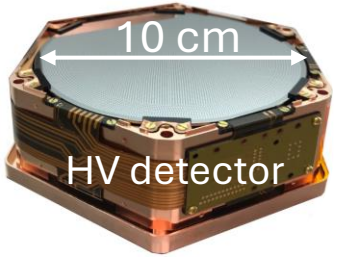
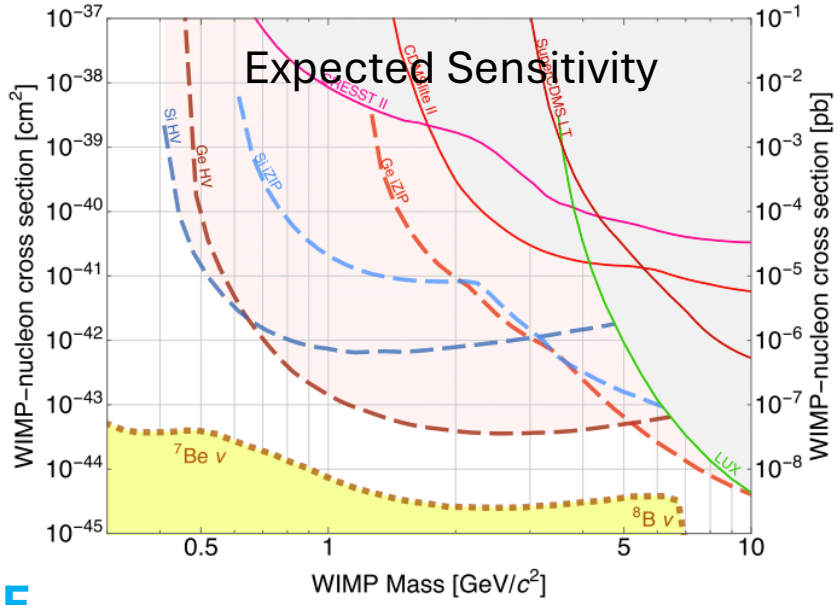
SuperCDMS

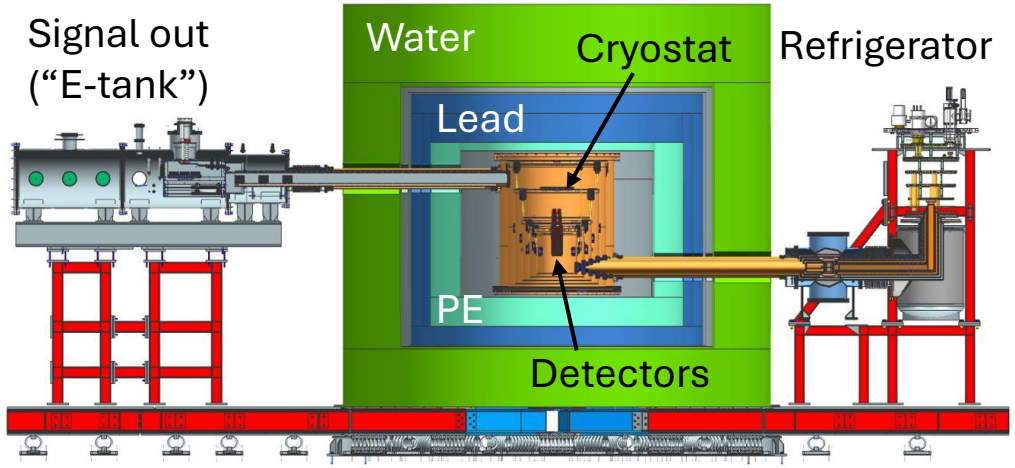
Dark Matter Search with Cryogenic Detectors



SuperCDMS Overview

- Under construction at SNOLAB
- 18 Ge and 6 Si detectors (~30 kg) operated at ~30 mK
- Measure energy depositions through charges/phonons
- “iZIP”: ph./ch. signals for background identification
- “HV”: measure ch. through amplified ph. signal
- Low threshold (O(100 eV phonons); single charges)
- Shielding: 6000 mwe, lead, PE, water

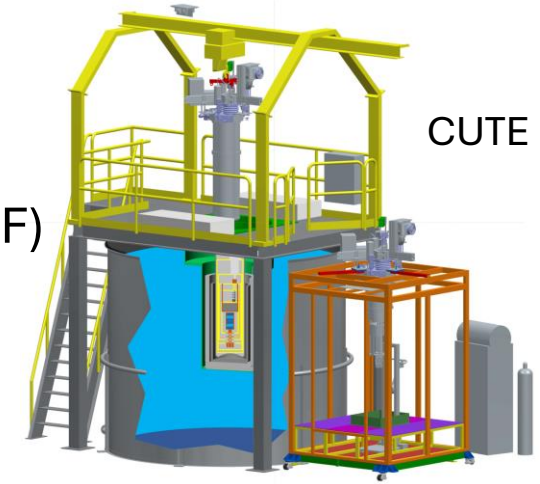




SuperCDMS experimental setup

SuperCDMS and TRIUMF

- TRIUMF/UBC: W. Rau, S. Oser, 2 PDFs, 3 grad students
- MIDAS DAQ developed at TRIUMF (Oser)
- Detector testing at CUTE (Rau)
- Analysis coordinator (Y. Liu, PDF)
- Various leadership roles in SuperCDMS



CUTE

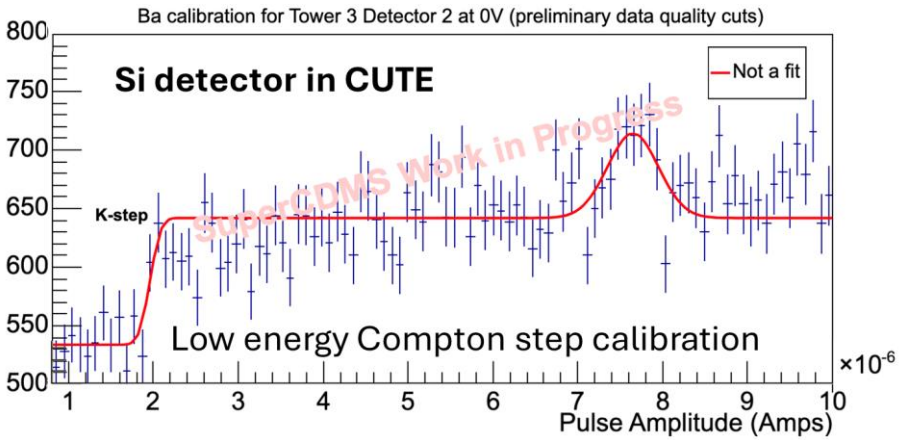
Discovery, accelerated

SuperCDMS

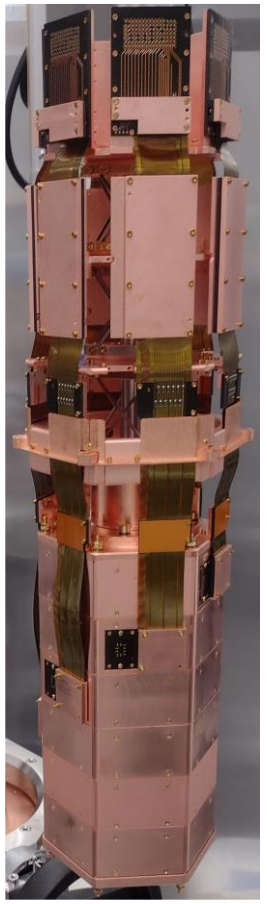
Dark Matter Search with Cryogenic Detectors

Status and near-term future

- Construction progressing at SNOLAB
- Almost all major components on site
- DAQ installation complete
- Developing analysis methods and tools using data from SuperCDMS detectors @ CUTE
- Commissioning preparation in full swing (Lessons-learned from CUTE operations)
- First cooldown expected for summer 2025
- Commissioning phase ~0.5 years
- Start of science data taking: early 2026



Outer cryostat can, placed on the bottom of the shielding



"Tower" of 6 stacked detectors

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SuperCDMS

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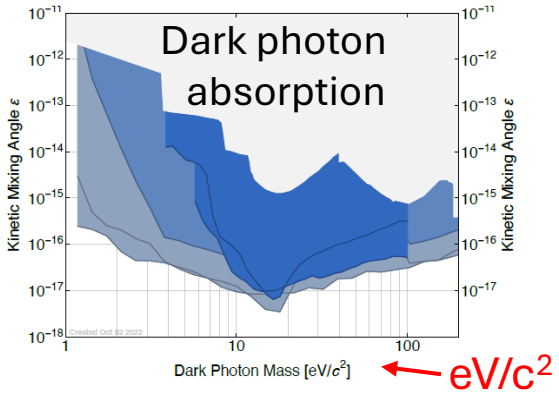
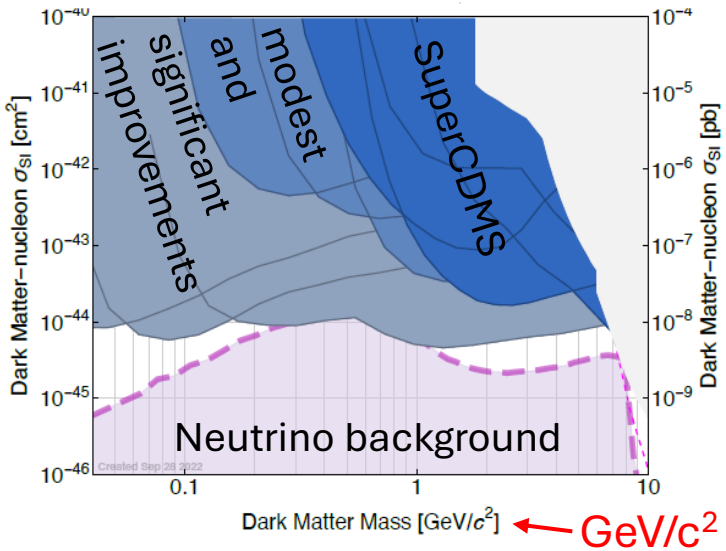
Longer-term outlook

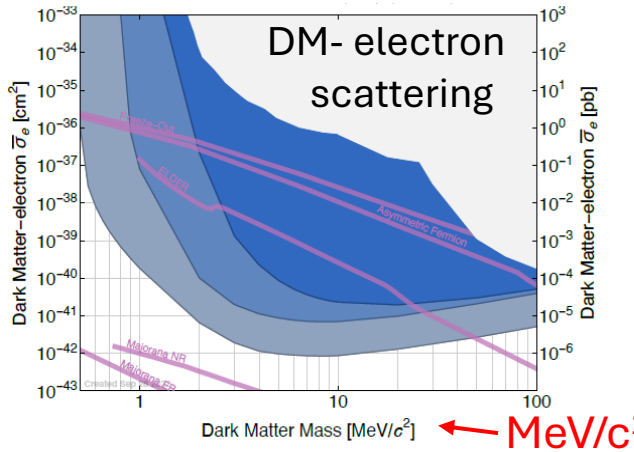
- SuperCDMS SNOLAB science run (funded): 2026 – 2028
- Ongoing data analysis effort until at least 2030
- Variety of upgrade options are considered (arXiv:2203.08463v2):
  - Smaller detectors / sensor area provide better energy resolution
  - Better crystal quality can improve charge transport
  - Improved readout electronics can improve charge resolution
  - Lower superconducting transition temperature improves phonon energy resolution
  - Background reductions improve sensitivity
- Start of modest R&D efforts once SuperCDMS SNOLAB is operational
- Detector test facility at TRIUMF and CUTE contribute to testing of improved detectors
- Operation of improved detectors at SNOLAB potentially from 2029 onwards



Example sensitivity projections

Dark matter – nucleon scattering





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