Application of gamma Transition-Edge-Sensor (TES) to 112Sn two-neutrino double electron capture search

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Double electron capture (DEC) is a rare nuclear decay process in which two orbital electrons are captured simultaneously in the same nucleus. The measurement of its two-neutrino emitting mode provides a new reference for calculating nuclear matrix elements, while the zero-neutrino emitting mode would demonstrate a violation of lepton number conservation. The two-neutrino DEC mode in 124Xe has been previously observed by the XENON1T experiment. For other nuclei, however, no significant signal was observed. For example, our target isotope of 112Sn, DEC to the excited state in 112Cd was searched using an HPGe detector, but no significant signal was observed. DEC to the ground state in 112Cd has not been conducted so far.

We propose an approach to search for the DEC mode to the ground state in 112Cd using gamma-ray Transition Edge Sensors (TES) with Sn absorbers. The calorimetric (source = detector) configuration allows us to detect two X-ray or Auger electrons resulting from the 112Sn DEC mode with high resolution. The state-of-the-art multi-pixel TESs increase the target amount, enhancing sensitivity. In this presentation, we will present the demonstration of our search for the 112Sn two neutrino DEC using gamma-ray TES and future prospects.

Submitted on behalf of a Collaboration?
No

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