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Toward the first neutrino mass measurement of Holmes

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The absolute mass of neutrinos is one of the most important riddles yet to be solved, since it has many implications in Particle Physics and Cosmology.
HOLMES is an ERC project started in 2014 that will tackle this topic. It will perform a model independent calorimetric measurement of the neutrino mass with a sensitivity of the order of 1 eV using 1000 low temperature microcalorimeters detectors (TES). A TES is a sensitive thermometer, able to detect the energy of a X-ray photon with a resolving power $E/\Delta E < 10^3$.

The goal is to employ these detectors to study the end-point region of the electron capture (EC) decay of ^{163}Ho. In such a measurement, all the energy is measured except for the fraction carried away by the neutrino. Although the neutrino is not detected, the value of its mass affects the shape of the de-excitation spectrum, reducing also the end-point of the spectrum by an amount equal to the effective neutrino mass. The spectrum distortion is statistically significant only in a region close to the end-point, where the count rate is lowest and background can easily hinder the signal.

Holmes has adopted a high-risk/high-gain approach: with a target single pixel activity of 300 Bq, both the detectors and the readout will be tested to their technical limits, requiring also advanced discrimination techniques to decrease the resulting number of pile-up events.

In this contribution, I will present the recent results achieved that lay the grounds for the low-activity phase of the Holmes experiment, that will lead to its first limit on the neutrino mass.

Collaboration

Holmes

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