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Study of Ocean Bottom Detector for observation of geo-neutrinos from mantle

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Observation of geo-neutrinos originating from radioactive isotopes in the Earth (238U,232Th, etc.) can be converted to the amount of radioactive isotopes and the heat generated by their decays which governs the Earth dynamics.

KamLAND experiment achieved world's first observation of geo-neutrinos in 2005. Improvement of observation accuracy allowed us to reach the level where we can obtain geoscientific knowledge. However, it is hard to obtain information of the mantle because 70% of neutrinos observed by detector currently operating or planned are derived from the crust.

Ocean Bottom Detector can observe geo-neutrinos originating from the mantle directly. Unlike existing other neutrino detectors, OBD detects neutrinos on the seafloor. Given that the oceanic crust is thinner than the continental crust and has lower densities of U and Th, ~70% of anti-neutrinos at OBD come from the mantle. Another unique feature of OBD is keeping the distance from the reactors which are the main background sources for continental detectors. In addition, this movable detector can observe at multiple points in the ocean.

Scientists at the University of Hawaii started to discuss the idea of observing the geo-neutrinos on the sea floor 15 years ago as the detector called "Hanohano". Unfortunately, the idea has not been realized yet.

In 2019 joint research between Tohoku University and JAMSTEC was started to lead the comprehensive research relating to understanding the Earth's deep interior and realize OBD. We are now working for the prototype detector.

Collaboration name

OBD working group

Primary author: Mr SAKAI, Taichi (Tohoku Univ. RCNS)

Co-authors: Prof. INOUE, Kunio (Tohoku Univ. RCNS); Dr WATANABE, Hiroko (Tohoku Univ. RCNS); Prof. MCDONOUGH, William (Tohoku Univ.RCNS , Tohoku Univ. Univ. of Maryland); Dr KENTA, Ueki (JAMSTEC); Dr NATSUE, Abe (JAMSTEC); Dr SAKURAI, Noriaki (JAMSTEC); Dr KYO, Masanori (JAMSTEC); Dr ARAKI, Eiichiro (JAMSTEC); Dr KASAYA, Takafumi (JAMSTEC); Dr YOSHIDA, Hiroshi (JAMSTEC)

Presenter: Mr SAKAI, Taichi (Tohoku Univ. RCNS)

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