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CUPID, the next-generation 0νββ bolometric experiment

Neutrinoless double-beta decay (0νββ) is a key process in addressing some of the most significant open questions in particle physics, namely the conservation of lepton number and the Majorana nature of the neutrino. Over the past decades, extensive efforts have been dedicated to improving the sensitivity of 0νββ half-life measurements across multiple isotopes. The next generation of experiments aims to probe half-lives greater than 10^{27} years, reaching the sensitivity required to explore the Inverted-Ordering region of the neutrino mass spectrum. Among the various techniques employed, low-temperature calorimetry has proven exceptionally promising and is expected to maintain a leading role in future searches, particularly through the CUPID experiment. CUPID (CUORE Upgrade with Particle IDentification) will search for the 0νββ decay of ^{100}Mo and it will be installed in the existing CUORE cryogenic infrastructure at the Laboratori Nazionali del Gran Sasso in Italy. CUPID will utilize scintillating Li_2MoO_4 crystals enriched in ^{100}Mo, coupled with light detectors featuring Neganov-Trofimov-Luke amplification. With a total isotope mass of 240 kg, CUPID is designed to achieve a background index of 10^{-4} counts/keV/kg/year and a FWHM energy resolution of 5 keV. This performance will allow for a 3σ discovery sensitivity of 1.0×10^{27} years after 10 live-years of data-taking, corresponding to an effective Majorana neutrino mass sensitivity in the range of 12–21 meV. In this talk, I will present the current status of the CUPID experiment with particular emphasis on the design, construction and results of the CUPID first prototype tower hosting 28 Li_2MoO_4 crystals and 30 light detectors. I will outline as well the upcoming steps towards the construction of the experiment.

Title

CUPID, the next-generation 0νββ bolometric experiment

Topic

Cryogenics and quantum sensors

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