

## Neutrino Geophysics with KamLAND and future prospects

# Sanshiro Enomoto[1]; Eiji Ohtani[2]

[1] Research Center for Neutrino Science, Tohoku University; [2] Institute of Mineralogy, Petrology, and Economic Geology, Tohoku University

<http://www.awa.tohoku.ac.jp/~sanshiro/research/>

The Kamioka liquid scintillator anti-neutrino detector (KamLAND), which consists of 1000 tons of ultra-pure liquid scintillator surrounded by 1879 photomultiplier tubes, has discriminative sensitivity to the electron-type antineutrinos and is capable to detect few MeV neutrinos. Although KamLAND is primarily designed to detect antineutrinos from nuclear power reactors, it is also the first detector sensitive to geologically produced antineutrinos (geoneutrinos).

Geoneutrinos are produced by beta-decays of radioactive elements such as U, Th and K inside the Earth. Owing to neutrinos' extremely small cross-section, geoneutrinos reach to Earth's surface essentially without any interaction. With 749.1 days exposure of the detector, KamLAND set the 90 per cent confidence interval for the number of geoneutrinos detected to be from 4.5 to 54.2.

We constructed a model of the Earth based on the bulk silicate Earth (BSE) composition in order to evaluate the rate of geoneutrinos detectable by KamLAND. Within the uncertainty of the measurement, the present observation with KamLAND is consistent with our model prediction. We found that KamLAND can be used to determine the absolute abundances of U and Th in the Earth with an accuracy sufficient for placing important constraints on Earth's accretion and succeeding thermal history. If a neutrino detector were to be built in Hawaii, where effects of the continental crust would be negligible, it could be used to estimate the U and Th content in the lower mantle and the core.

Our calculation of the geoneutrino event rate on the Earth's surface indicates that geoneutrino observation can provide key information for testing the current models of the U and Th content and distribution in the Earth.