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Characterization of a High Precision TES Light Detector for Neutrinoless Double Beta Decay Search

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The cryogenic calorimeters employed in rare event searches, such as the direct dark matter detection and neutrinoless double beta decay (0νββ) search experiments, desire the lowest energy thresholds and highest energy resolutions to discriminate background events, which therefore require the detector operating temperature to be as low as readily accessible. Superconducting Transition Edge Sensors (TES), in addition to their leading energy resolution, also provide the advantage of high timing resolution, which is essential for experiments with a high background rate. Based on our successful recipes for low-Tc superconducting films, we are developing a large area Iridium based TES light detector targeting O(10) eV baseline energy resolution and O(100) µs pulse timing resolution for potential applications in the CUORE Upgrade with Particle ID (CUPID) project, a next generation 0νββ experiment. The light detector is fabricated at room temperature by patterning an Ir/Pt bilayer or a Au/Ir/Au trilayer TES element at the center of a two-inch silicon wafer. The superconducting transition temperature of the TES is tuned to be around 30 mK to achieve the target energy resolution by utilizing the proximity effect between Ir and normal metals Pt and Au. We will give a brief status overview for the development of the large area low threshold TES light detectors, present the measured dependence of the transition temperatures with varied Iridium and normal metal thicknesses, describe the fabrication of the Iridium-based TES detectors, and show results of their bolometric characterization.

Less than 5 years of experience since completion of Ph.D

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