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Development of Cryogenic CaMoO4 Crystal Detectors for the AMoRE Double Beta Decay Project

The AMoRE (Advanced Mo-based Rare process Experiment) project is an international experiment to search for neutrinoless double beta decay of 100Mo. High energy resolution and efficient particle-type discrimination are essential to improve the experimental sensitivity in neutrinoless double beta decay search experiments. Here we report performances of cryogenic detectors with CaMoO4 crystals and metallic magnetic calorimeters that were operated at tens of milli-Kelvin temperatures. An energy resolution 10 keV (FWHM) was obtained for 2615 keV gamma quanta, and less than 1 ms of pulses rise-time was achieved at 40 mK. This is a relatively fast value compared with other cryogenic detectors using resistive thermistors. It may improve rejection ability for random coincidences of two-neutrino double beta decay events that could be one of the major background sources in cryogenic neutrinoless double beta decay experiments with 100Mo. Moreover, pulse shape discrimination of single phonon sensor was successful to separate the electron and alpha induced events with 7.7σ discrimination power.

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