

MAGNETO- ν : Sterile Neutrino Search with Precision Pu-241 Decay Measurement

Pu-241 is a newly proposed nuclide for studying the nature of neutrinos to complement tritium-based experiments. Pu-241 decays via first-forbidden non-unique beta minus decays with 20.8 keV Q-value, making it suitable for keV sterile neutrino search as well as active neutrinos mass measurement. MAGNETO- ν experiment uses magnetic microcalorimeters in conjunction with SQUID magnetometers to acquire the most precise Pu-241 decay spectrum. We conducted our first experiment in Lawrence Livermore National Laboratory using pure source provided by the same lab. The experiment accumulated the most precise Pu-241 beta decays spectrum that consists of one billion counts above the 3 keV threshold. Analysis based on the data yields a $|\text{Ue4}|^2 \sim 2 \times 10^{-4}$ sensitivity to 10-keV neutrinos, which surpasses the previous best limit. Experimental details and analysis results for keV neutrino will be presented for the first time. This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. This work was supported by the Laboratory Directed Research and Development program of Lawrence Livermore National Laboratory (23-LW-043).

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