Development of New Technology for Geoneutrino Directional Measurement

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Directional sensitive neutrino detectors have contributed to astronomy and particle physics. For example, directional measurement of solar neutrinos had strong power to confirm neutrino oscillation. Liquid scintillator detectors are marked by the ability to detect low energy neutrino signals, such as reactor, geo, and extraterrestrial neutrinos. On the other hand, liquid scintillator detectors do not have sensitivity of neutrino direction.

KamLAND (Kamioka, Japan) and Borexino (Gran Sasso, Italy) have showed the geo anti-neutrino detection realized by the event rate and energy spectra. We have begun to use neutrinos as “probe” to observe the Earth’s interior. Since geo-neutrino measurement does not have the sensitivity of its direction, what we can do is measuring total geo-neutrino flux from mantle and crust.

It is hoped the development of new measurement technology to measure neutrino direction. We found that combination of lithium-loaded liquid scintillator and imaging detector had the potential to have the high sensitivity of coming anti-neutrino direction. Directional sensitive detectors will contribute to the better understanding of the earth interior using geo anti-neutrino flux information. Other motivations are the earlier determination of supernova direction and improvement of oscillation sensitivity for reactor anti-neutrinos.

Keywords: geoneutrino, radiogenic power

