Highlights fomr EPS HEP Conference

(depending on what I like, what I followed, what I omitted not to be tedious)

G. Dho

17/07/2025

Main News from other fields

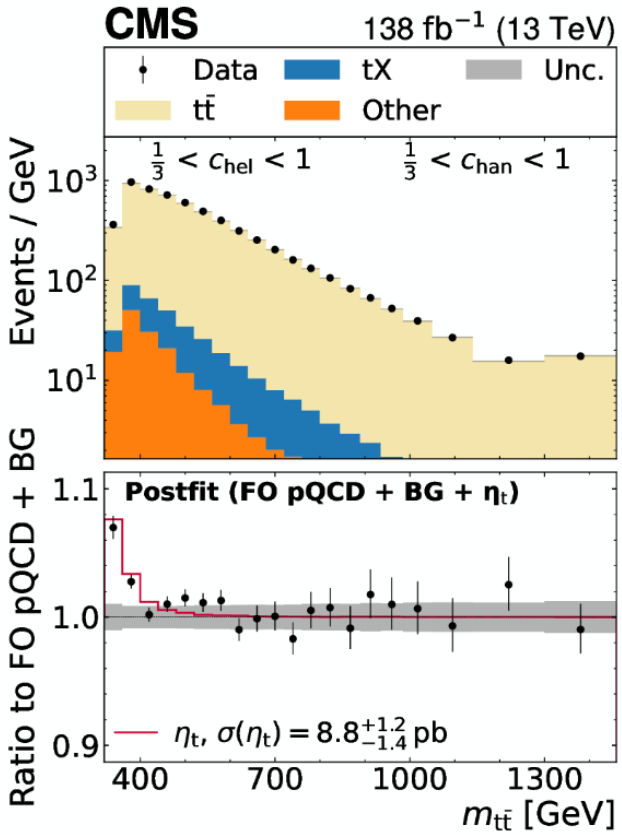
https://indico.in2p3.fr/event/33627/contributions/154956/attachments/94073/144233/CMS_ttbar_threshold_CS_final.pdf

Toponium bound state

Excess above 5 sigma

For resonance at toponium ($t\bar{t}$) mass scale

Both CMS and ATLAS



Main News from other fields

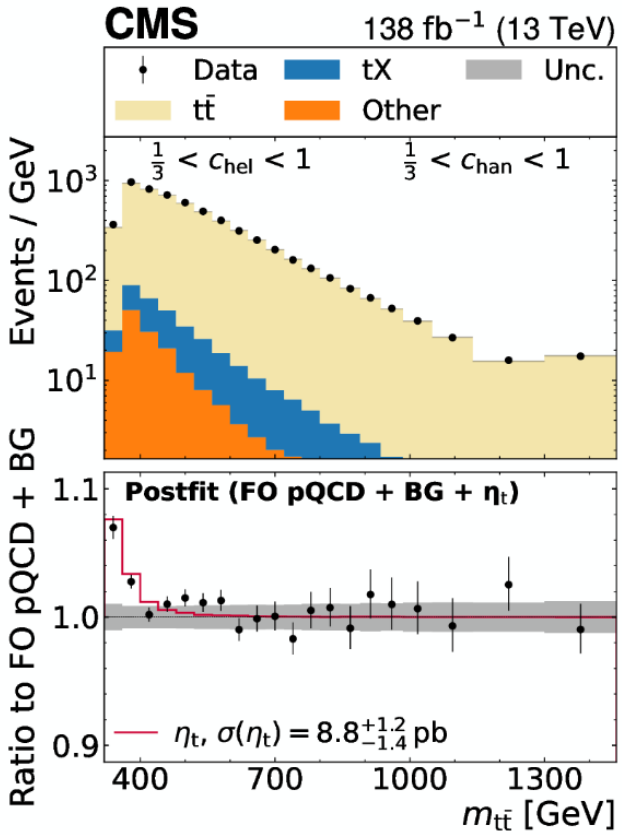
https://indico.in2p3.fr/event/33627/contributions/153149/attachments/94190/145866/gershon-EPSHEPP2025-plenary.pdf

Toponium bound state

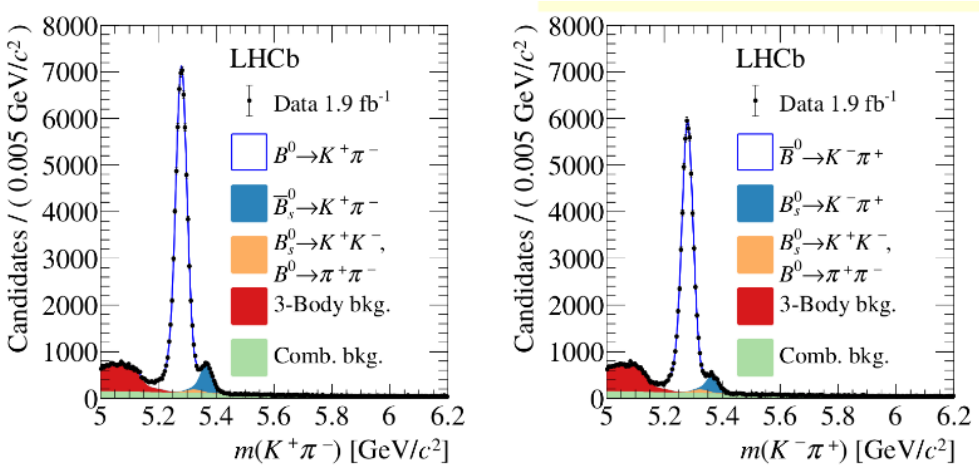
Excess above 5 sigma

For resonance at toponium ($t\bar{t}$) mass scale

Both CMS and ATLAS



Baryon decay with CP violation



$A_{CP}(B^0 \to K^+\pi^-) = (-8.24 \pm 0.33 \pm 0.33)\%$

Still trying to understand why other channels are suppressed

Matter antimatter asymmetry contribution still unknown

Don’t Miss Out

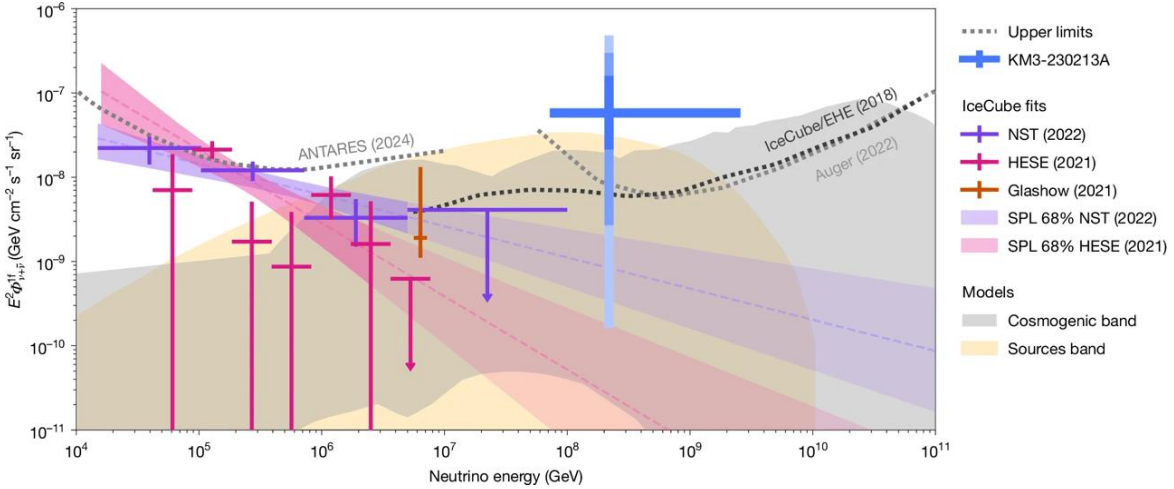
https://indico.in2p3.fr/event/33627/contributions/153158/attachments/95380/146063/EPS-AI-4-HEP-plenary-2025.pdf

- Interesting presentation on AI and ML on high energy physics
- Especially interesting for the emulation of simulation: a way to make large simulation and modeled physics into predictions or helping inference

Neutrinos

KM3Net

- PeV neutrino observation
- Oscillation measurements in line with world experiments

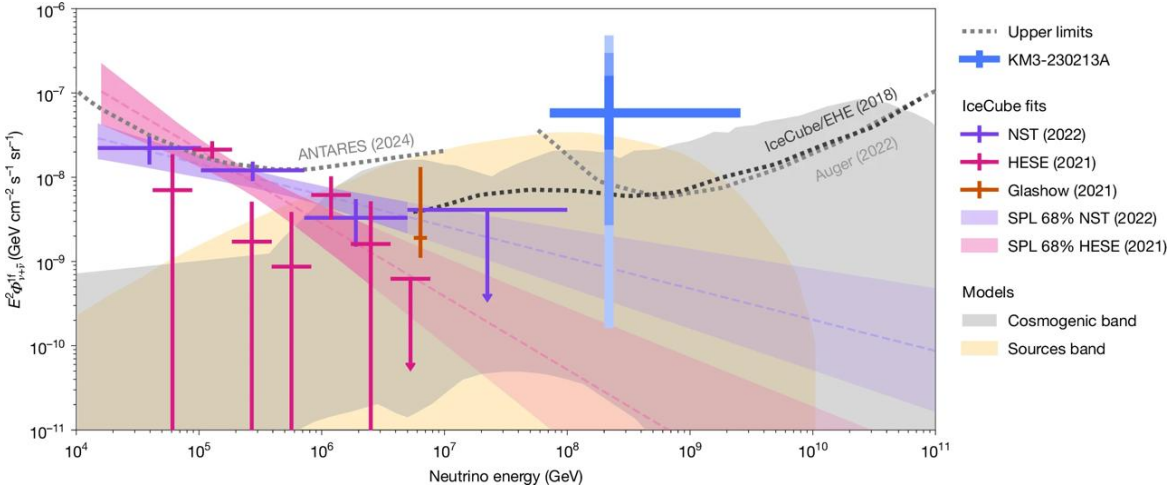


Neutrinos

https://indico.in2p3.fr/event/33627/contributions/153142/attachments/95233/145773/marseille25-neutrino-experiment.pdf

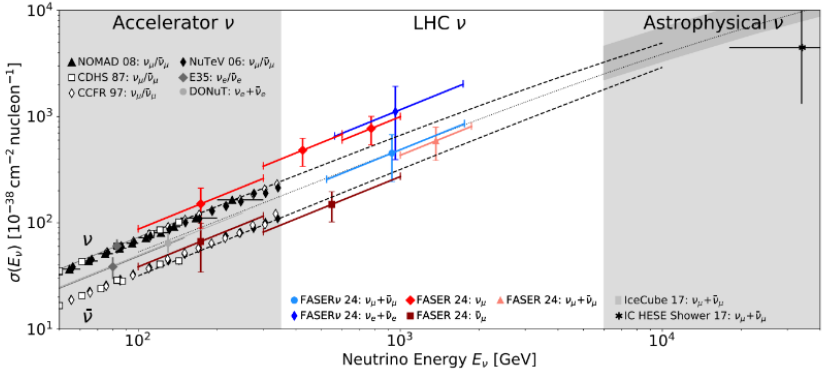
KM3Net

- PeV neutrino observation
- Oscillation measurements in line with world experiments



FASER

- Experiment close to CERN
- New measurement of neutrino cross sections



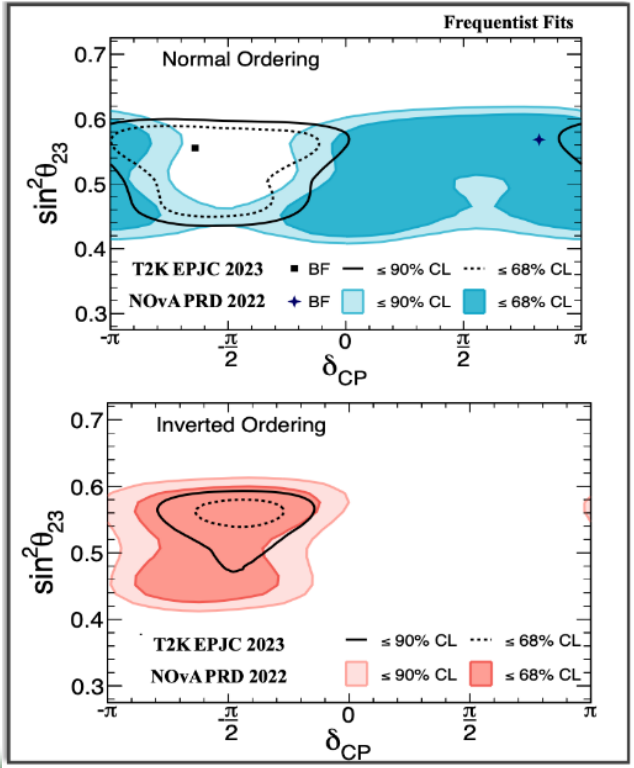
Neutrinos

Plenary talk, but more specific in parallel sessions

https://indico.in2p3.fr/event/33627/contributions/153142/attachments/95233/145773/marseille25-neutrino-experiment.pdf

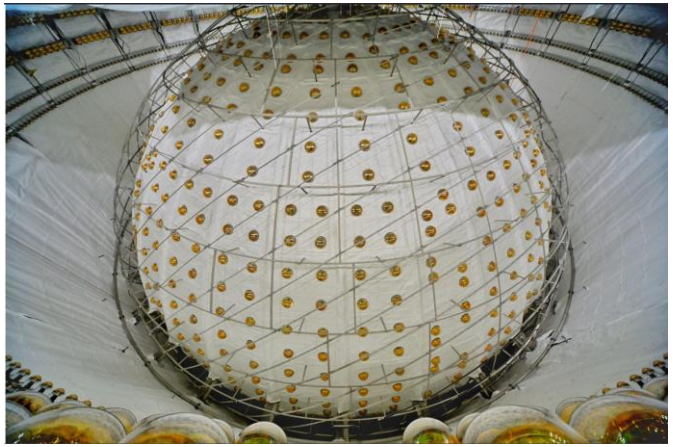
Oscillation parameters

- Updates from T2K, NOvA… no real news on octant of s_{23} angle nor anything else



JUNO and DUNE advancements

- Especially JUNO, ready with scintillator in August
- All data with water and partially scintillator match expectations



1000 ev/day of CNO expected..

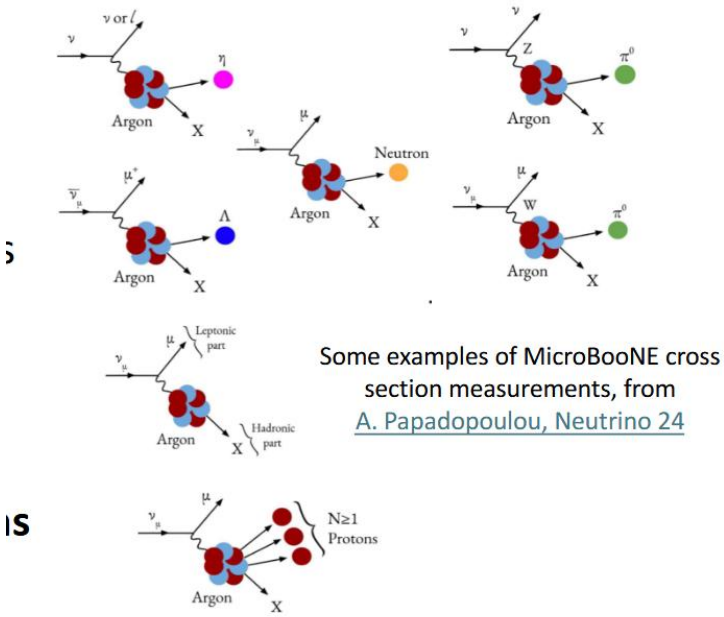
CNO does not need us?

Neutrino Physics case

- Oscillation parameters should be well established by the time a big CYGNO lands into LNGS
- What could we focus on?

  - Precise spectroscopy at low energy?
  - Precise measurement of flux when no oscillation is expected?
  - Size the core of the Sun?
  - Focus on cross section studies?

    Something like microboone



Some examples of MicroBooNE cross section measurements, from A. Papadopoulou, Neutrino 24

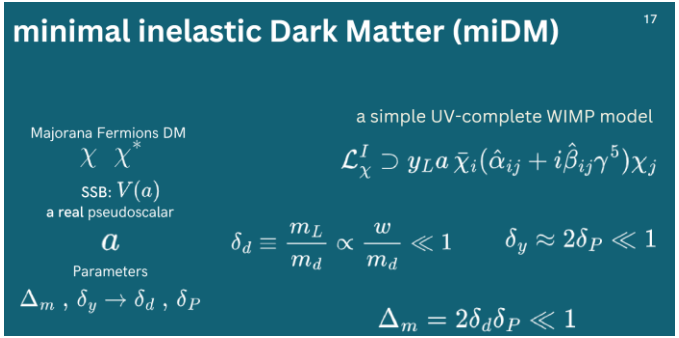
Study of cross section of ν with

Ar, especially anelastic

Dark Matter Theory

- Apparently from theory there is *always* a way to get a stable DM-behaving particle in a unexplored region of parameter space

https://indico.in2p3.fr/event/33627/contributions/154667/attachments/95167/145659/EPS%20-%20news%20iDM%20-%2016%20min%20presentation%20HEP-phth%20Public%20(1).pdf



- Will paradigm change more in the future?

https://indico.in2p3.fr/event/33627/contributions/153137/attachments/95072/145604/cosmology_bonvin.pdf

https://indico.in2p3.fr/event/33627/contributions/153141/attachments/95227/145762/EPS.pdf

Neutrino oscillation measurements are giving a lower bound to masses

$\sum_i m_i \geq 0.059\ eV$ for NO if $m_1 = 0$

$\sum_i m_i \geq 0.099\ eV$ for IO if $m_3 = 0$

Cosmology with DESI data and ΛCDM model

$\sum_i m_i \leq 0.072\ eV$ (CMB+DESI DR1) 2404.03002

$\sum_i m_i \leq 0.064\ eV$ (CMB+DESI DR2) 2503.14744

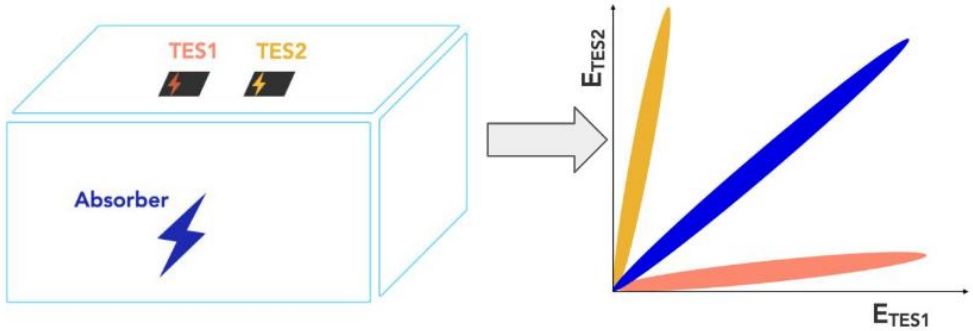
Other tensions with ΛCDM model

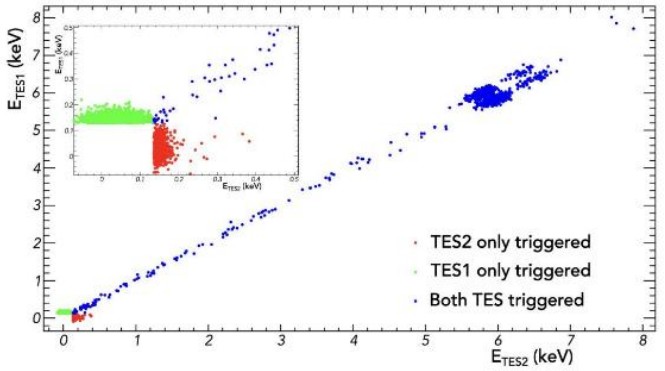
- Different models relax the neutrino problem
- Possible effect on DM??

CRESST Update on EXCESS

- Scintillating bolometers for DM studies at low energy
- New detector design with towers of crystals
- Low energy excess (common to all very low threshold experiments apart from possibly BULLKID) still an issue
- Test with 2 TES. Idea: different expansion coefficient of TES and crystal might cause stress.. Events of excess closer to TES
- Interesting calibration at low energy. exploit NR after gamma emission: energy fixed

Could this be used to estimate QF? We need to study possible transitions of C, F, He (unluckily low A nuclei)





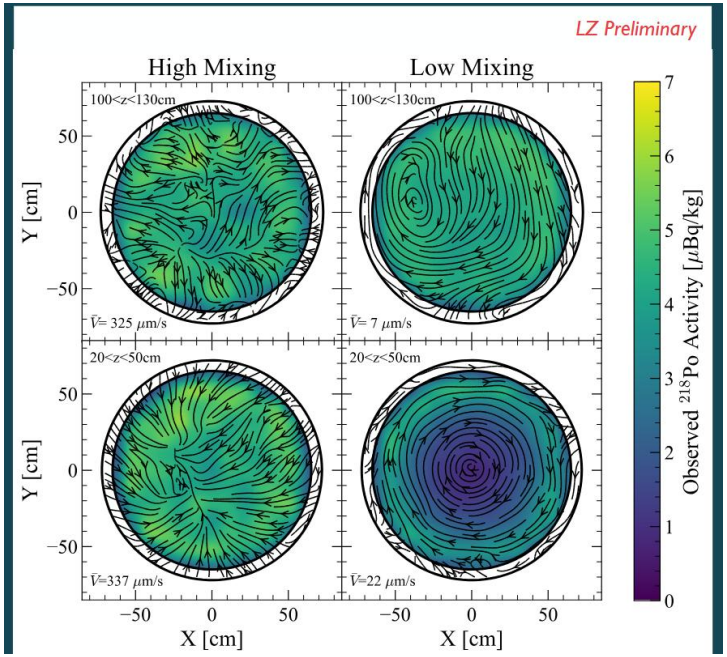
Eur. Phys. J. C 84, 1001

LuX SD news

https://indico.in2p3.fr/event/33627/contributions/154642/attachments/94209/144453/LZ_EPSHEP_Cottle.pdf

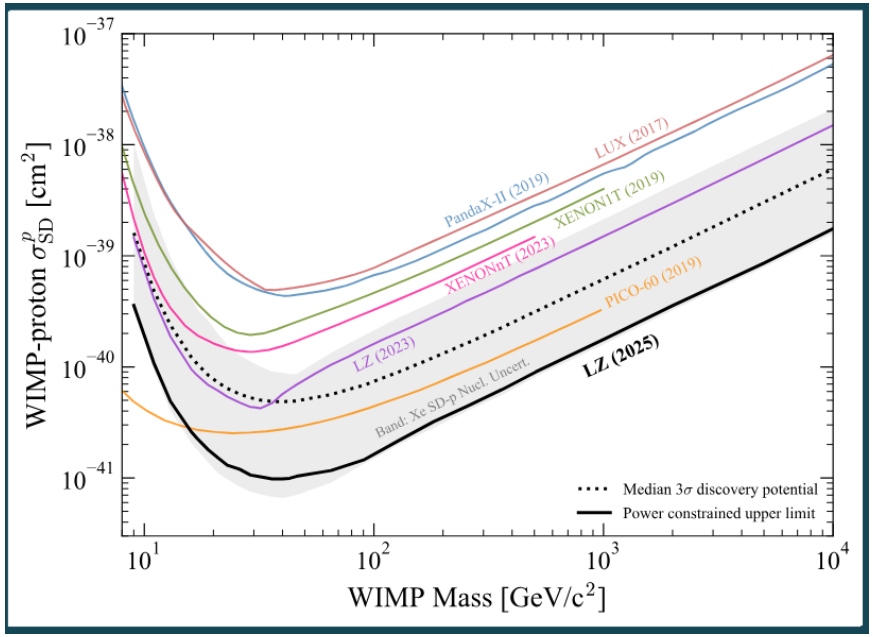
Rn progeny tagging

- With low flow of xenon they can predict the motion of radon daughters



SD limits beats PICO

- New SD-p limit

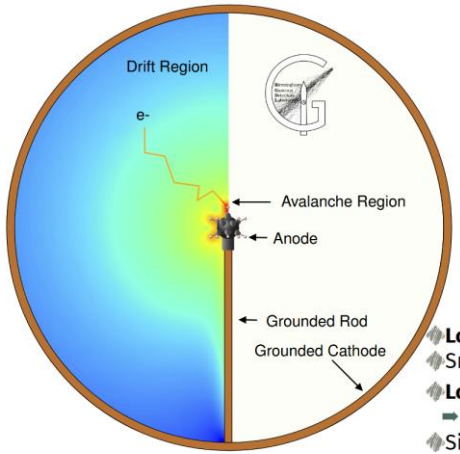


NEWS-G: Hydrogen Rocks

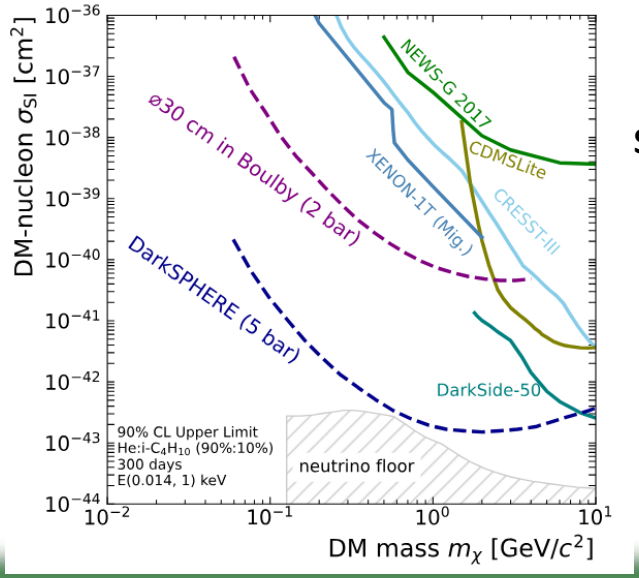
https://indico.in2p3.fr/event/33627/contributions/154646/attachments/95215/145769/knights_spc_epshep_2025.pdf

- Spherical prop counter for low mass DM search

- Moving to DarkSphere in Boulby with:
  - Max 3 m diameter
  - Electroforming copper underground (already under test) which will remove 70% of their background
  - Adding water shield

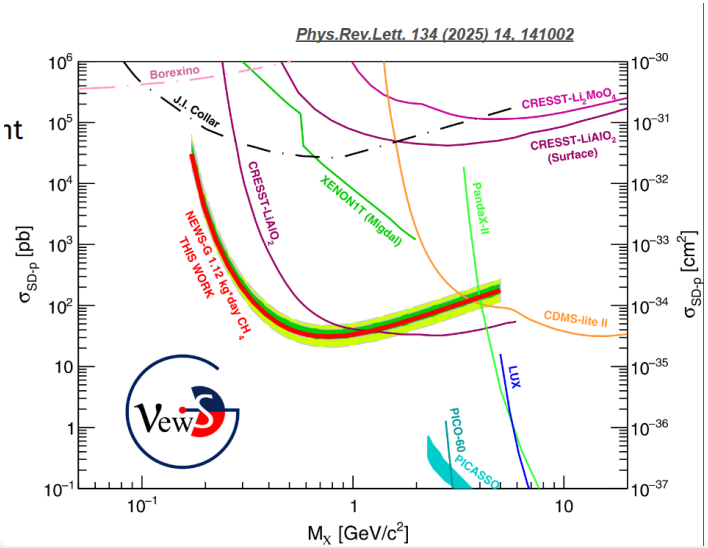


- **Low capacitance**, single-e detection
- Smallest surface area to volume ratio
- **Low-mass target nuclei**
  - ➡H and C (in CH_4, i-C_4H_{10}), He, Ne, etc.
- Simple, radiopure construction



Strong also in low mass SI

NOW

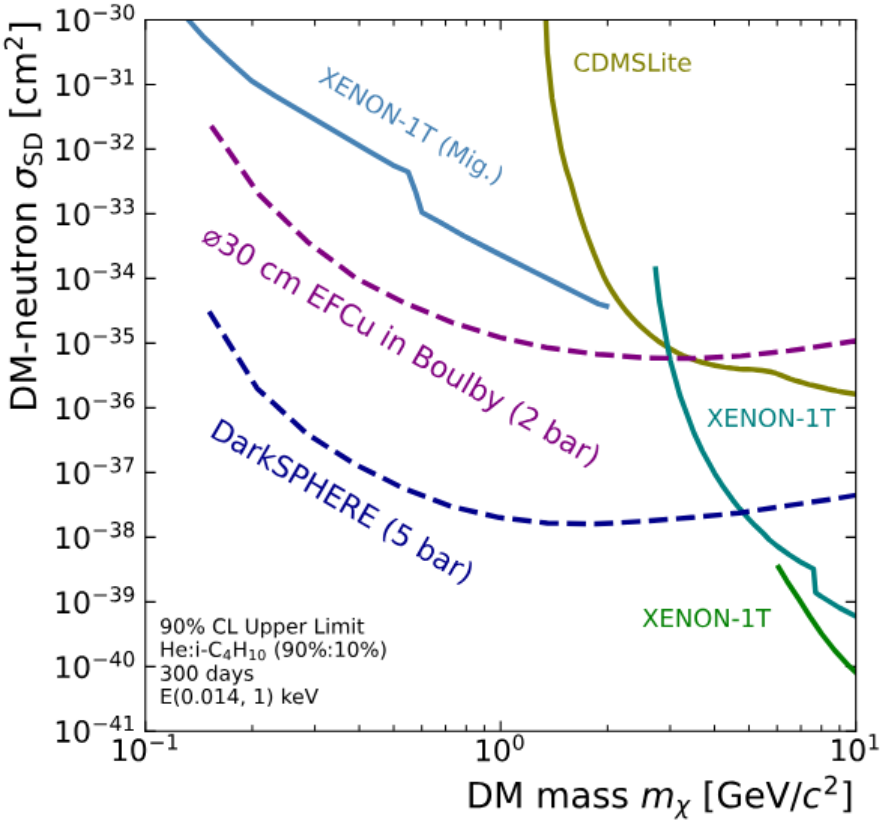


H-mix is paramount for better limits

Also considering new low mass PandaX results
https://arxiv.org/pdf/2507.11930

C13 SD neutron

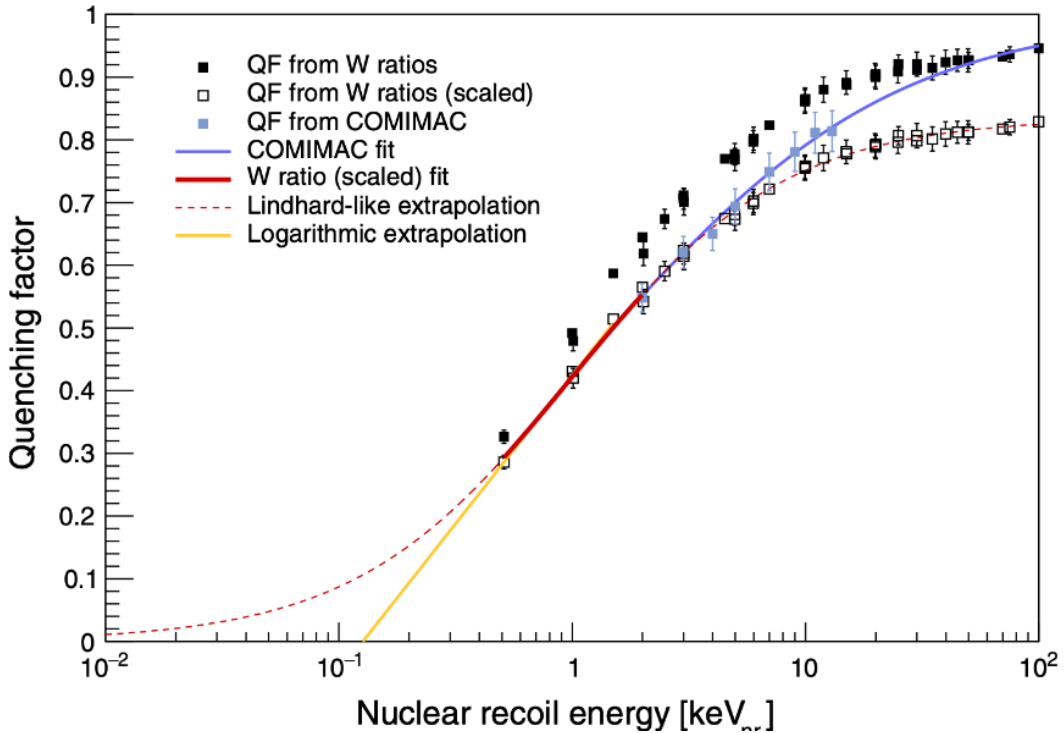
- They reminded us ^{13}C is rare but present and unlocks SD-n



We should also!

Quenching Factor

- They measured QF in different ways



2 measurement approaches in NEWS-G
- Neutron scattering at TUNL — *Phys.Rev.D 105 (2022) 5, 052004*
- Electron/Ion beam, COMIMAC, Grenoble — *Eur.Phys.J.C 82 (2022) 12, 1114*

Innovative approach using literature measurements — *Astropart.Phys. 141 (2022) 102707*

- The two measurements were made with different gases so no crosscheck
- They proved the literature approach with W-value works
- If you know hao W-value for e- and ions changes as a function of energy you get QF (or with QF and W-value of e- you get the ion one)

Calibration low energy

http://www.lnhb.fr/nuclides/Ar-37_tables.pdf

- They calibrate with:
    - Alpha induced Al fluorescence (1.5 keV)
    - Laser on cathode
    - ^{37}Ar fluorescence after decay (2.8 keV and 270 eV). Also used by T-REX
- Gaseous ^{37}Ar can provide volume calibration, but in prototypes can provide measurement of W-value of e- at low energy
- It can be produced by neuton activation of Ca: they send to a neutron gun a chalk
- QF and W-value are linked.. We should think about this!