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γ -ray measurements of Th-229 isomer using TES microcalorimeters

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The lowest energy of ^{229}Th isomeric state is widely known to be around 10 eV and by utilizing this level, a nuclear clock may be realized. The ^{229}Th nuclear clock is expected to have an enhanced sensitivity to the time variation of the fine structure constant.

To realize the clock, we need to determine the lowest-energy of the ^{229}Th isomeric state precisely. The approach to measure the energy level is utilizing the energy difference of the doublet lines at 29.19 keV.

We developed TES microcalorimeters for this measurements and measured the emission lines of ^{229}Th decayed from ^{233}U . In the first campaign conducted in 2017, the energy resolution of the TES microcalorimeter degraded to 40 eV at 26 keV in the measurement environment. Thus the doublet was not resolved in the spectrum. We estimated the isomer energy level using the decay chain starting from 97.1 keV. Then we improved the detector system and recently confirmed an energy resolution of 18 +/-4 eV FWHM at 26 keV in the environment to measure ^{229}Th . We report the first results from the campaign in 2017 and the improvement of the detector.

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

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