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Status of the HOLMES neutrino mass experiment

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The assessment of the neutrino absolute mass scale remains one of the most crucial challenges in today particle physics and cosmology. Nuclear beta decay spectrum end-point study is currently the only experimental method to provide a model independent measurement of the lowest neutrino mass. HOLMES is an experiment to directly measure the electron neutrino mass by performing a calorimetric measurement of the energy released in the electron capture decay of ^{163}Ho.
In a calorimetric configuration the detector measures all the energy released in the decay process, except for the fraction carried away by the neutrino. This approach eliminates both the issues related to the use of an external source and the systematic uncertainties arising from decays on excited final states.

HOLMES plans to deploy a large array of low temperature micro\-calorimeters implanted with ^{163}Ho nuclei. The neutrino mass statistical sensitivity is expected in the eV range, thereby making HOLMES an important step forward in the direct neutrino mass measurement with a calorimetric approach as an alternative to spectrometry. HOLMES will also establish the potential of this approach to achieve a sub-eV sensitivity.
HOLMES is designed to collect about 3×10^{13} decays with an energy resolution of about 1 eV FWHM and a time resolution of about 1 μs. This will be achieved in three years of measuring time using 16 sub-arrays of TES microcalorimeters. Each sub-array has 64 pixels ion implanted with ^{163}Ho ions to give an activity of about 300\,Bq per pixel. The TES arrays are read out using microwave multiplexed rf-SQUIDs in combination with a Software Designed Radio data acquisition system.
The current HOLMES activity will culminate with the deployment of the first implanted sub-array which will provide crucial high statistics data about the EC decay of ^{163}Ho together with a preliminary limit on the electron neutrino mass.

In this contribution we outline the HOLMES project with its physics reach and technical challenges, along with its status and perspectives. In particular we will present the status of the HOLMES activities concerning the ^{163}Ho isotope production by neutron irradiation and purification, the TES pixel and multiplexed array read-out, the cryogenic set-up, and the isotope embedding process optimization.

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