

[U-02_28AM2]Particle Geophysics

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The great success in the imaging of volcanoes with elementary particles called muons (muography) as well as in the detection of neutrinos generated inside the earth (geo-neutrinos) has resulted in observation opportunities completely independent from the capabilities of conventional geophysical methods. By facilitating the future goals and concerns of the geophysical community, ideally shared among the muography observation group, geo-neutrino observation group, and earth scientists through international and interdisciplinary interactions, the aim is to strengthen the evolution of particle geophysics. Various muographical projects have been promoted worldwide, and each international group has been producing valuable results. Concerning geo-neutrino detection, the quantity of radioactive materials generating heat inside the Earth will be recognized via the frequency of geo-neutrino counts. Since this radioactive heat generation reflects the geodynamics and the chemical composition of the building blocks of our planet, improvements to measurement accuracy will likely yield useful geo-scientific information in the near future. With active cooperation between international communities, we aspire to expand the frontiers of earth observation techniques.

11:45 AM - 11:54 AM

[U02-P07_PG]Upgrade plan of the KamLAND detector for improvement of sensitivity to geo-neutrino

3-min talk in an oral session

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Neutrino, which is a kind of elementary particles, interacts with other particles only via weak interaction. RCNS, Tohoku University, researches the neutrino science with the large neutrino detector, KamLAND. Measuring the geo-neutrinos that are produced in beta decays within the Earth's interior, is only way to estimate the Earth's radiogenic heats production and constrain composition models of the Earth. The KamLAND detector is marked by the ability to detect low energy electron-type anti-neutrinos. Radioactive isotopes, such as ^{238}U and ^{232}Th decay as follows, and produce the electron-type (anti-) neutrinos (geo-neutrino). $^{238}\text{U} \rightarrow ^{206}\text{Pb} + 8\ ^4\text{He} + 6\text{e}^- + 6\text{v}_e^{\text{bar}} + 51.7[\text{MeV}]$ $^{232}\text{Th} \rightarrow ^{208}\text{Pb} + 6\ ^4\text{He} + 4\text{e}^- + 4\text{v}_e^{\text{bar}} + 42.7[\text{MeV}]$ Geo-neutrino flux directly informs us the radiogenic heat generation. In fact, previously, the KamLAND experiment has given the result; the radiogenic heat production in the Earth's interior by ^{238}U and ^{232}Th is estimated to be $20.1_{-9.1}^{+9.1}$ TW through measuring the geo-neutrinos, and it is obviously smaller than the Earth's total heat flow (44 ± 1 TW). In order to improve the sensitivity of the KamLAND detector, the upgrade plans (KamLAND2 experiment) are in progress. Large light intensity liquid scintillator, light collection mirror, high quantum efficiency photomultiplier, imaging device, scintillation film, etc... In the KamLAND2 experiment, improving energy and vertex resolution are expected. Therefore it will be possible to observe geo-neutrinos with higher accuracy and statistics. This experimental improvement will have higher ability to discriminate between models and separate contributions from ^{238}U and ^{232}Th . The KamLAND2 will play a contribution to the geo physics in that way. In this presentation,

future prospects and R&D are discussed.