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P4.058 A neutrinoless double beta decay search based on ZnMoO_4 and Li_2MoO_4 scintillating bolometers

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on behalf of LUMINEU collaboration

The LUMINEU project envisages a high-sensitivity search for neutrinoless double beta decay of ^{100}Mo with the help of scintillating bolometers based on zinc molybdate (ZnMoO_4) and lithium molybdate (Li_2MoO_4) crystals. A major achievement of LUMINEU is the development of a protocol for producing high-quality large-mass Mo-based crystal scintillators with extremely high internal radiopurity. Large crystalline boules were grown by the low-thermal-gradient Czochralski technique for both compounds. In case of ZnMoO_4 , it was demonstrated that the production cycle provides an acceptable level – around 4 % – of irrecoverable losses of the costly enriched material. Similar results are expected for Li_2MoO_4 . After the production of high-quality crystals of natural isotopic composition in the first phase of the project, several ^{100}Mo -enriched scintillator elements were obtained, with masses up to 380 g for ZnMoO_4 and ~ 190 g for Li_2MoO_4 . In order to optimize the performance of the Mo-based scintillating bolometers, preliminary bolometric tests were conducted aboveground in CSNSM Orsay (France). The internal radiopurity and the ultimate performance of the detectors were tested underground in LSM (France) and LNGS (Italy) in collaboration with the EDELWEISS and LUCIFER collaborations, respectively. The excellent results obtained in terms of energy resolution (5-10 keV FWHM in the region of interest), alpha/beta rejection factor ($\gg 99.9$ %) and intrinsic radiopurity (better than a few Bq/kg for the most harmful components – thorium and radium –) show that the LUMINEU technology – whose development is part of the program of CUPID, the proposed follow-up to CUORE – is extremely promising for a next-generation tonne-scale experiment. A 10-kg pilot search is in preparation to confirm these encouraging preliminary indications.