



Stockholms
universitet



XENON

Light Dark Matter with XENONnT

Torben Flehmke (Stockholm University)

Partikeldagarna 2025

Nov 24-25

The XENON Collaboration

Laboratori Nazionali del Gran Sasso

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San Diego

Houston

THE UNIVERSITY OF CHICAGO
Chicago

COLUMBIA UNIVERSITY
New York City

PURDUE UNIVERSITY
Lafayette

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12 countries

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MIDDLE EAST

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THE UNIVERSITY OF TOKYO

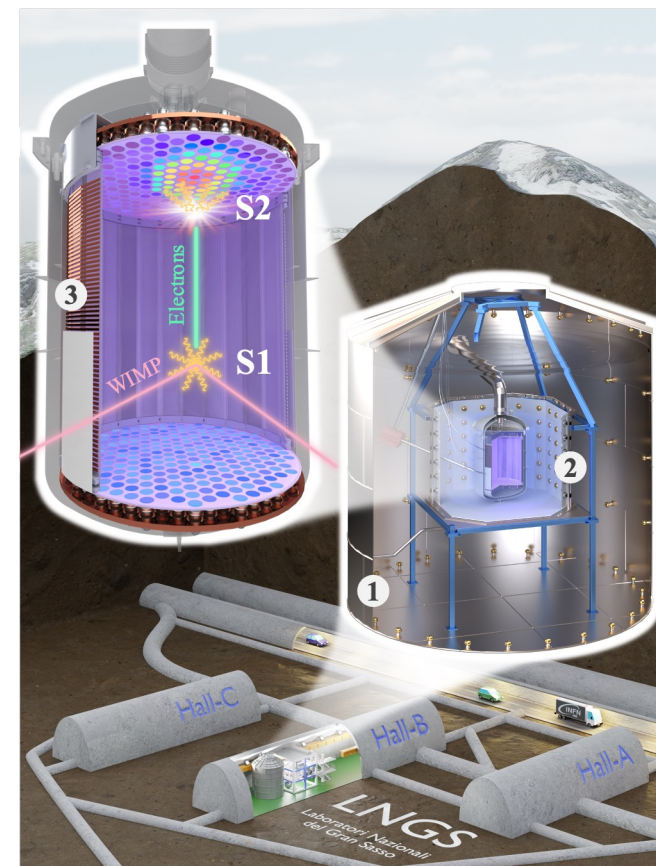
Tokyo

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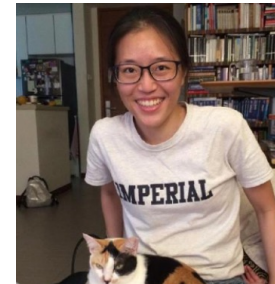
The XENON Collaboration

Currently working on an electrode upgrade
for the TPC, **ON SCHEDULE!!!!**

Stockholm group:



Jan



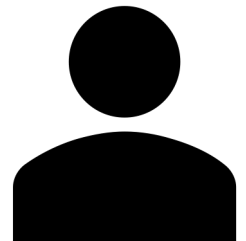
Pueh



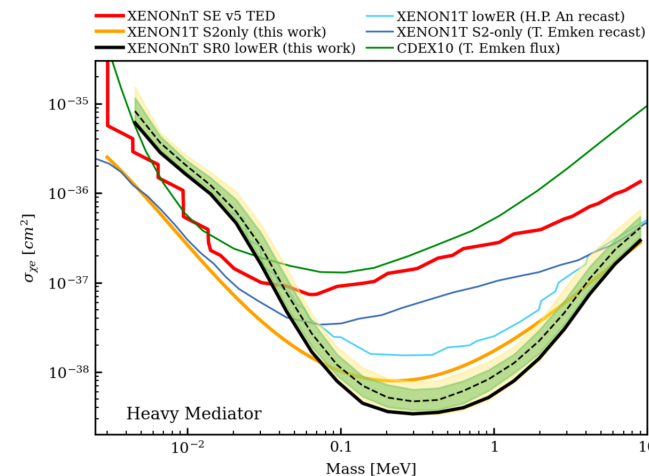
Torben



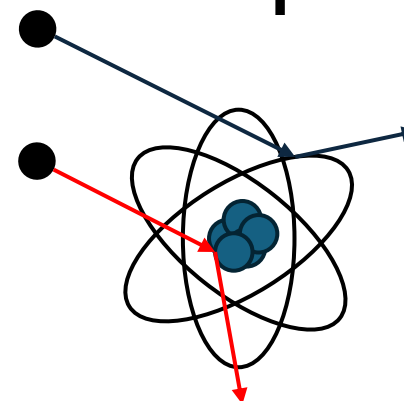
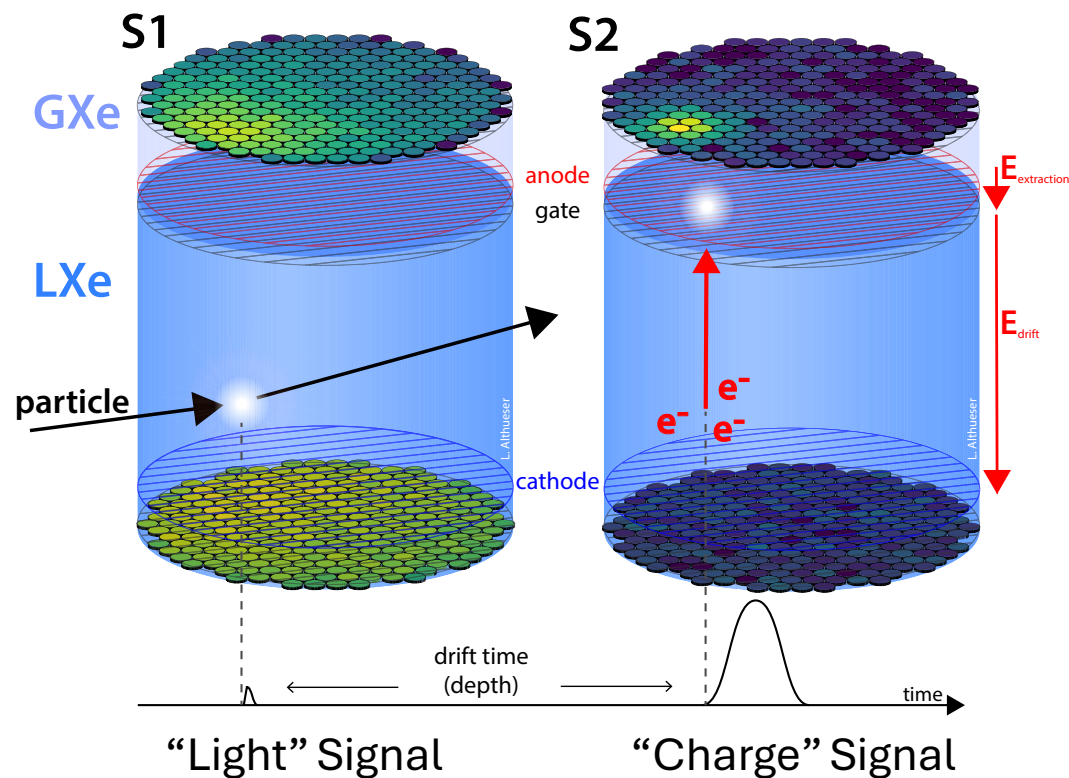
Jörn



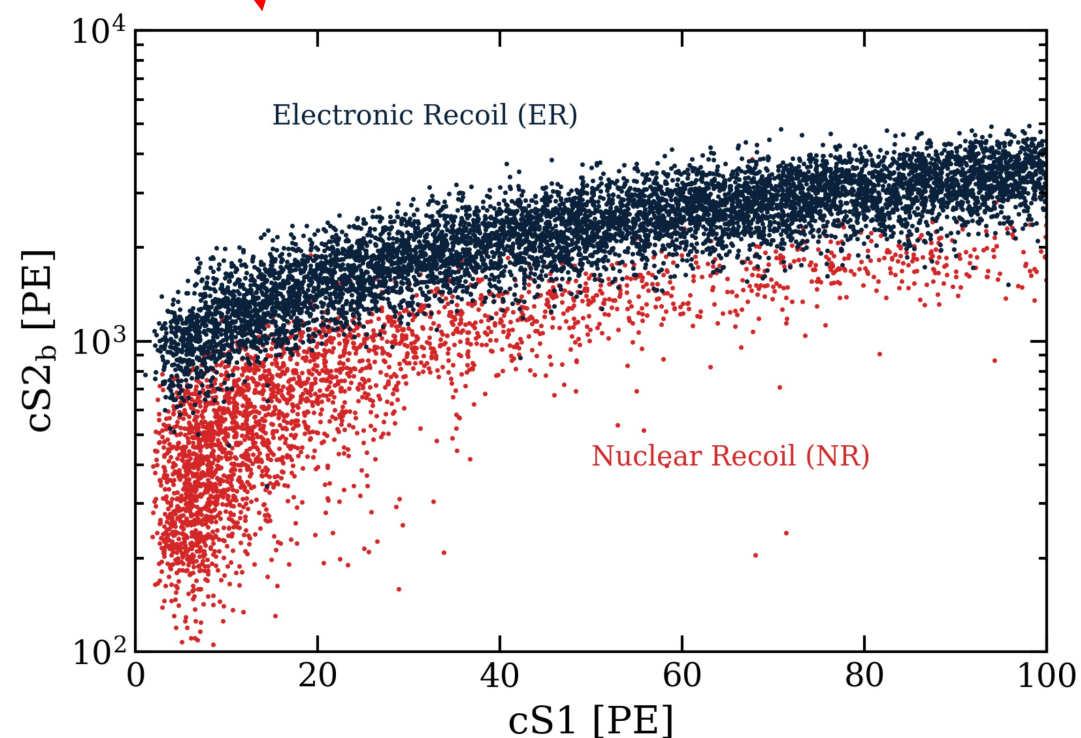
You?



The XENONnT Working Principle



- **Electron Recoil**
- **Nuclear Recoil**



Today: Light Dark Matter

PHYSICAL REVIEW LETTERS 134, 111802 (2025)

Editors' Suggestion

First Search for Light Dark Matter in the Neutrino Fog with XENONnT

E. Aprile¹, J. Aalbers², K. Abe³, S. Ahmed Maouloud⁴, L. Althueser⁵,
D. Antón Martín⁸, F. Arneodo⁹, L. Baudis¹⁰, M. Bazyk¹¹, L. Bellagamba¹²,
K. Boese¹³, A. Brown¹⁴, G. Bruno¹¹, R. Budnik¹⁵, C. Cai¹⁶,
A. P. Cimental Chávez¹⁰, A. P. Colijn¹⁸, J. Conrad¹⁹, J. J. Cuenca-García¹⁰

B. Andrieu⁴, E. Angelino^{6,7},
A. Bismark¹⁰

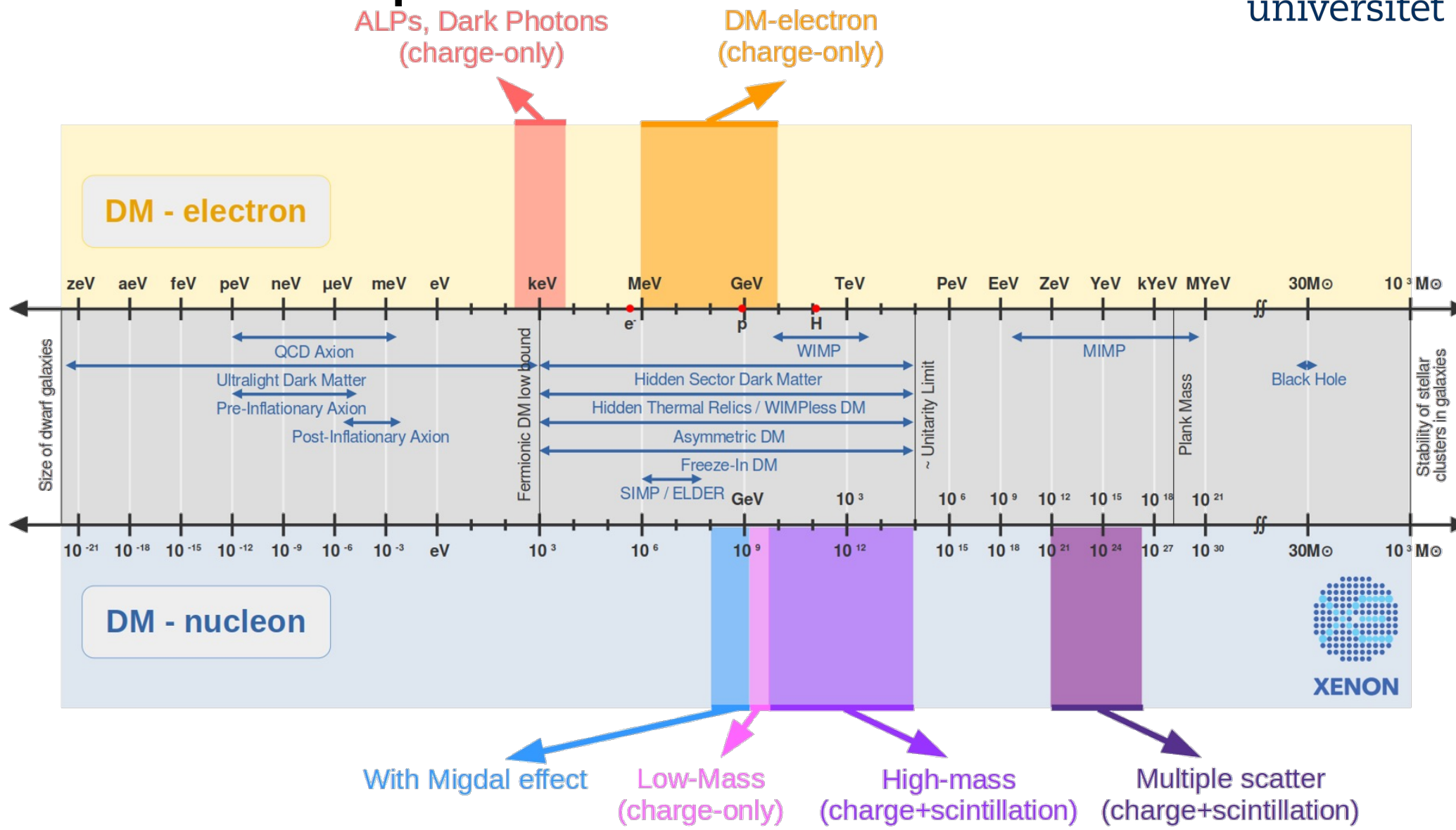
PHYSICAL REVIEW LETTERS 134, 161004 (2025)

Editors' Suggestion

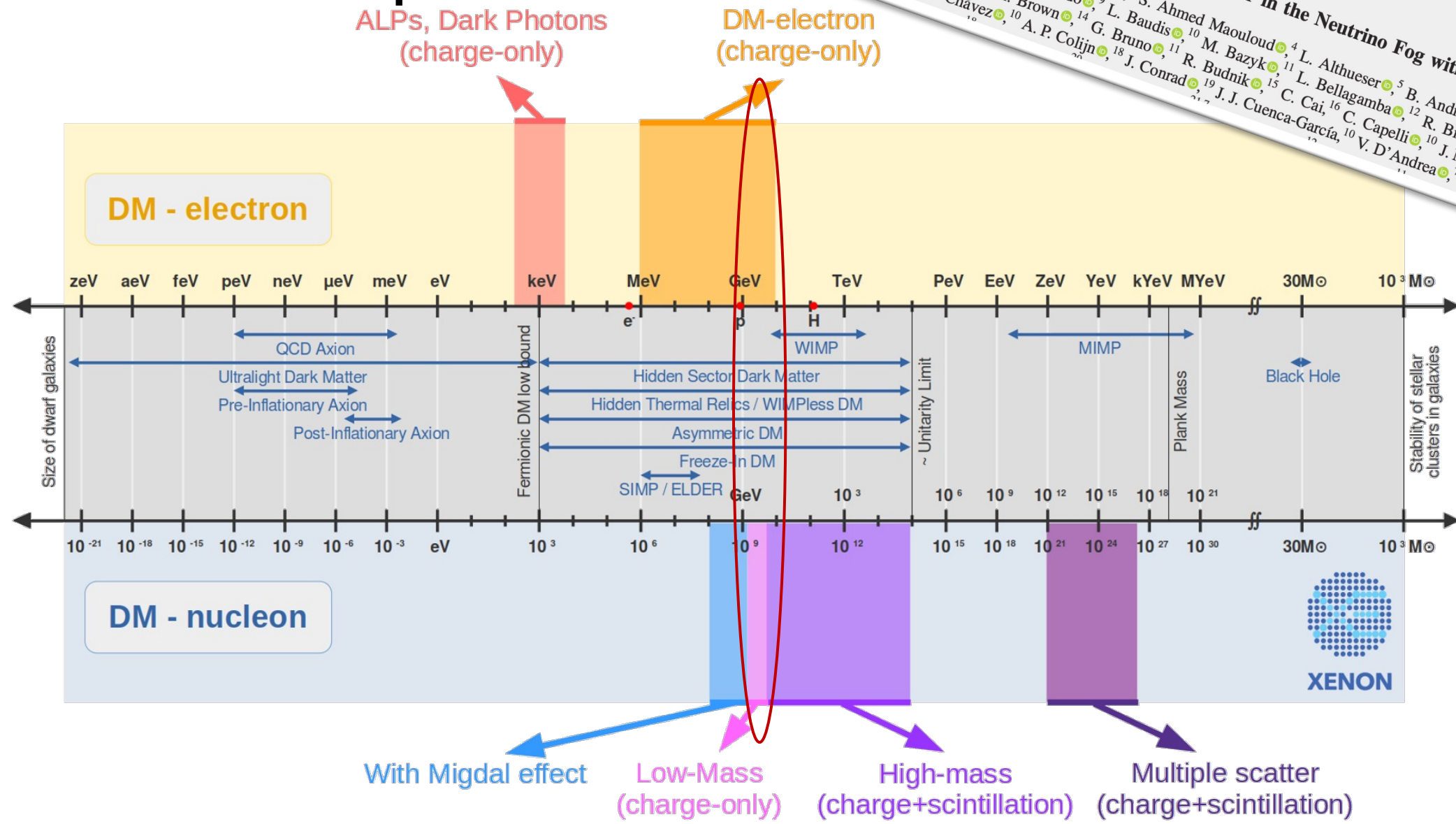
Search for Light Dark Matter in Low-Energy Ionization Signals from XENONnT

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A. P. Cimental Chávez¹⁰, A. P. Colijn¹⁸, J. Conrad¹⁹, J. J. Cuenca-García¹⁰, V. D'Andrea^{7,*},
L. C. Daniel García⁴, M. P. Decowski¹⁸, A. Deisting²⁰, C. Di Donato^{21,7}, P. Di Gangi¹², S. Diglio¹¹,
V. D'Andrea⁷, H. Fischer¹⁴, T. Flückiger¹⁹

DM Landscape at XENONnT



DM Landscape at XENON

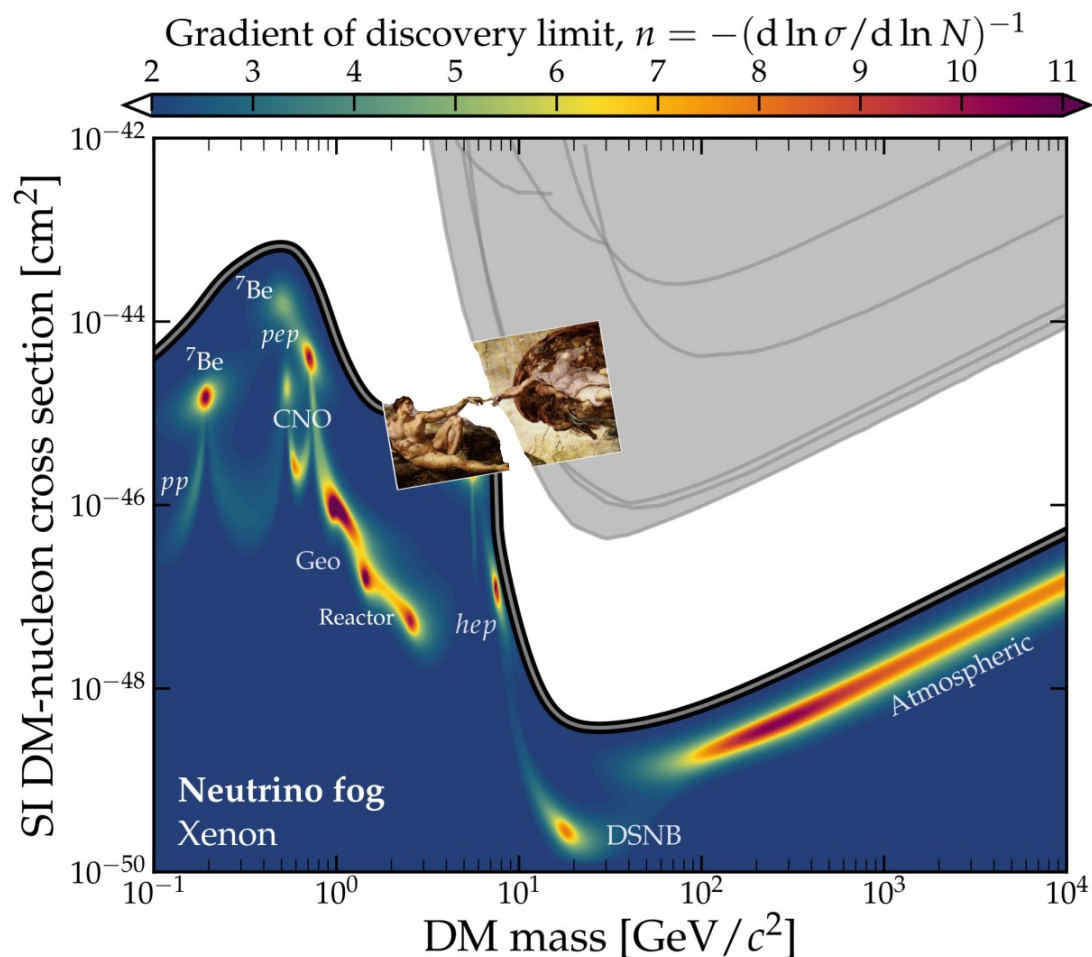


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The ν fog

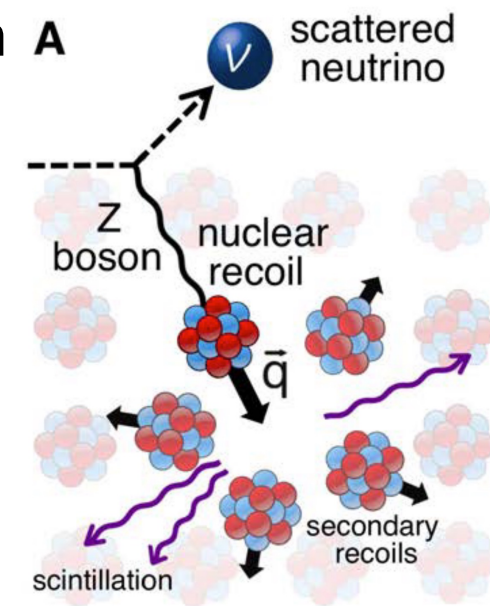


Coherent Elastic ν -Nucleus Scattering (CE ν NS)

- Signal indistinguishable from **A** WIMPs

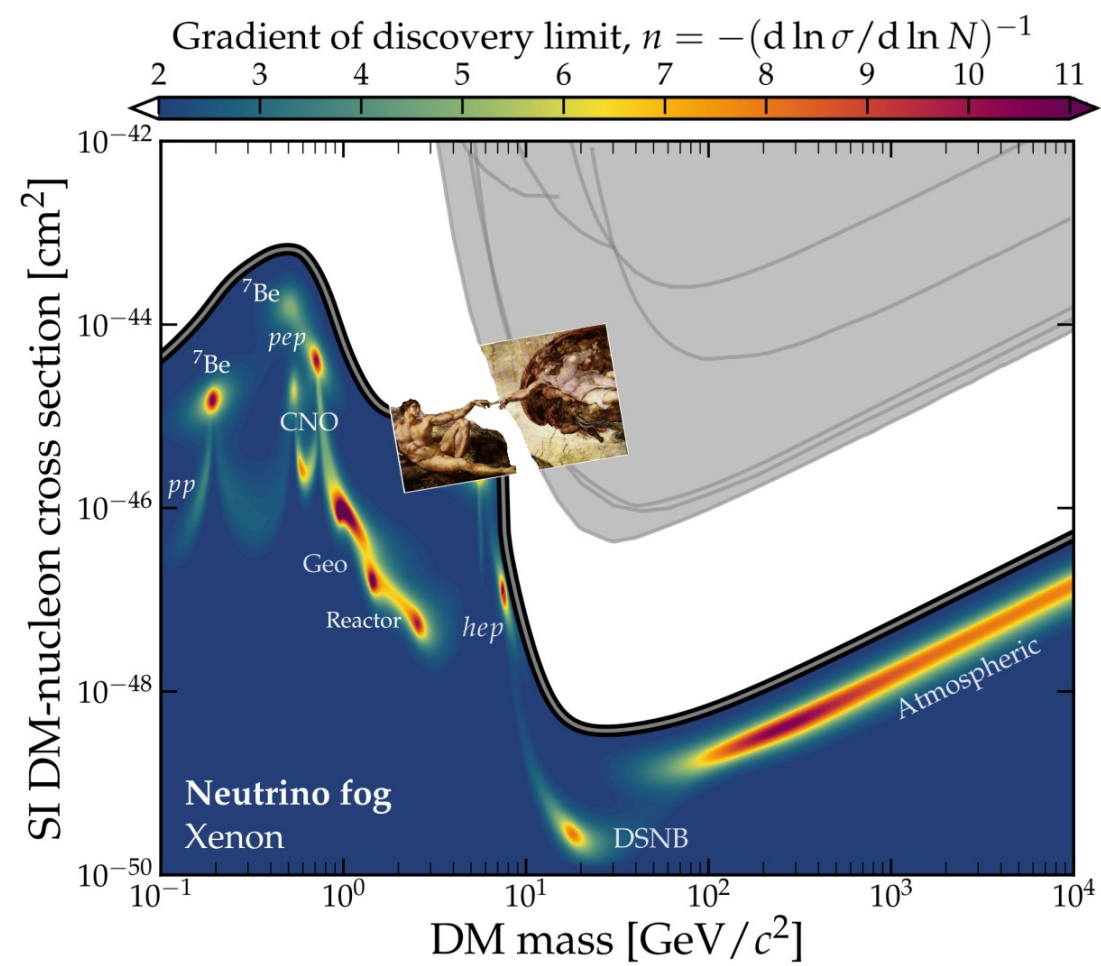
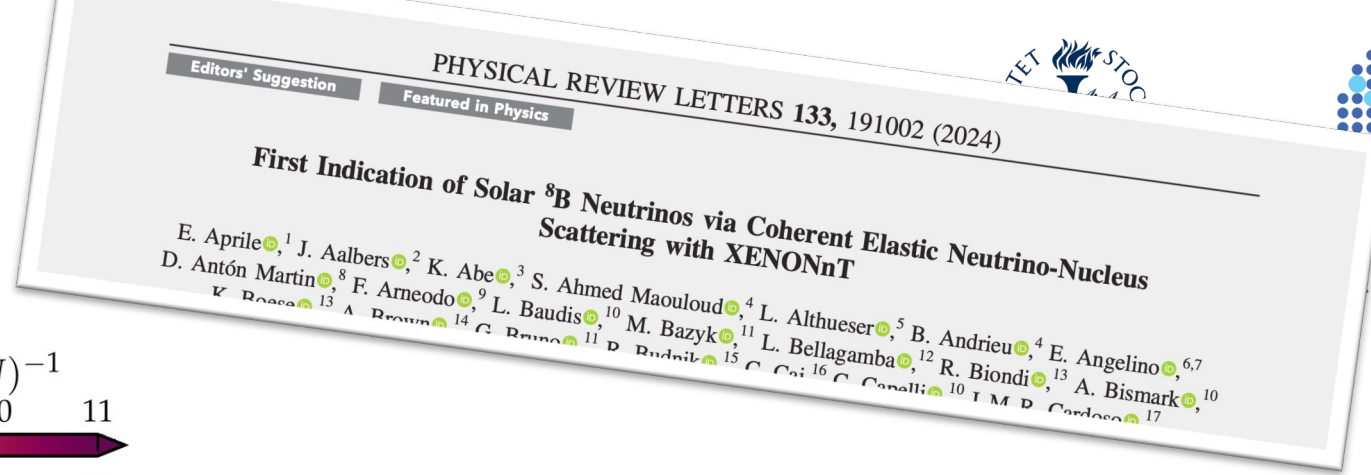
→ Increasingly difficult to Search for DM

→ ≈ 20 times increase in rate from decreased energy threshold



[arxiv:1708.01294](https://arxiv.org/abs/1708.01294)

Last Year:



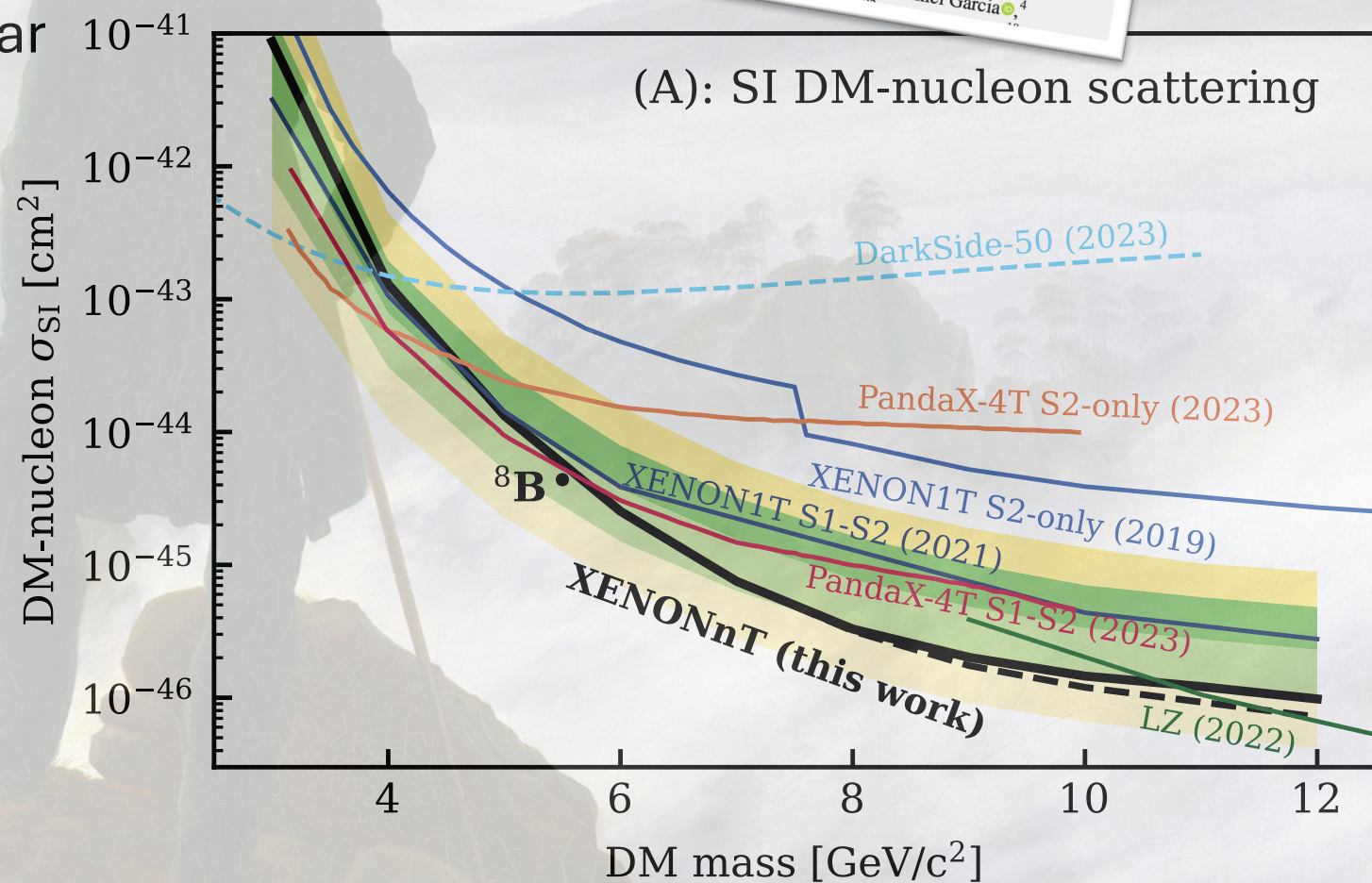
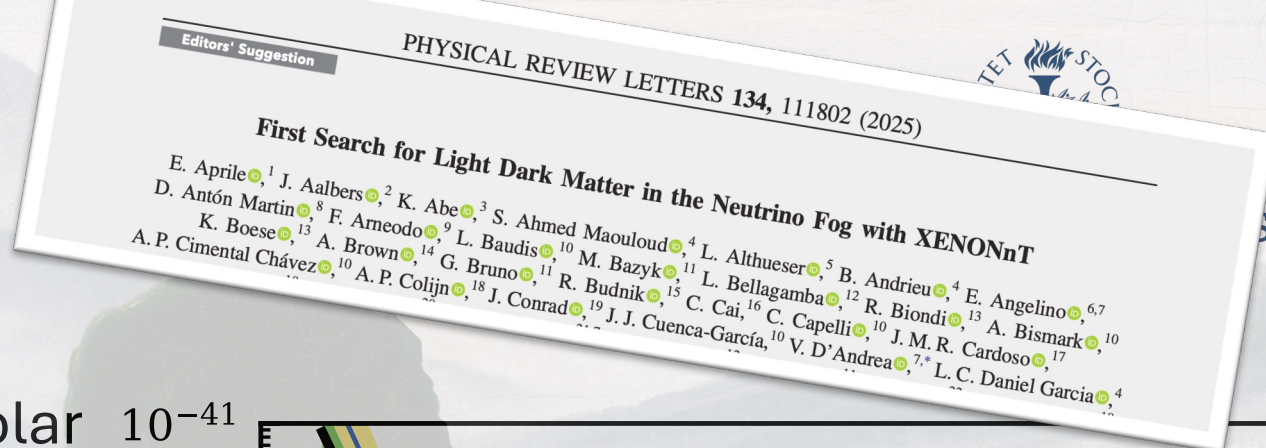
Component	Expectation	Best-fit
AC (SR0)	7.5 ± 0.7	7.4 ± 0.7
AC (SR1)	17.8 ± 1.0	17.9 ± 1.0
ER	0.7 ± 0.7	$0.5^{+0.7}_{-0.6}$
Neutron	$0.5^{+0.2}_{-0.3}$	0.5 ± 0.3
Total background	$26.4^{+1.4}_{-1.3}$	26.3 ± 1.4
⁸ B	$11.9^{+4.5}_{-4.2}$	$10.7^{+3.7}_{-4.2}$
Observed	37	

Measured the solar ν flux at 2.73σ significance

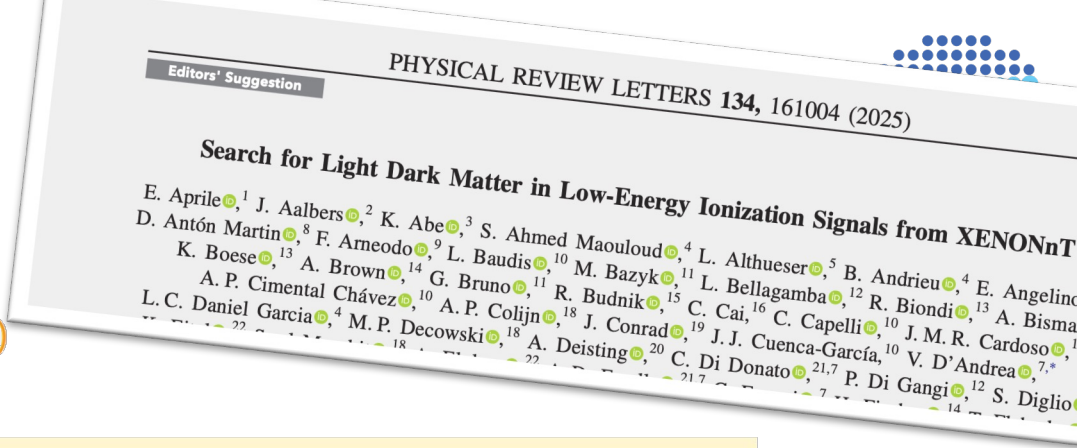
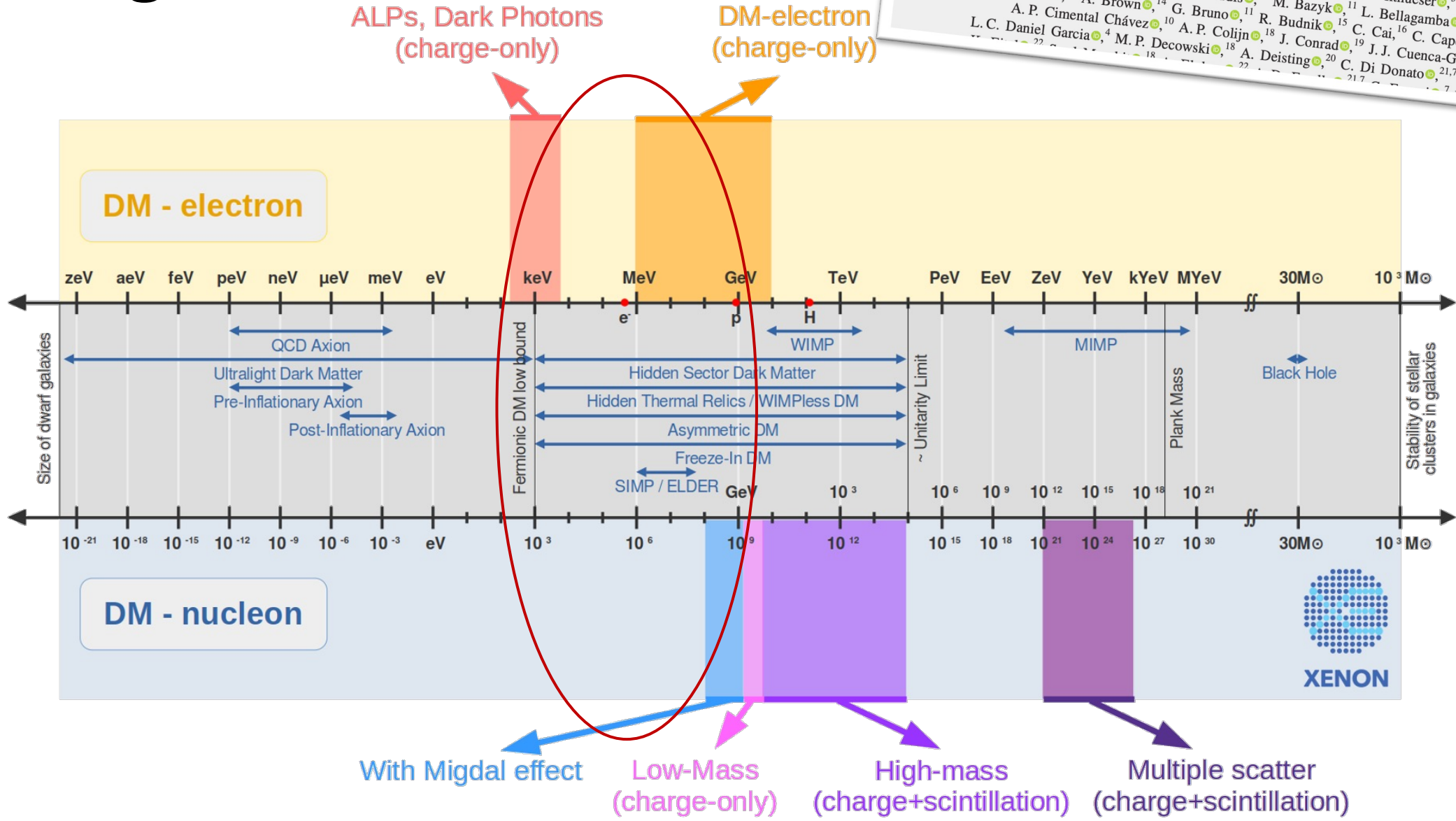


Into the Fog

- Same Data and Analysis as the Solar ν study
- Previously: Solar ν as a the signal
- Now: They are part of the background

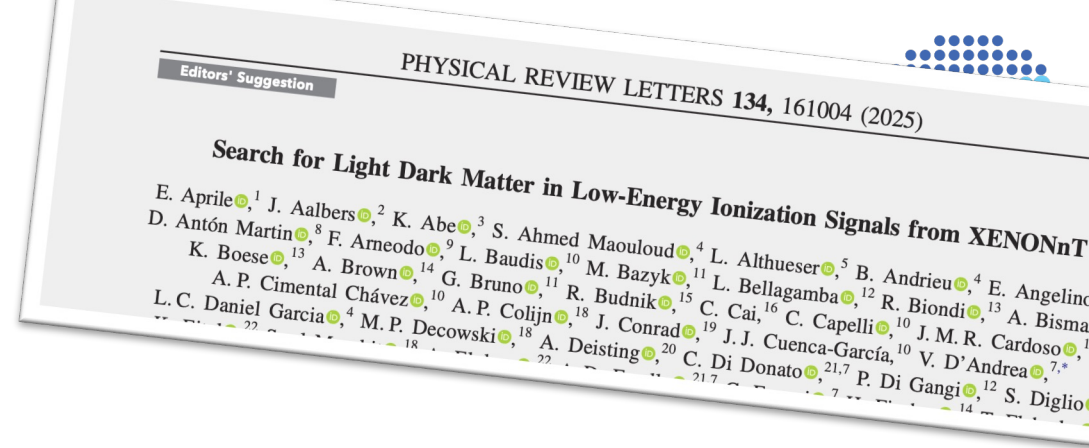
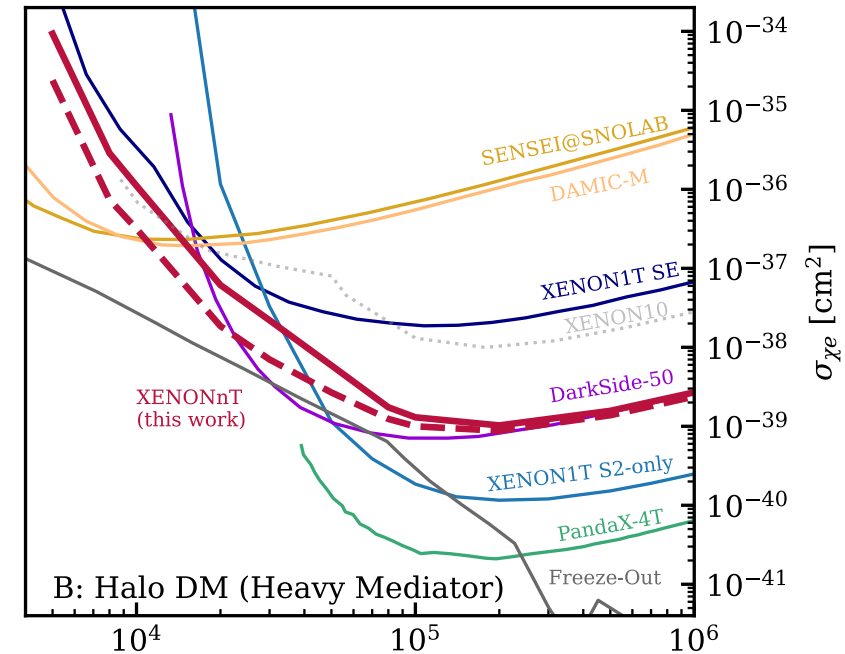
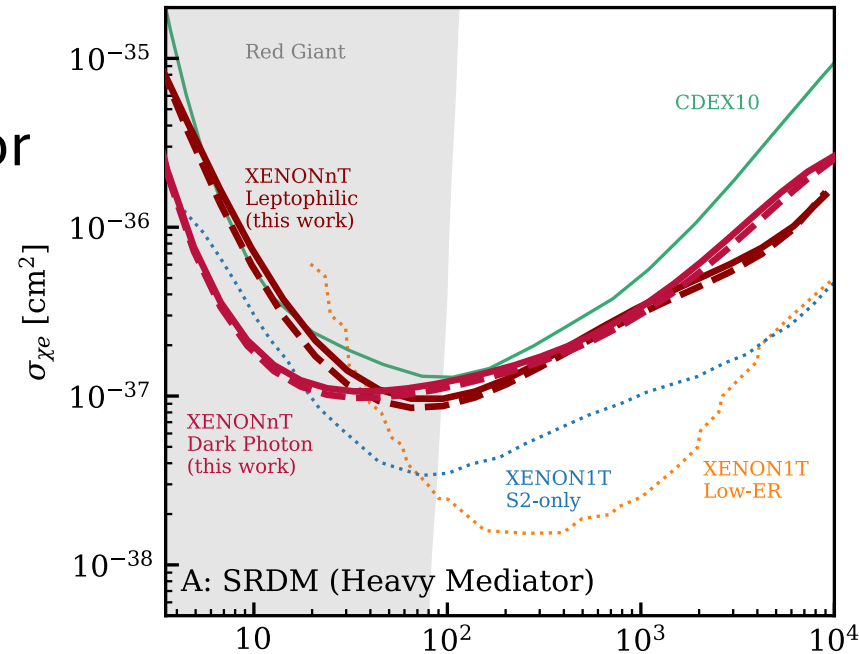


Going Even Lower



Even Lower Masses

- Looking at few electron S2 signals
- Requires different detector model and dataset
- Only $\sim t$ -days exposure
- DM model dependent results



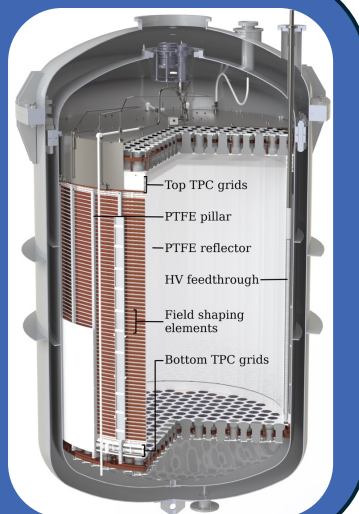
Summary:

XENONnT experiment:

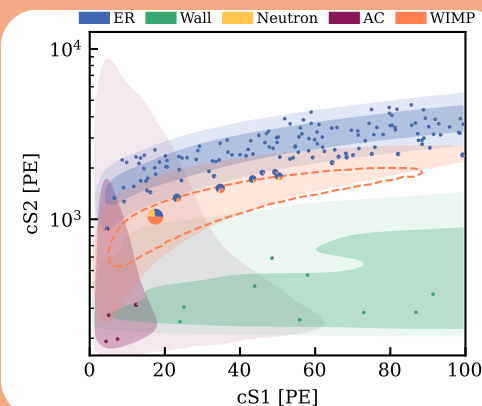
TPC with 5.9t active LXe target

Collected $> 3.5\text{t} \cdot \text{yr}$ exposure

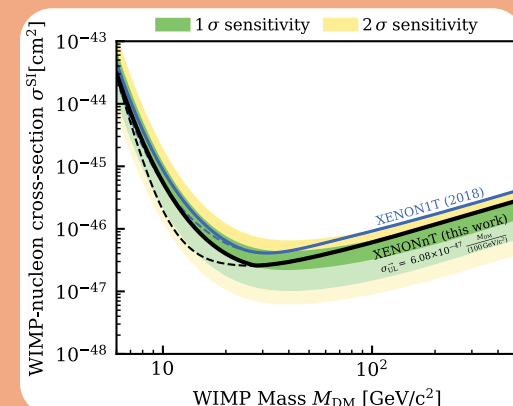
Currently upgrade ongoing,
ON SCHEDULE



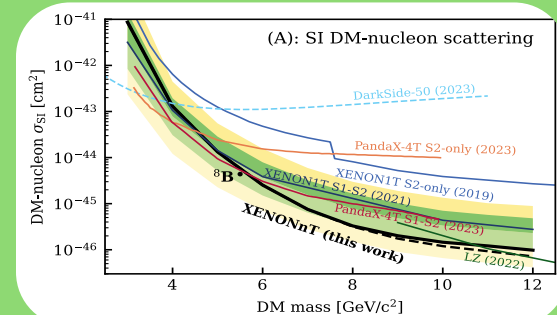
WIMP direct detection



arXiv:2303.14729 [hep-ex]



Light dark Matter

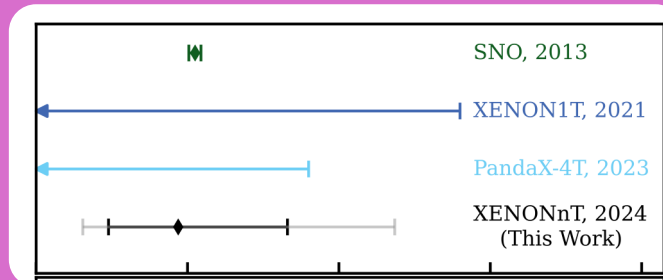


arXiv:2411.15289 [hep-ex]

arXiv:2409.17868 [hep-ex]

Neutrinos

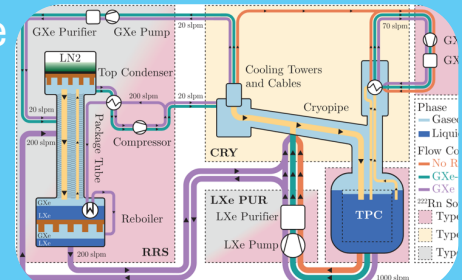
Solar ν , $\text{CE}\nu\text{NS}$, $0\nu\beta\beta$



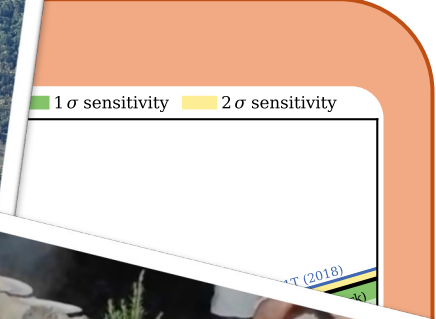
arXiv:2408.02877 [nucl-ex]

Technology

Probably purest ≈ 6 tons of Xe in
the universe



arXiv:2502.04209 [physics.ins-det]



[arXiv:2411.15289](https://arxiv.org/abs/2411.15289) [h
[arXiv:2409.17868](https://arxiv.org/abs/2409.17868) [h

[v:2502.04209](https://arxiv.org/abs/2502.04209) [physi





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