

LUMINEU: a pilote scintillating bolometer experiment for neutrinoless double beta decay search

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The Luminescent Underground Molybdenum Investigation for NEUtrino mass and nature (LUMINEU) aims at preparing the ground for a next-generation neutrinoless double beta decay experiment employing scintillating bolometers: these devices are in fact very promising tools in rare events search, in terms of efficiency, energy resolution and background control. In particular, they can tag alpha events, which are the dominant residual background for double beta decay candidates with a transition energy higher than 2615 keV.

LUMINEU's goal is the operation of a pilote detector, consisting of four 400 g ZnMoO₄ scintillating bolometers, probing an active 100Mo mass of about 0.7 kg, the energy transition of this isotope being 3034 keV. The enriched material for this setup is available and the experiment is fully funded by ANR in France. This preliminary investigation intends to be feasibility test for a next-generation neutrinoless double beta decay experiment aiming at probing the inverted hierarchy region of the neutrino mass pattern. LUMINEU will help to fix the detailed structure of the single module of this future large-scale experiment.

The ZnMoO₄ crystals will be grown at the Nikolaev Institute for Inorganic Chemistry in Novosibirsk, Russia. LUMINEU foresees a systematic optimization of the crystal growth parameters, in order to optimize the bolometric performance, the light yield, the alpha particle rejection factor and the radiopurity of the scintillating bolometers. On this purpose, an aboveground facility was set up at the Centre de Sciences Nucléaires et de Sciences de la Matière (CSNSM), in Orsay, France.

In this contribution, we will describe the LUMINEU program, we will discuss its sensitivity and that one of a future large search based on this technology. We will also present preliminary experimental results achieved in Orsay with scintillating bolometers fabricated employing the first LUMINEU ZnMoO₄ crystals, which have been delivered in June 2013.

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