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The possible experiment for search of sterile neutrinos

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An advance in solution of the sterile neutrino search can be reached by creation of the intensive $\bar{\nu}_e$-source with well known hard spectrum. The most intensive artificial antineutrino sources used for neutrino experiments are the nuclear reactors. The resulting reactor $\bar{\nu}_e$-flux is the complicated additive function of fluxes: from fission fragments; from β-decay of heavy nuclei. In spite of the doubtless superiority in flux value the antineutrino reactor spectra (formed by main fuel isotopes are characterized by large uncertainties in the total $\bar{\nu}_e$-spectrum $(4 \div 6)$\% -precision at energy up to ˜ 6 MeV) that lead to very serious problems in interpretation of neutrino oscillation results [1,2].

The creation of intensive source of well definite hard spectrum can be solved by the scheme of continuous circulation of ^{8}Li produced in (n, γ)-capture on the ^{7}Li activation close the reactor active zone. The created ^{8}Li-isotope is pumped continuously in the elongated channel loop which includes the large reservoir and remote $\bar{\nu}_e$-detector. The scheme allows the unique possibility to produce the variable and controlled hardness of the total $\bar{\nu}_e$-spectrum [3].

For the scheme (3+1) with three active and one sterile neutrinos the probability of $\bar{\nu}_e$-source of existence at distance $L(m)$ from the source is given by two flavor model $P = 1 - \sin^2(2\Theta) \times [1.27\Delta m^2_{41}(L(\mathrm{m})/\mathrm{E(MeV)}]$, Θ - angle of mixing; $\sin^2(2\Theta) = 4|U_{i4}|^2(1 - |U_{i4}|^2)$; U_{i4} - element of mixing matrix for active neutrino flavor

$i = e, \mu, \tau$; $\Delta m^2_{41}(\mathrm{eV}^2)$ - maximum squared-mass difference between sterile and active neutrinos (i.e., $|\Delta m^2_{41} \gg |\Delta m^2_{31}| \gg |\Delta m^2_{21}|$ [4,5].

It was obtained the dependencies of cross section for ($\bar{\nu}_e,\ p$)-reaction from the hardness H that allows to simulate the expected number of events for oscillation experiment. The simulation fully confirmed the reality to ensure the hard spectrum in the space not far from the reservoir. It was obtained the dependences of count errors (in the total spectrum) on detector position for the specified geometry and operation regime [3, 5]. The results also demonstrates an important advantage of the hard lithium spectrum at increase the threshold of registration –large decrease of the expected errors (below 1.5%) in case of increase of the threshold from 3 MeV to 6 MeV.

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