DEVELOPMENT OF SETUP FOR NEUTRINO-NUCLEUS COHERENT SCATTERING OBSERVATION

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Recent Neutrino and Dark Matter search experiments revolutionized detection of rare events and rare events with low energies in particular. Experiments achieved sensitivities on the level of several events per hundreds kg of detector’s material per day with energy thresholds below of 1 keV. This opens a new unique possibility for experimental detection of neutrino-nucleus coherent scattering that was considered to be impossible so far.

The present project consists in using of low threshold HPGe detectors developed by JINR (Dubna) [1] for creation of a setup designated for first observation of neutrino coherent scattering of Ge. General conception of this project can be described as following:

1) Based on four point contact HPGe detectors with total mass of ~1400 g developed by JINR (Dubna) the spectrometer with energy threshold at ~300 eV is built. The constructed spectrometer (the cryostat, detector holders, etc) fulfills the requirements for low background experiments.

2) The background of the spectrometer is being studied in details at LSM underground laboratory using infrastructure of the EDELWEISS experiment [2]. The signal of light WIMPs recently reported by some experiments could be a source of background for observation of coherent neutrino scattering. Thus on this stage of the experiment an important goal is to set a limit or a value of such WIMPs’ signal.

3) As a powerful neutrino source the experiment will use antineutrinos from one of the power-generating unit of Kalininskaya nuclear power plant. Therefore, after finishing the background studies the setup will be moved from LSM to the Kalininskaya power plant site where it will be deployed into improved low background shield of the GEMMA experiment [3]. Observation of coherent neutrino scattering will be checked using the differential method that compares the spectra measured at the reactor operation and shut down periods. For the setup set at a 10 m distance from the center of reactor core and with an energy threshold at ~300 eV several tenths of events of neutrino coherent scattering expected to be detected per day in the constructed setup with 4 HPGe low energy threshold detectors (450 g each).

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