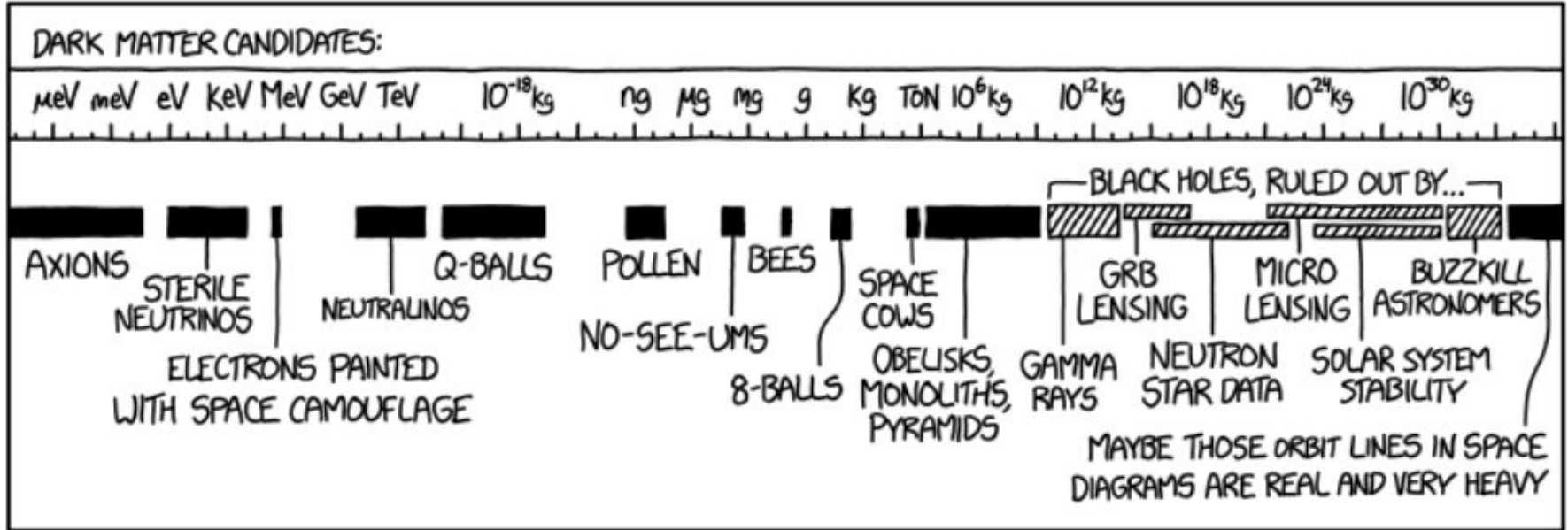


SuperCDMS at SNOLAB, status and prospects

Emanuele Michielin, on behalf of the SuperCDMS
collaboration



What dark matter could be..



From xkcd.com

And infinite other options!

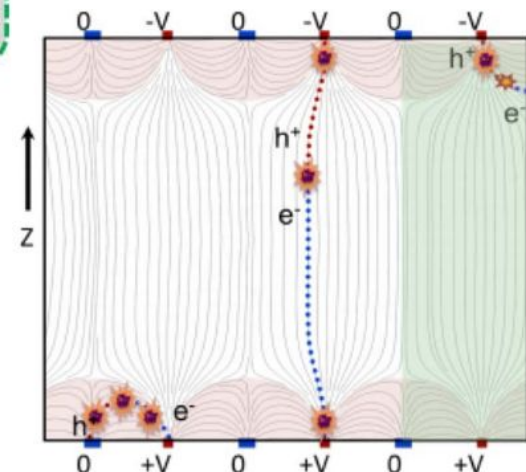
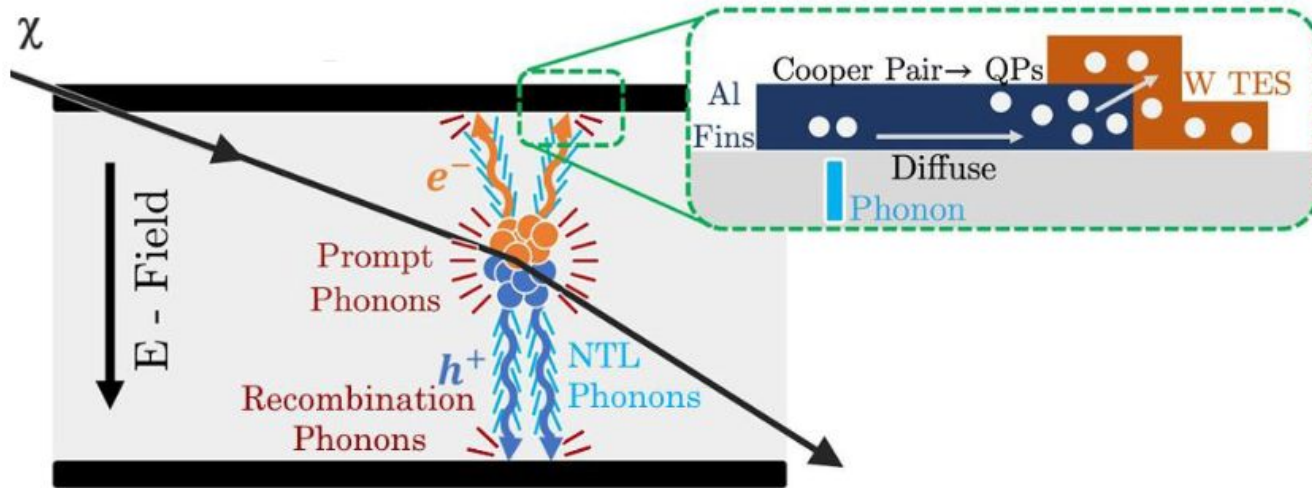
The SuperCDMS collaboration



SuperCDMS is a direct detection experiment which looks for interactions of low-mass ($<5 \text{ GeV}/c^2$) dark matter particles with standard model particles.

The detection technology

Measure recoil energy dissipated via heat (phonons) and ionization (charges).



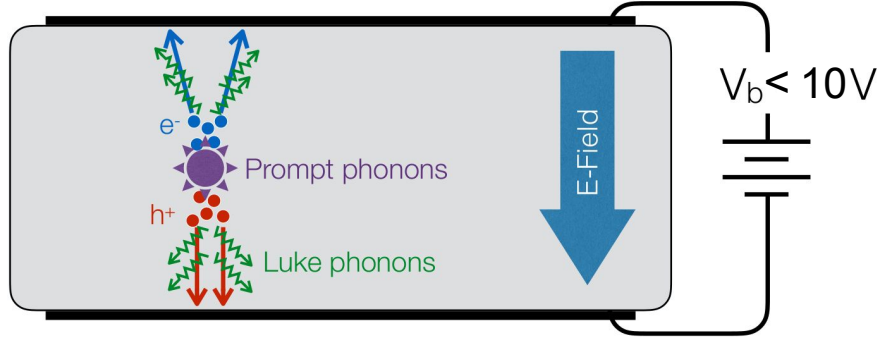
$$E_{\text{phonon}} = E_{\text{recoil}} + n_{eh} eV_{\text{bias}}$$

Neganov-Trofimov-Luke (NTL) gain

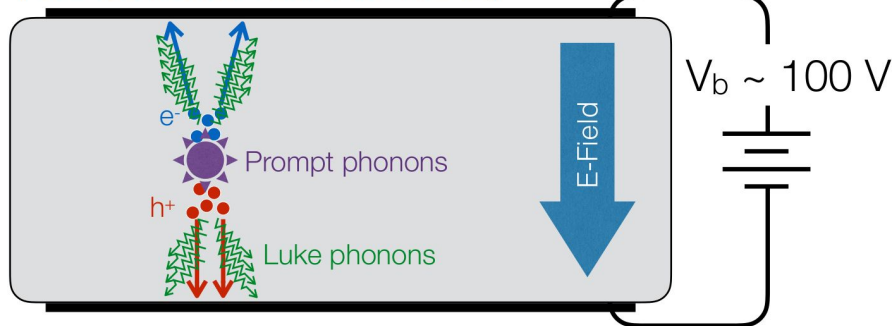
Charges measured via interleaved electrodes. 4

The detectors

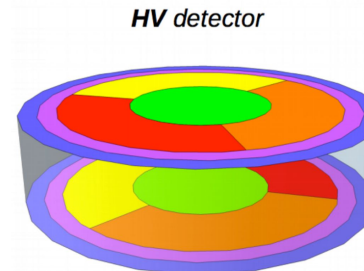
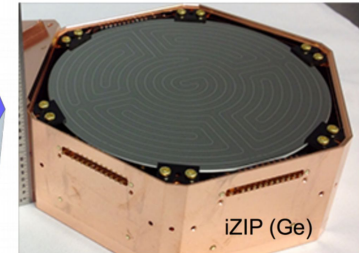
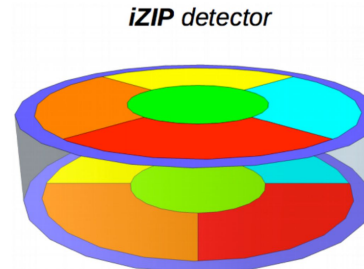
iZIP: Sensors measure E_t , and n_{eh}



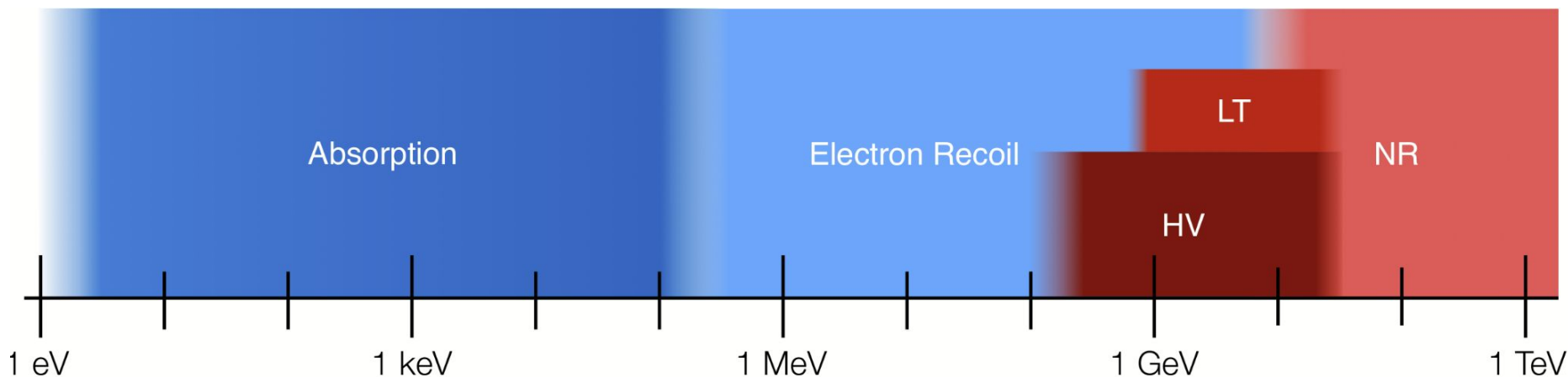
HV: Sensors measure E_t



- Ge (1.4 kg) and Si (0.6 kg) crystals
- Cooled to a temperature of 15 mK
- iZIP ~1 keV threshold, electron/nuclear recoil (ER/NR) discrimination
- Si HV ~100 eV energy threshold
- 12 channel geometry for position reconstruction



SuperCDMS: a broad band dark matter search



Signal

Traditional Nuclear Recoil:

Low Threshold NR:

HV mode:

Electron recoil:

Absorption:

Detector type

iZIP, Background free

iZIP, limited discrimination

HV

HV

HV

Mass range

>5 GeV

>1 GeV

0.3 - 10 GeV

0.5 MeV - 10 GeV

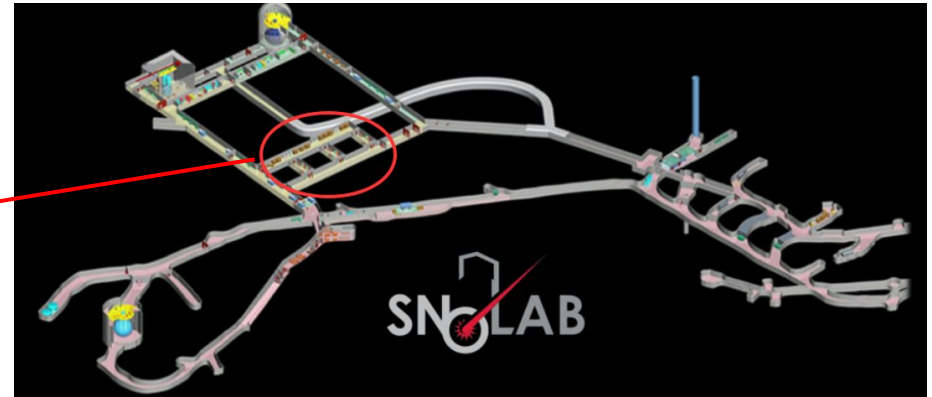
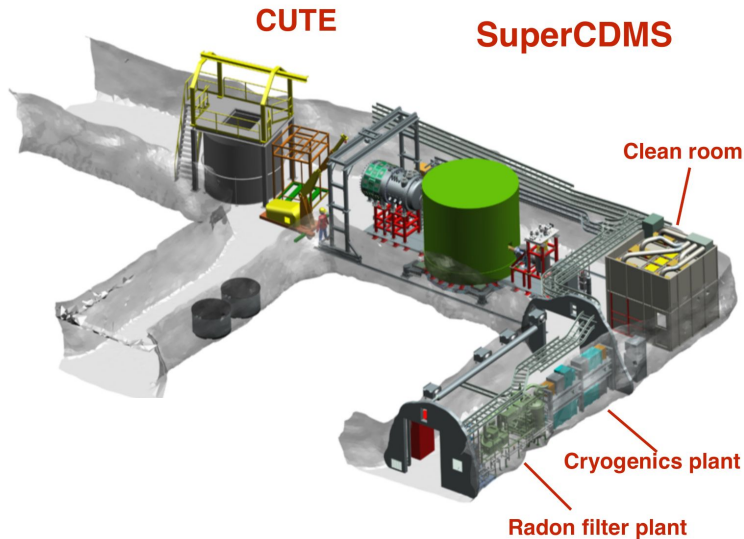
10 eV - 500 keV

The SNOLAB laboratory

2 km underground, 6800 mwe overburden.

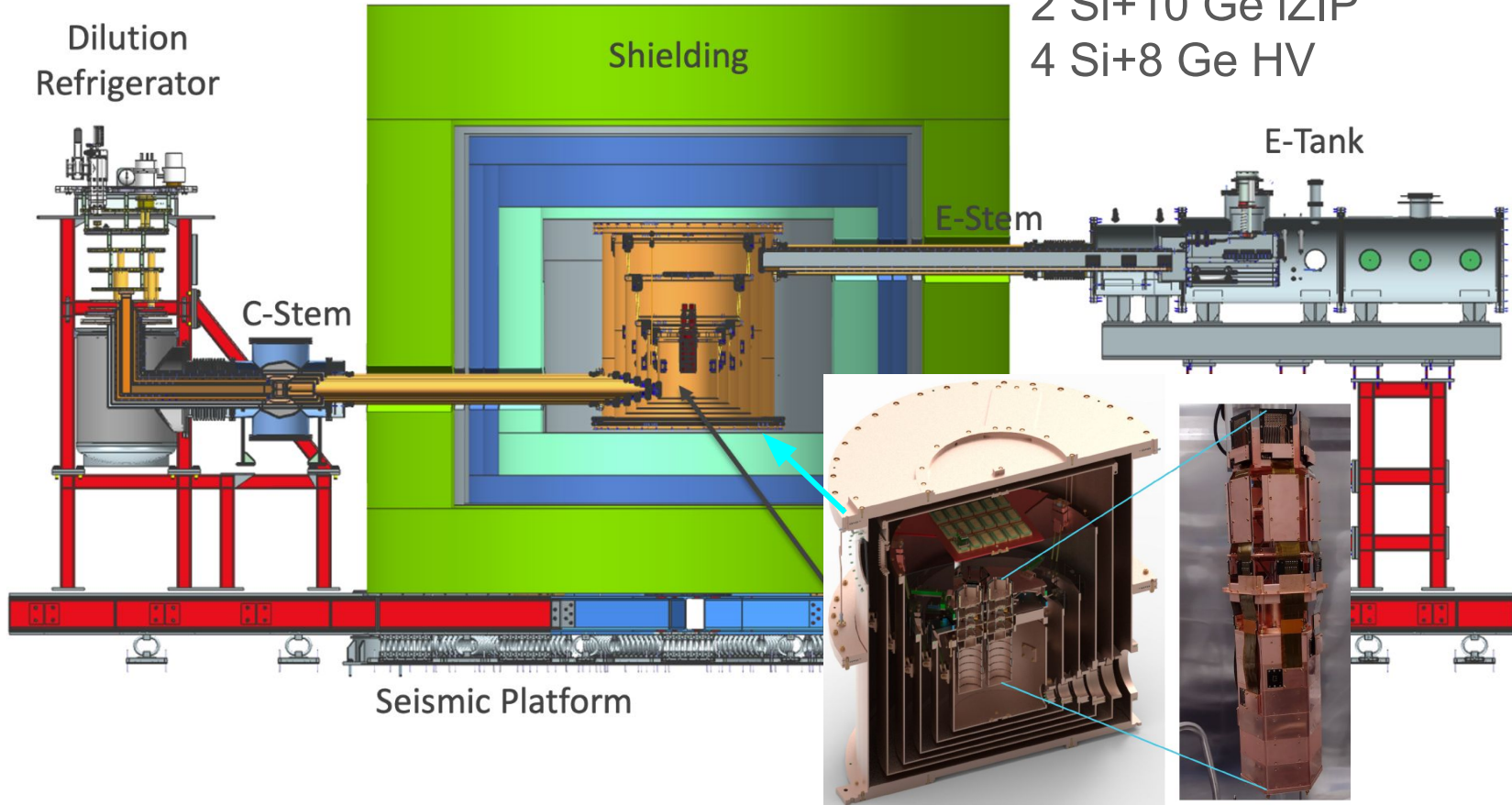
Whole lab cleanroom of class 2000 or better.

Muon flux of $0.27 \mu/m^2/day$.

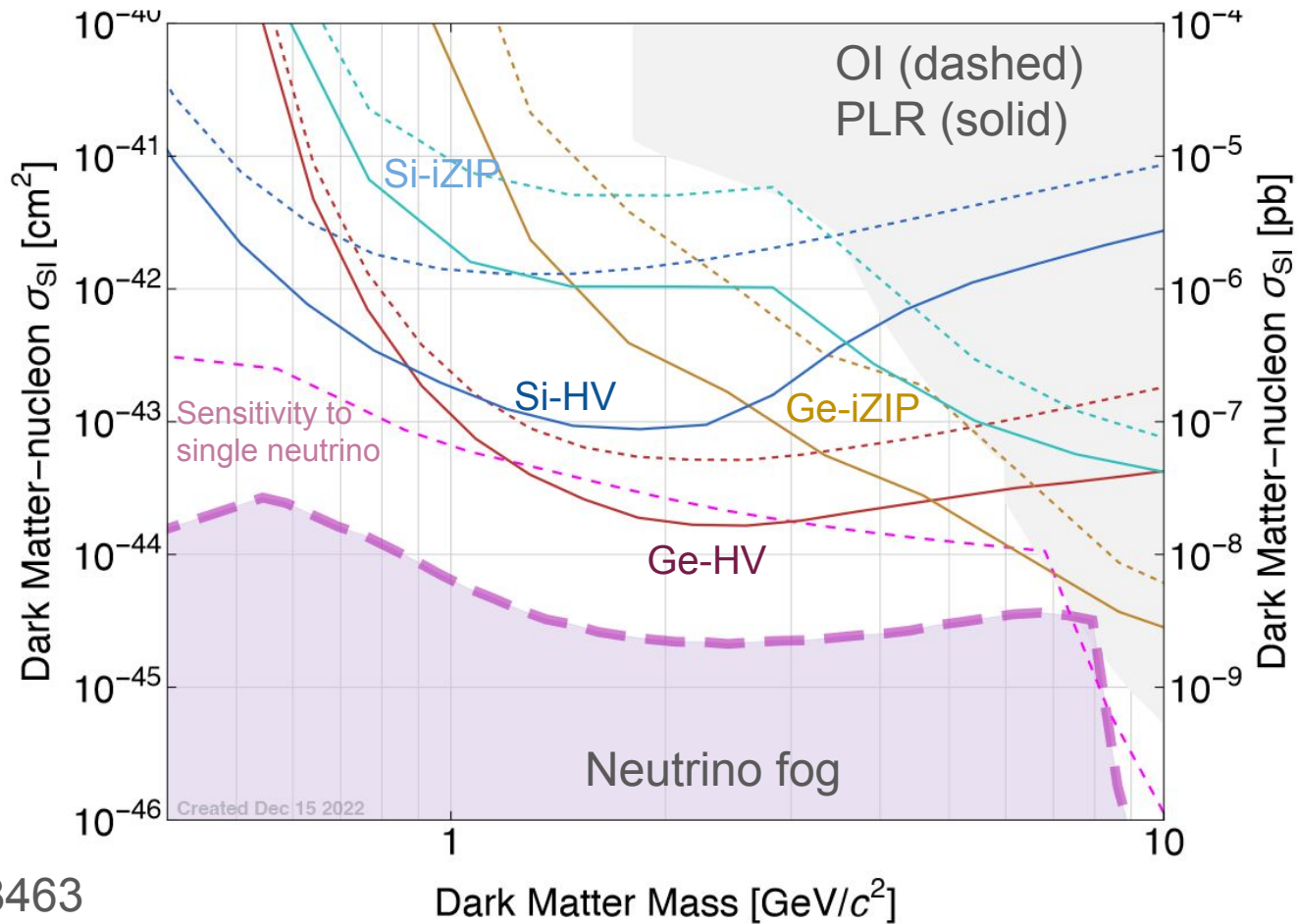


The SuperCDMS experiment

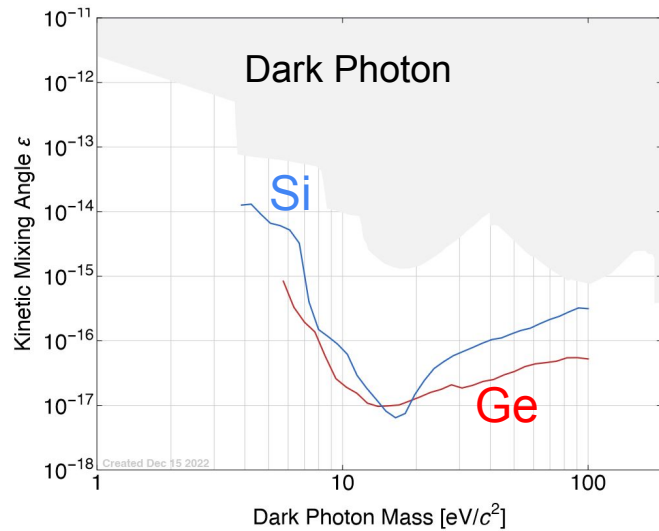
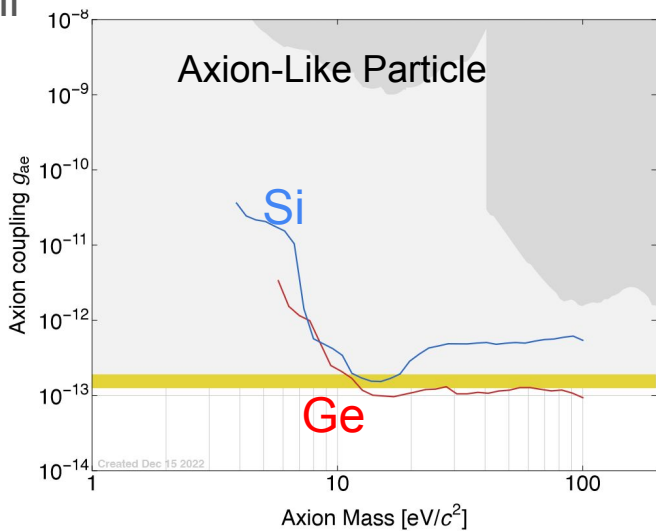
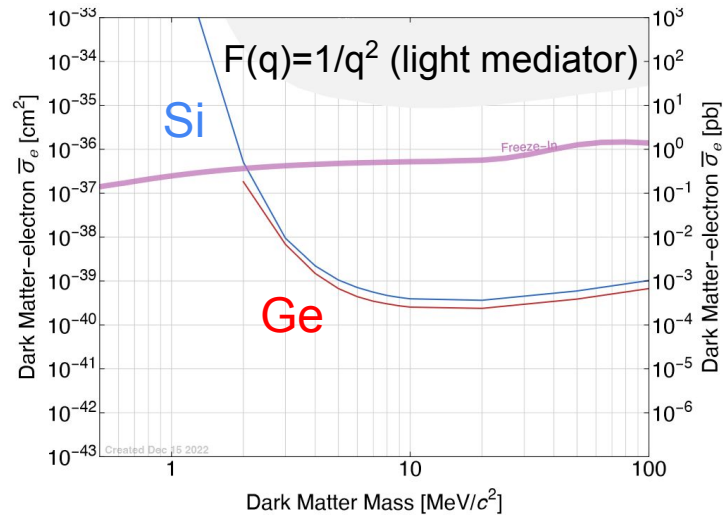
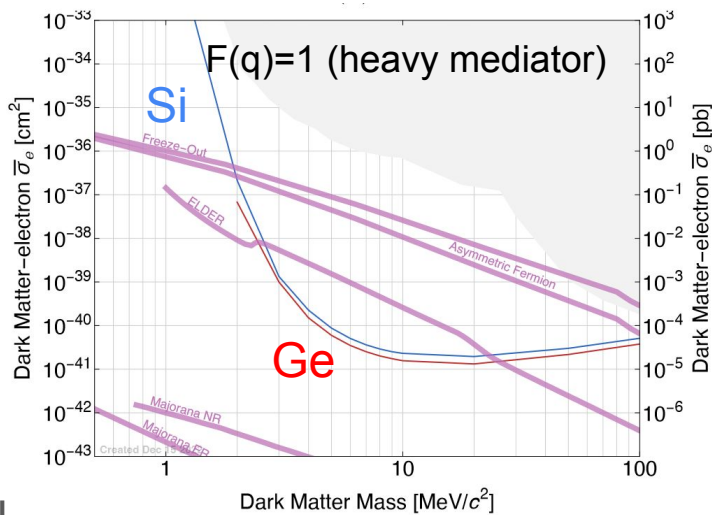
Detectors stacked in 4 "towers"
2 Si+10 Ge iZIP
4 Si+8 Ge HV



Nuclear recoil projected sensitivity, assuming 4 year exposure



Projected sensitivity to electron recoil signals.



The experiment is coming alive! Installation happening now:

All detectors are currently underground. One HV tower fully tested UG at CUTE, **see Aditi Pradeep's talk!**
Low radon cleanroom completed and working.



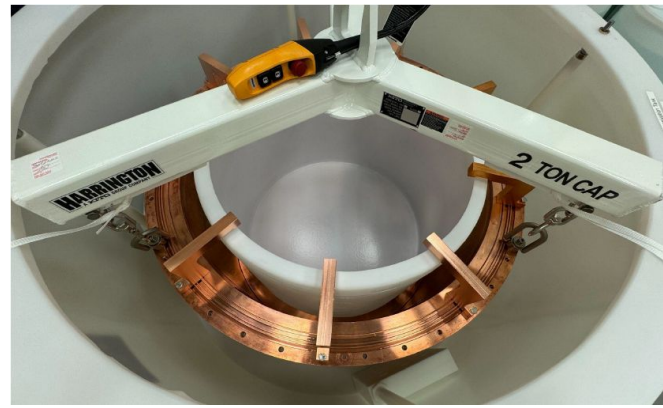
Fridge installed and tested.

Installation happening now:

Shield base finished and wall partially constructed.



Installation to be completed by early next year!



Outer vacuum can shipped and cleaned.

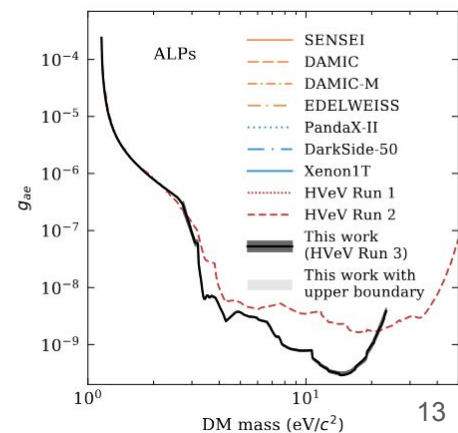
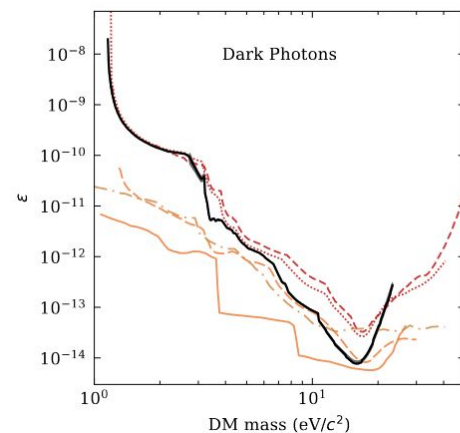
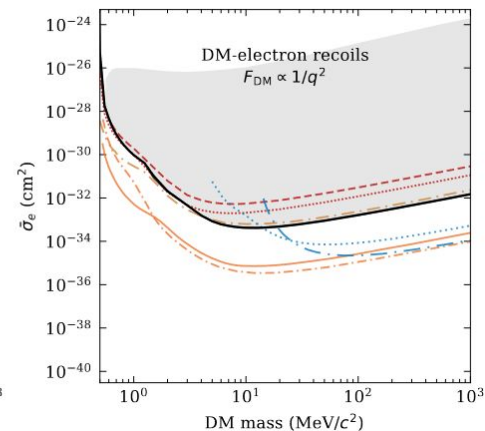
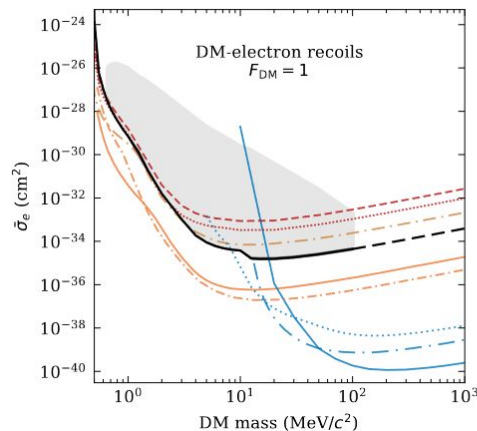
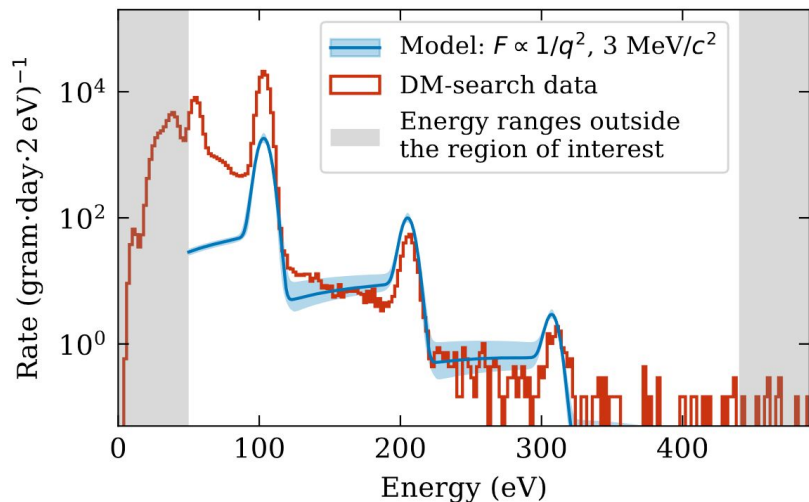


The R&D HVeV program

(arXiv/2407.08085)

Gram-scale detectors with eV energy resolution.
Resolving single charges!

New result with 3 detectors running in a shallow
UG facility (300 mwe), in same optical cavity to
remove coincidence events!



Running now at SNOLAB in the CUTE facility!

Summary



Thanks to its unique detectors, the SuperCDMS SNOLAB experiment will explore new parameter space for low mass dark matter signals!

Broad sensitivity to a range of dark matter models.

Entering now in a very exciting phase:

- Installation underway and on track to be completed early next year
- More new science results from HVeV detectors are just around the corner!