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## Neutrinoless double beta decay searches with an enriched $^{116}\text{CdWO}_4$ scintillating bolometer

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Cadmium-116 is one of the most favourable candidates for neutrinoless double-beta decay ( $0\nu\text{BB}$ ) searches for two main reasons: first, the energy of the decay ( $Q = 2813.49$  keV) is higher than the end point of the natural gamma radioactivity (2615 keV); then, it can be embedded in  $\text{CdWO}_4$  crystals, which are efficient scintillators. It was used by the AURORA experiment, which improved the half-life limit on  $0\nu\text{BB}$  decay previously achieved by the Solotvina experiment, by setting a new constraint at  $2.2 \times 10^{23}$  years.

In the search that we present here, the  $0\nu\text{BB}$  decay is investigated using a  $\text{CdWO}_4$  crystal scintillator enriched in Cadmium-116 to 82% as a scintillating bolometer. The detector is installed underground at LSM (Laboratoire Souterrain de Modane) in France. The crystal, which has a mass of 579 g, is coupled to a bolometric light detector in order to collect the scintillation light. The double read-out of heat and scintillation allows us to reduce the background by discriminating between different populations of particles. The main goal of this test is the study of the radio-purity of the crystal and the performance of the detector.

The achieved results are extremely promising. The energy resolution at 2615 keV is 11 keV FWHM at 20.7 mK (to be compared with 163 keV achieved by AURORA with the same crystal operated as a room-temperature pure scintillator). The challenging alpha background can be discriminated with efficiency higher than 99.9%. This result, achieved for the first time with a large-masse enriched crystal, confirms that the bolometric technology provides high energy resolution and background discrimination efficiency, and makes cadmium tungstate one the most promising candidates to investigate  $0\nu\text{BB}$  with this technique.

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

N

### Student (Ph.D., M.Sc. or B.Sc.)

Y

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