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Novel techniques for thermal detectors and applications for rare events physics

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The current technology of thermal detectors for rare events physics is based on large cryogenic calorimeters read with NTD thermistors (es. CUORE, CUPID). Measuring the energy deposition via the heat release in the crystals allows for optimal energy resolutions when the detectors are operated at 10mK. In case of scintillating crystals, a double readout of heat and scintillation light allows for a discrimination between alpha and beta/gamma events. The light detectors are usually Ge or Si wafers, operated also as thermal detectors. A fundamental aspect for the CUPID detectors is the improvement in the collection and detection of scintillation light.
A different realisation of the NTD thermistor electrodes can affect the sensitivity of these thermal sensors; 10B/11B ion isotopes of the NTD electrode implants have a different specific heat at low temperatures which is inversely correlated with the thermal rise for a given energy release. New strategies for coupling the NTD thermistor to the absorber can also improve the system sensitivity and reduce the thermalisation time constants; eutectic bonding and silicate bondings are tested and compared with the traditional glue coupling. Moreover, a reflective coating of the absorber surfaces can increase the light collection, such as an Al layer deposited on the Li2MoO4 crystals.
We will show the performance measured in the Milano Cryogenic Lab of several thermal detectors realised with the mentioned novel techniques for CUPID R&D.

Submitted on behalf of a Collaboration?

Yes

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