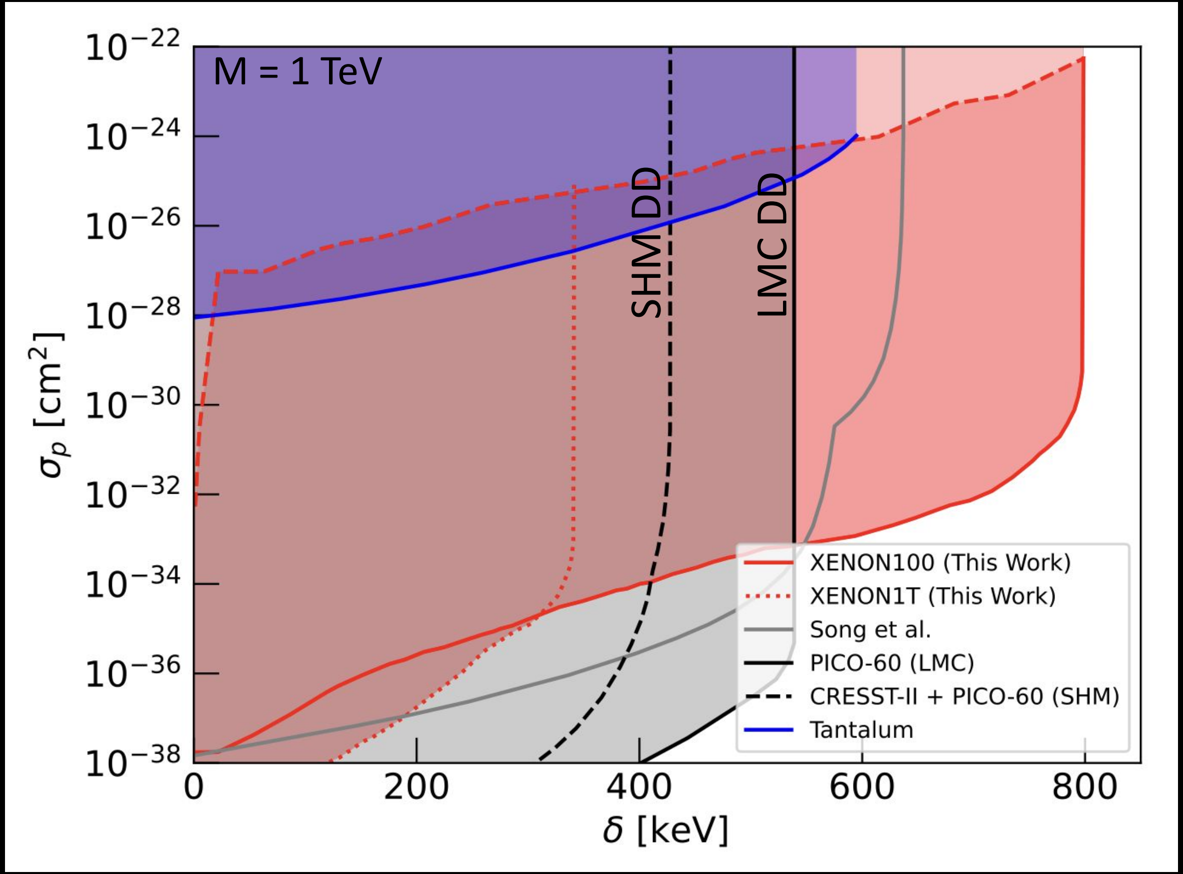
Limits from XENON100



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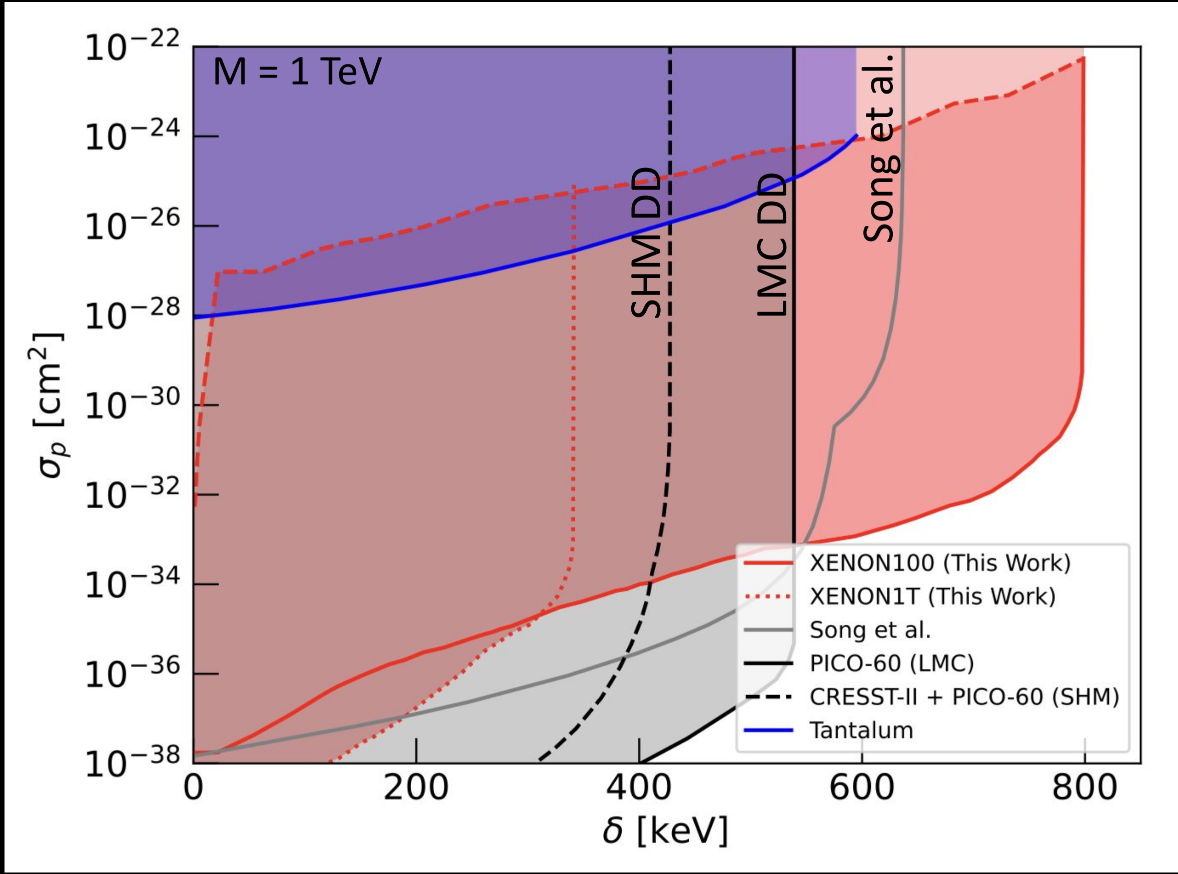

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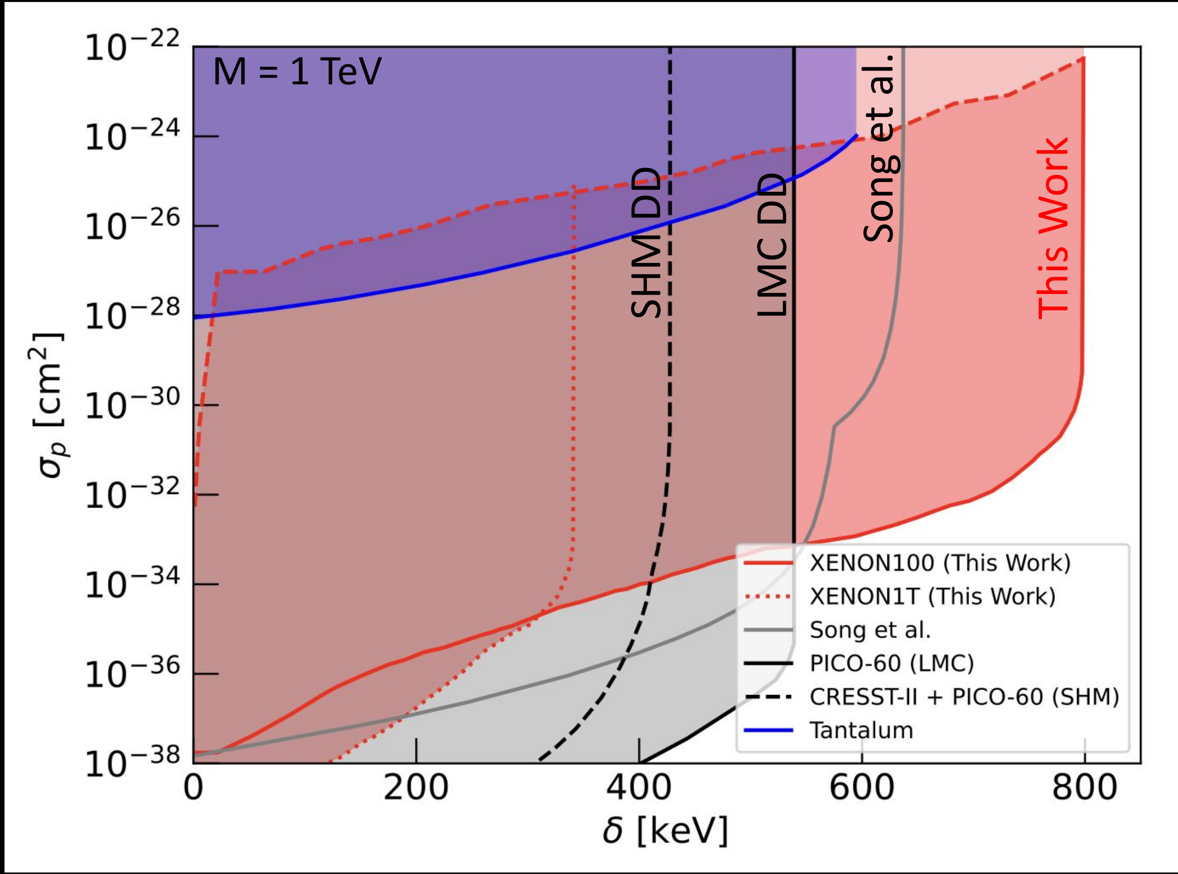

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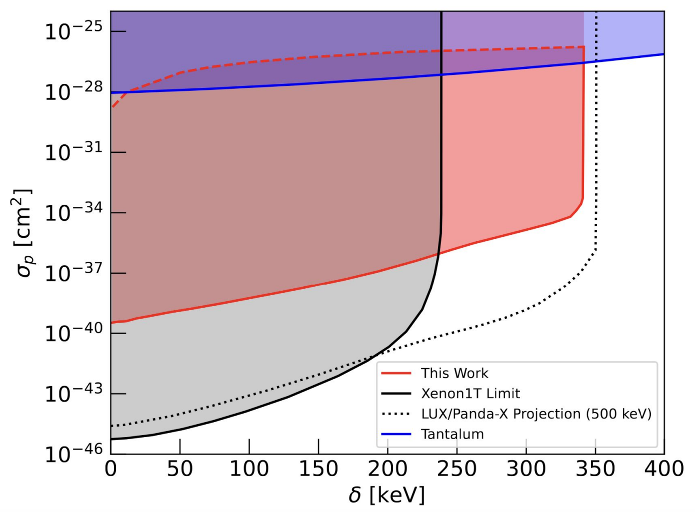
Zamiul Alam

Conclusions & Acknowledgments



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