Status of the Experiment on the Laboratory Search for the Electron Antineutrino Magnetic Moment at the Level $\mu_\nu \leq 3 \cdot 10^{-12} \mu_B$

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The experiment on the direct detection of antineutrino-electron scattering using an artificial tritium β-active source will allow lower the currently available laboratory limit for the neutrino magnetic moment [1] by two orders of magnitude [2]. A source of antineutrinos from tritium decay of a 40MCi activity (4 kg of tritium chemically bound to titanium) will produce antineutrinos with flux density of $\sim 6{\cdot}10^{14}\mathrm{cm}^{-2}{\cdot}\mathrm{s}^{-1}$ in a detector array positioned inside the source [3]. Semiconductor detectors using principles of internal signal amplification in the electric field, namely, a silicon cryogenic detector based on the ionization-into-heat conversion effect [4] and a high pure germanium avalanche detector [5], will be capable of detecting electrons from $\tilde{\nu} - e$ scattering with recoil energy down to $\sim$10 eV, where the electromagnetic scattering dominates over the weak one.
Favorable background conditions for running the experiment can be achieved by locating a compact installation in a specially equipped laboratory underground ($\geq$100 mwe). With detector assembly masses 3 kg and 5 kg for the silicon and germanium ones, respectively, and background level about 0.1events/day per kg of detector mass, a limit for the electron antineutrino magnetic moment $\mu_\nu \leq 3 \cdot 10^{-12} \mu_B$ will be obtained during 1-2 years of data-acquisition. Accessing such a limit for μ_ν in laboratory would fill an ample gap between existing experimental constraint and the ones deduced from astrophysics. Detection of a neutrino magnetic moment at this level would reveal the structure beyond the standard theory and would be influential in the understanding of scenarios with magnetic-field-induced spin precession in the Sun, supernovae, active galactic nuclei, or the early universe. Motivation for the experiment and scheme of its running, as well as principles of detectors' operation and physics of the tritium source, are presented. Status of the experiment and state-of-the-art are reported [6].

References

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