Status of the AMoRE experiment

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AMoRE experiment

Advanced Mo-based Rare process Experiment
Search for neutrinoless double beta (0νββ) decay of 100Mo
Double β decay
=> In most naturally occurring even-even nuclei, single β decay is forbidden.
But, for a large number of them, double β decay is allowed.

0νββ source :100Mo isotope
=> relatively high Q-value (3034 keV), shorter half-life expected
=> high natural abundance of 9.74 %

Detector (pilot) : 40Ca100MoO4 crystal with low temperature (LT) phonon and photon sensors
=> Scintillating crystal, Source = Detector
=> 100Mo enriched (> 95 %), 48Ca depleted (4.27 MeV, < 0.001 %)
=> Excellent energy resolution with LT sensors
=> Demonstrated excellent α/β separation with phonon sensor
=> Simultaneous phonon and photon detection allows further background reduction

AMoRE at pilot phase

Yangyang (Y2L) underground lab
Located in Yangyang pumped storage power plant
700 m minimum vertical depth (3000 m-w.e.)
ln free air supply facility

Background identification
=> Stycast (Epoxy), PCB, pin connectors near crystal seem to generate significant background.

Background rejection in ROI

Why 0νββ ?
=> Unambiguous signature for Majorana neutrino
=> Lepton number non-conservation
=> Absolute neutrino mass scale
=> Neutrino mass hierarchy
=> CP violation in the lepton sector

AMoRE-I, II

AMoRE-I
=> 13 40Ca100MoO4 crystals
+5 other molybdate (XMoO) crystals (X:Li, Na, Pb, etc)
=> Reducing the background identified at pilot phase
=> 6 kg, 18 crystals, 3+ years data taking

AMoRE-II
=> target mass: 100 kg of 100Mo isotope, 5 years data taking
=> Selecting best molybdate crystals for scaling up
=> Exploiting the new underground lab in Jeongseon

Sensitivity Goal

Crystals AMoRE-I, II AMoRE-I AMoRE-II
mass 1.9 kg ~5 kg ~300 kg
Channels 12 36 1000
Background (cnts/keV/kg/yr) 0.01 0.001 0.0001
Sensitivity (T1/2 year) ~10^24 ~10^27 ~5 x 10^29
Location Y2L Y2L New lab
Schedule 2016-2018 2018-2021 2021

Neutrino mass (eV)

Lightest Neutrino Mass [eV]

Lowest Lightest Neutrino Mass [eV]