

# High Precision and High Sensitivity Measurements of Electron Anti-Neutrinos Originated from Reactors and the Earth

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## **【 Outline of survey 】**

KamLAND, 1000-ton liquid scintillator neutrino / anti-neutrino detector which is led by the present principal researcher was constructed under being supported by the COE program during 1997-2003. The data-taking has been continuing since 2002. In 2002 KamLAND discovered the reactor neutrino disappearance which is deeply connected with neutrino oscillations. This result gave the ultimate contributions not only to determining the finite neutrino masses, but also to solving the solar neutrino deficit which is almost 30 year long-standing puzzle. Based on these activities, the present project aims at observing the first evidence of reactor neutrino oscillations and detecting geoneutrinos with high precision and high sensitivity measurements. The geoneutrino detection will provide the first experimental probe diagnosing the inside Earthby neutrinos.

## **【 Expected results 】**

- \* Evidence of reactor neutrino oscillation.
- \* Precise determination of neutrino oscillation parameters:  $\Delta m^2$  and  $\sin^2 2\theta$ .
- \* First observation of geoneutrinos.
- \* First understanding the energy-generation sources inside the Earth.
- \* Providing the new tool (neutrinos) to explore the deep-inside the Earth.

## **【 References by the principal researcher 】**

- ( 1 ) First Results from KamLAND : Evidence for Reactor Anti-Neutrino Disappearance,  
K. Eguchi, K. Inoue, A. Suzuki et al., Physical Review Letter 90, 021802, 2003.
- ( 2 ) A High Sensitivity Search for Electron Anti-Neutrinos from the Sun and Other Sources at  
KamLAND  
K. Eguchi, K. Inoue, A. Suzuki et al., Physical Review Letter 92, 071301, 2004.

**【 Term of project 】** F Y 2004 - 2008

**【 Budget allocation 】** 90,700,000 yen

**【 Homepage address 】** [http://www.awa.tohoku.ac.jp/KamLAND/index\\_j.html](http://www.awa.tohoku.ac.jp/KamLAND/index_j.html)