“CAMEO/GEM program for the future double beta decay and dark matter researches”

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The present status of neutrino physics makes it necessary to enhance the sensitivity of 2β decay experiments (in terms of the half-life limit for the neutrinoless mode) to the level of $10^{26} - 10^{28}$ yr. Requirements for future super-sensitivity projects are formulated and the conclusion is obtained that such a goal will certainly be reached in the next generation experiments kike CAMEO, CUORE, MAJORANA, GEM GENIUS). In particular, pilot measurements with ^{116}Cd and Monte Carlo simulations show that sensitivity of the proposed CAMEO experiment (in terms of the half-life limit for $0\nu2\beta$ decay) is $\approx 10^{26}$ yr with $\approx$100 kg of enriched $^{116}CdWO_4$ crystals placed in the liquid scintillator of the CTF. The last value corresponds to a bound on the neutrino mass of $m_\nu \leq 0.06$ eV. To advance these results further, the GEM experiment is designed for the 2β decay study of ^{76}Ge in the CTF. About one ton of "naked" HP Ge detectors (natural in the first phase of the GEM and enriched in ^{76}Ge to 86% in the second stage) are operating in super-high purity liquid nitrogen contained in the Cu vacuum cryostat. The latest is placed in the one kt water shield. The sensitivity of the GEM is $\approx 10^{27}$ yr with natural HP Ge crystals and $\approx 10^{28}$ yr with enriched ones. These bounds corresponds to the restrictions on the neutrino mass $m_\nu \leq 0.05$ eV and $m_\nu \leq 0.015$ eV for natural and enriched detectors, respectively.

In addition, the GEM and GENIUS projects may advance the best current limits on the existence of neutralinos – as dark matter candidates – by three orders of magnitude, and at the same time may be able to identify unambiguously the dark matter signal by detection of its seasonal modulation. All of these results will provide crucial tests of the key theoretical models of modern astroparticle physics and cosmology.