



Contribution ID: 201

Type: **Poster**

A TeO₂ bolometer with Cherenkov signal tagging

TeO₂ crystals are currently used as bolometers in the search for neutrinoless double beta decay: CUORE, an array of 988 TeO₂ bolometers, is about to be one of the most sensitive experiments searching for this process. The sensitivity of this experiment could be further improved by removing the background from alpha particles generated by natural radioactivity of the copper structure holding the crystals.

This goal can be achieved detecting the Cherenkov light emitted from beta particles and not by alpha ones. For the first time we measured the Cherenkov light emitted by a CUORE crystal, and found it to be 100 eV at the Q-value of the decay. The signal is however small, at the same level of the noise of the bolometric light detectors we are using. We point out that an alternative light detector technology must be developed to obtain TeO₂ bolometric experiments able to probe the inverted hierarchy of neutrino masses.

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Track Classification: Neutrinoless Double Beta Decay