Current Status of Development for Geo-Neutrino Directional Measurement

*Shirahata Yutaka[1]

1. Research Center for Neutrino Science, Tohoku University

Neutrino is one of the elementary particle and neutrino physics has been developing. Liquid scintillator (LS) detectors have a good sensitivity to low energy anti-neutrinos. However, unlike water Cherenkov detectors, LS detectors are not sensitive to anti-neutrino direction. Directional sensitive LS detector has possibility that it can reveal information. For example, it will contribute to better understanding of the Earth’ s interior using geo-neutrino flux measurement in kton scale detector, and there is possibility of application to reactor monitoring system in small size detector.
Anti-neutrinos are detected by inverse beta decay reaction and tagged by the delayed coincidence method (prompt signal is positron and delayed signal is neutron capture event) that provides a powerful tool to suppress backgrounds. Although the emitted neutron retains the directional information of incoming anti-neutrinos, current LS cannot identify neutron capture point before directional information is lost. Li-loaded LS has the ability to shorten the neutron capture range because of large neutron capture cross section (940barn cf. ^{1}H 0.3 barn) of ^{6}Li and neutron capture point is point-like because alpha ray and ^{3}H are emitted after neutron is captured by ^{6}Li.So we can know directional information of anti-neutrino by observing positron reaction point and neutron capture point.
And, to separate prompt and delayed points clearly, optical discrimination of energy deposit points by high resolution imaging devices is also required. We are planning to use reflective optical system and multi-channel photomultiplier as an imaging device. Recently, we were able to image ^{6}Li capture event.
I will report about the current status of development for geo-neutrino directional measurement.

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