Accelerator Version of the Intensive Lithium Antineutrino Source

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The combination of the decay parameters of the neutron rich β^- -decaying ^{8}Li isotope (short $T_{1/2}$= 0.84 s) and it hard spectrum ($E_{\tilde{\nu}}^{\max}$ =13 MeV and $< E_{\bar{\nu}} >$ = 6.5 MeV) of well-known distribution allows to consider it as the very perspective candidate for the artificial antineutrino source. In comparison with nuclear reactor which traditionally used as an intensive antineutrino source the lithium one is characterized by well-known spectrum that excludes the serious problems arising due to the soft and rapidly decreasing reactor spectrum obtained with significant errors ((4-6)% -precision at energy up to ~6 MeV) caused by unknown schemes of decays, time variations, presence of the spent nuclear fuel, that put together cause an unsolved puzzles in precision and interpretation of neutrino oscillation results [1].

The construction of the intensive neutrino sources are possible in different schemes basing on the nuclear reactor (as neutron source for (n,γ)-activation of purified ^{7}Li), on the preparing (basing on the reactor technology) of the high Ci-activity β^--source (as in proposal [2]), on the tandem scheme of the accelerator with neutron producing target plus lithium blanket (neutron converter) irradiated by ^{7}Li(n,γ)^{8}Li activation [3]. It is possible the dynamical scheme realized in transport regime where an activated ^{7}Li is pumped in the close cycle through the active zone of the reactor; further (in cycle) it is delivered close to the neutrino detector. Strong advantage of the dynamical scheme is the possibility to decrease the total spectrum errors in order of values [4] and high count rate in the compact (~ m^3) neutrino detector – ~4×10e+4 of $(\bar{\nu}_e, p)-$ events (m^{-3}×day^{-1}×GW^{-1}) [5].

In the other perspective realization the proton beam strike into the heavy-element-target and produces the significant neutron yield for the lithium blanket irradiation. The scheme is considered for energies up to ~ 600 MeV for different heavy targets (W, Pb, Bi, Ta). The density of ^{8}Li creation is simulated in details that allowed to propose an effective blanket scheme with central lithium containing volume enclosed by carbon (acting as an effective neutron reflector) and outer thick water layer to diminish the neutron escape. The analysis of ^{8}Li distribution in the blanket allows to propose an approach of tandem schemes of linear accelerators (with proton energy about several tens of MeV) and construction of small-volume- $\bar{\nu}_e$ -source (of short dimension ~70 cm) that is exclusively important for search of sterile neutrinos in case of $\Delta m^2 \sim 1$ eV^2 [6].

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