Contribution ID: **39** Type: **Poster presentation**

Recent results from CUORE and path towards CUPID

Tuesday 9 September 2025 16:46 (1 minute)

The search for neutrinoless double beta decay ($0\nu\beta\beta$) is fundamental for investigating lepton-number violation, probing new physics beyond the Standard Model, and determining whether neutrinos are Majorana particles. CUORE, a cryogenic calorimetric experiment at LNGS, studies $0\nu\beta\beta$ in ^{130}Te using 988 TeO_2 crystals, reaching a tonne-scale mass and operating below 15 mK. Since 2017, CUORE has accumulated over 2.5 tonne-years of exposure, constraining $0\nu\beta\beta$ in ^{130}Te and achieving one of the most precise two-neutrino double beta decay ($2\nu\beta\beta$) half-life measurements and a detailed background reconstruction across a broad energy range. These results provide essential nuclear physics benchmarks for $0\nu\beta\beta$ searches. Building on CUORE's success, CUPID (CUORE Upgrade with Particle ID) aims to significantly enhance its $0\nu\beta\beta$ discovery sensitivity to 10^{27} yr in ^{100}Mo, covering the Inverted Hierarchy of neutrino masses. It will deploy in total 240 kg of ^{100}Mo in 1596 enriched Li_2MoO_4 crystals. 1710 light detectors with Neganov-Trofimov-Luke amplification will enable simultaneous heat and light readout for enhanced background rejection, particularly against α surface contamination and $\beta\beta$ pileup. CUPID will reuse CUORE's cryostat and infrastructure. Current efforts focus on detector performance validation, sensitivity studies, and finalizing the experimental design to maximize physics reach. This work presents the latest CUORE results and outlines the key milestones towards CUPID's realization.

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Session Classification: Poster Session and BBQ