AMoRE and AMoRE-II preparation status

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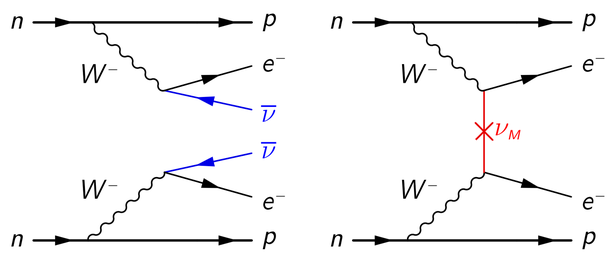
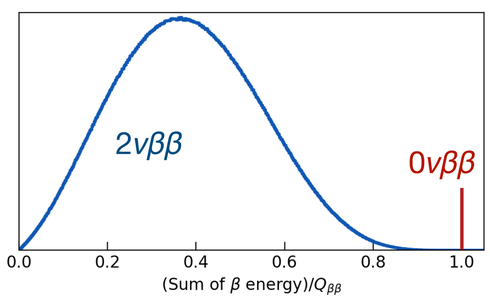
Neutrinoless double beta ($0\nu\beta\beta$) decay

- Double beta decay:
  - Rare nuclear transition in some even-even nuclei: ^{48}Ca, ^{76}Ge, ^{82}Se, ^{100}Mo, ^{130}Te, ^{136}Xe, …

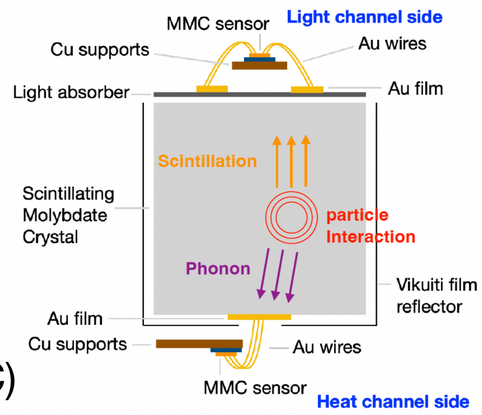


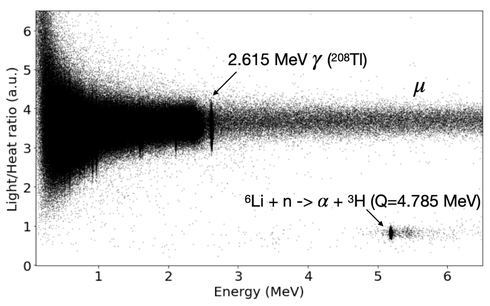
- $\nu = \bar{\nu}$? Majorana/Dirac nature.
- Lepton number violation (ΔL=2).
- Absolute mass scale: light Majorana-ν exchange.
- High E resolution detector with the lowest possible background for experimental sensitivity.

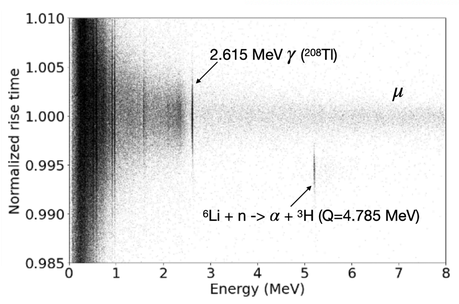


Experimental apparatus

- ^{100}Mo based scintillating crystals
  - $^{48depl}CaMoO_4$, Li_2MoO_4.
  - Isotopic enrichment of ^{100}Mo~95%.
- Cryogenic calorimeter
  - Detection of phonon+scintillation
  - Metallic magnetic calorimeter (MMC)





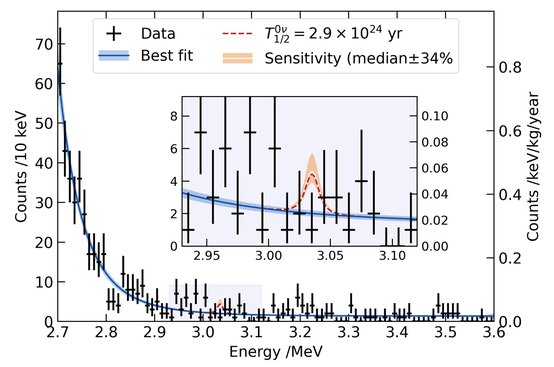


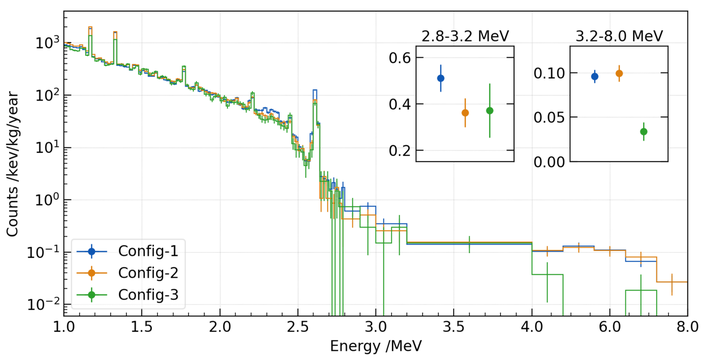
↑ Schematic detection principle

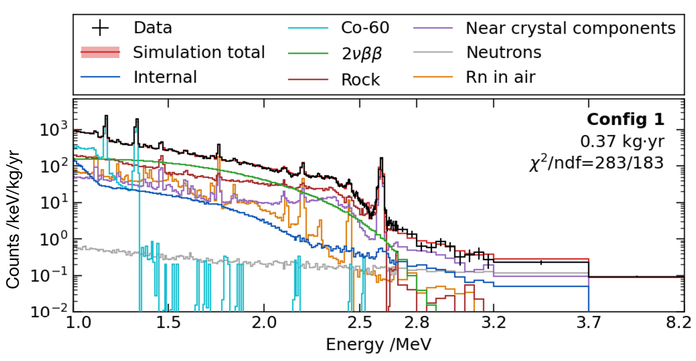
← RnD data using Li_2MoO_4 crystal at the surface lab

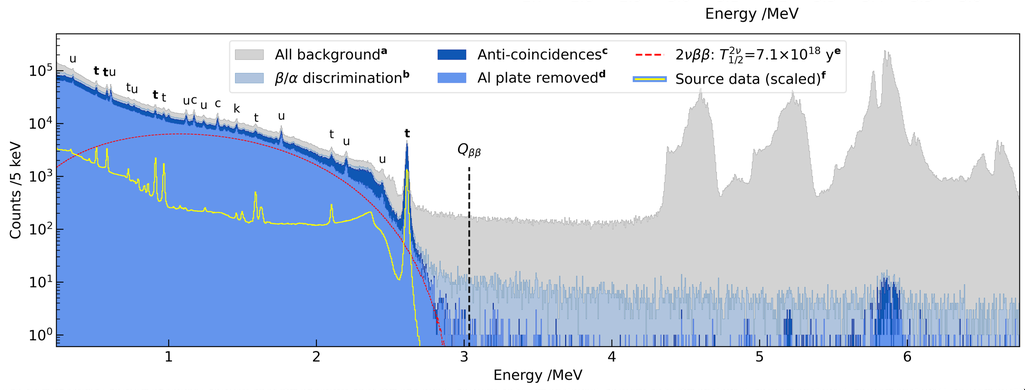
AMoRE-Pilot ('15-'18) and AMoRE-I ('20-'23) at Yangyang Underground Laboratory

- Demonstration of detector principle and performances, stable long-term operation.
- 6×$CaMoO_4$ crystals (1.9 kg, Pilot) + 7×$CaMoO_4$ and 5×Li_2MoO_4 crystals (AMoRE-I, 6.2 kg total).
- Understanding and reduction of background: material selection/purification, shielding enhancement.
  - ROI background level: ~0.5 ckky (Pilot) → 0.025 ckky (AMoRE-I)
- World best limit for the $0\nu\beta\beta$ decay half-life of ^{100}Mo from AMoRE-I: $T^{0\nu}_{1/2} > 2.9 \times 10^{24}$ yr at 90% C.L.

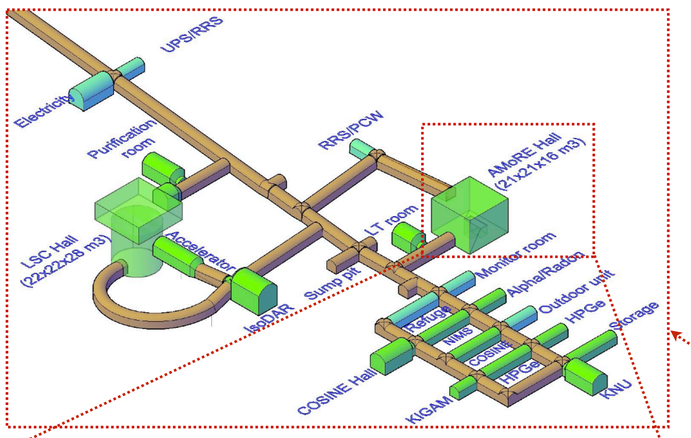


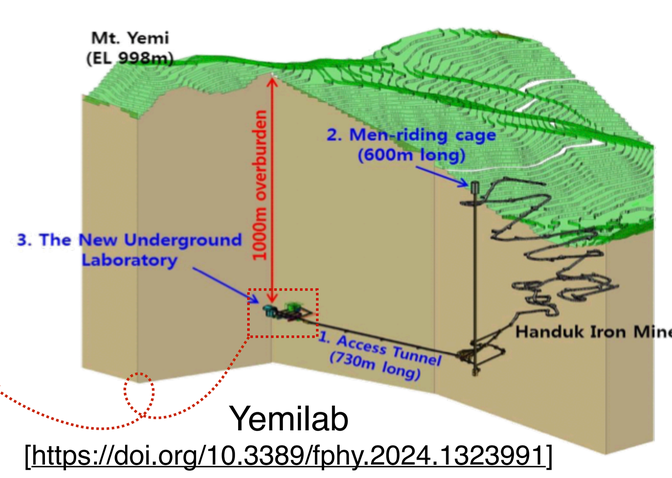




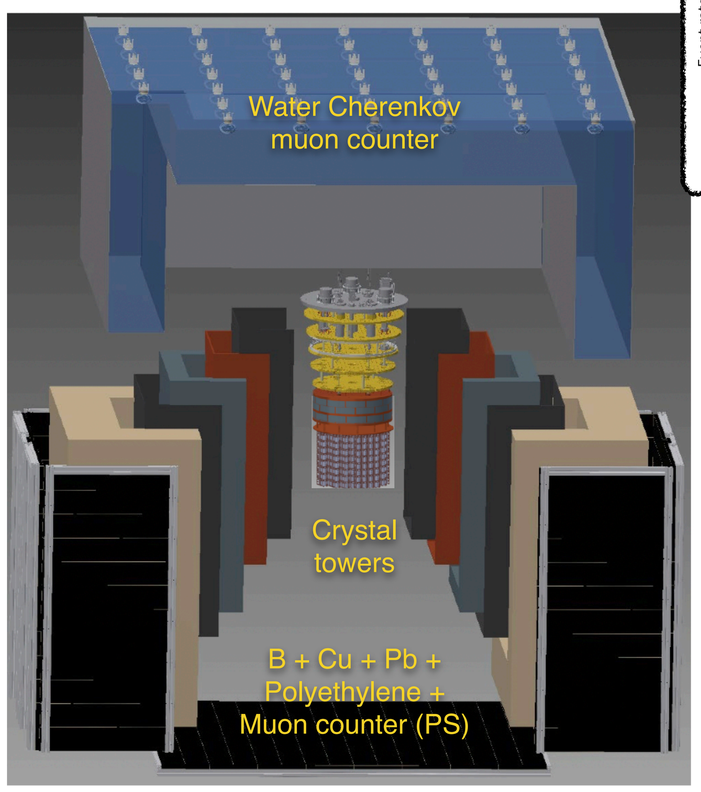


AMoRE-II preparation

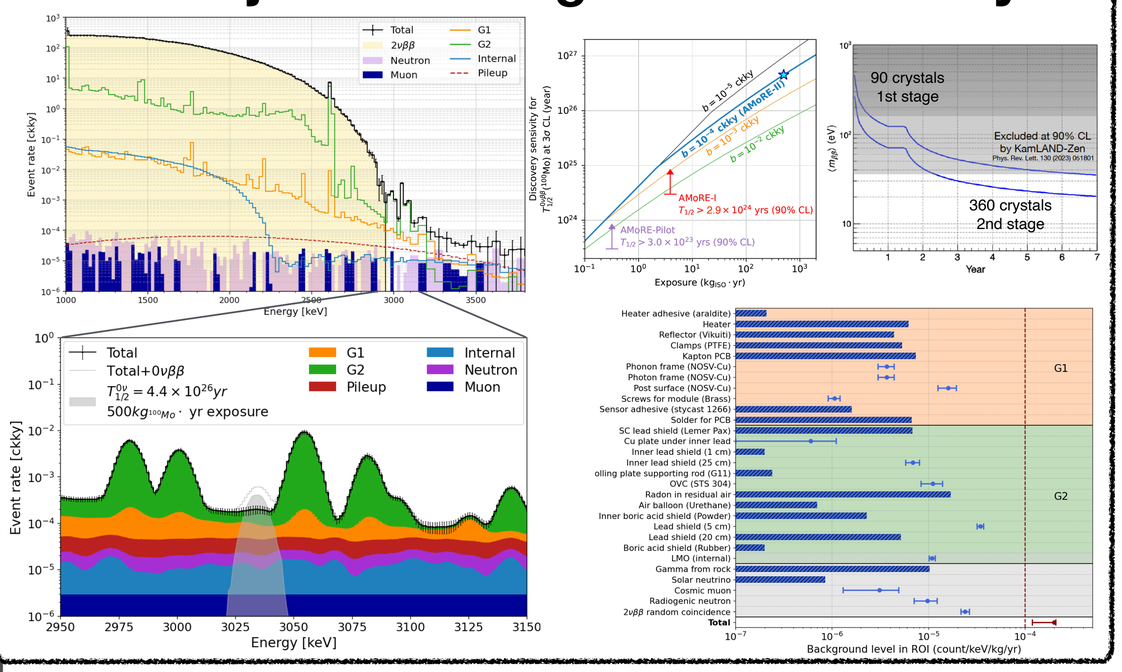


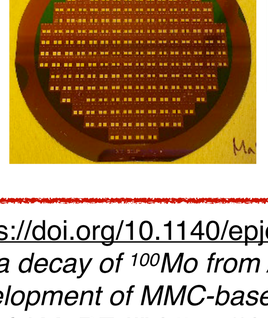


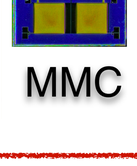
Yemilab
[https://doi.org/10.3389/fphy.2024.1323991]

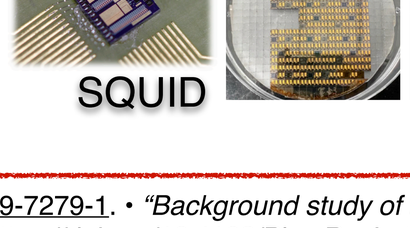


Projected background/sensitivity









Publications highlights: • *"First results from the AMoRE-Pilot neutrinoless double beta decay experiment"*, https://doi.org/10.1140/epjc/s10052-019-7279-1. • *"Background study of the AMoRE-pilot experiment"*, https://doi.org/10.1016/j.astropartphys.2024.102991. • *"Improved limit on neutrinoless double beta decay of ^{100}Mo from AMoRE-I"*, https://doi.org/10.1103/PhysRevLett.134.082501. • *"Radioassay of the materials for AMoRE-II experiment"*, https://doi.org/10.3389/fphy.2024.1362209. • *"Development of MMC-based lithium molybdate cryogenic calorimeters for AMoRE-II"*, https://doi.org/10.1140/epjc/s10052-024-13498-8. • *"Projected background and sensitivity of AMoRE-II"*, https://doi.org/10.1140/epjc/s10052-024-13516-9.