Reactor Neutrino Irradiation Effects on the Electrochemical Device Using Biological Product

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We have carried out experiment of low-energy neutrino detection both under irradiation of nuclear reactor neutrinos and under natural environmental situation [1]. To make clear the signal generation near the nuclear reactor, we presented electrochemical reaction mechanism formulation as well as another experimental data.

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1. Introduction

Interaction cross-sections of neutrinos are generally quite small (e.g. $\sigma_{\nu e \to \nu e} \sim 10^{-44}$ cm^2 (E/MeV)), so that an established standard model is inapplicable to explaining the output current increase near the nuclear reactor. To understand the experimental data, we propose that a neutrino is composed of two types of internal constituent particles (ν_c, ν_d). Some kinds of biological products may generate AV-type neutral scalar field B^0. It may influence the binding energy of the constituent particles of neutrino, and augment the interaction cross-section.

2. Detection principle of electrochemical device

The detection mechanism is based on electrochemical process with assistance of weak interaction . In the detector, a gold (anode) and a carbon (cathode) electrode were set in purified water, and biological product was placed around the anode. When a low-energy neutrino enters into this region, it breaks into two constituent particles while dissociating water molecule into positive and negative ions. Generated ions diffuse to individual electrodes, and they cause oxidation and reduction reactions at individual electrodes. Finally, the reaction leads to the output current between the electrodes as

$$I(t) \approx P\left[C_{\mathrm{H}^+\nu_c}(t)\right]^{n_{\mathrm{H}}}\left[C_{\mathrm{O}_2}(t)\right]^{n_{\mathrm{O}}} \exp\left(-\frac{\Delta G + 4\alpha E(t)}{k_{\mathrm{B}}T}\right),$$

where ΔG is the activation energy, and can be determined by Arrhenius plot. The time evolution of experimental data was mostly reproduced in the simulation.

We attempted to carry out another experiment near a light-water reactor. The experimental current was appreciably larger that in environmental situation. The formulation by Eq.(1) was also applicable to the analysis.

3. Conclusion

Weak-interaction assisted electrochemical process was applicable to the experimental data under irradiation of reactor neutrinos.

References

[1] Liu Wei et al.: "Possible Detection of Natural Neutrinos by Use of Small Apparatus", J. Nucl. Sci. Technol., Suppl. 4 (2004), 487-490.