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Latest results from CUORE and prospects for CUPID

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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 bolometric experiment at LNGS, studies $0\nu\beta\beta$ in 130Te using 988 TeO2 crystals. It is a milestone of cryogenic detector arrays with a tonne-scale detector operated for more than 7 years below 15 mK. Since 2017, CUORE has accumulated over 2.5 tonne-years of exposure, achieving one of the leading $0\nu\beta\beta$ limits and one of the most precise two-neutrino double beta decay ($2\nu\beta\beta$) half-life measurements thanks to a detailed background reconstruction across a broad energy range. 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 employ 1596 lithium molybdate (Li 2 MoO 4) crystals enriched in 100 Mo, alongside 1710 light detectors with Neganov-Trofimov-Luke amplification, enabling simultaneous heat and light readout for enhanced background rejection, particularly against alpha contamination and $2\nu\beta\beta$ 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 toward CUPID's realization.

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