

# UNIVERSITY OF HAWAII NEWS



**NEWS RELEASE**  
**EMBARGOED UNTIL**  
**JULY 27, 2005, 7 A.M. HST**

**Contact:** John G. Learned, 011-81-578-59-618  
Department of Physics and Astronomy  
[jgl@phys.hawaii.edu](mailto:jgl@phys.hawaii.edu) or

Eugene Guillian, (808) 956-2965  
Department of Physics and Astronomy

## **UH SCIENTISTS PART OF TEAM TO DETECT ANTI-NEUTRINOS FROM EARTH'S RADIOACTIVITY**

*Measurement of anti-neutrinos by KamLAND is an important first step in using neutrinos to understand the structure and composition of the earth at great depths*

HONOLULU – In the July 28 issue of Nature, a UH team of scientists, in collaboration with international partners, announced the first-ever positive identification of anti-neutrinos from the decay of Uranium and Thorium, radioactive elements that are distributed at different depths inside the earth. The measurement of earth's radioactivity provides the first step toward a better understanding of the structure and composition of the earth, marking the realization of an idea brought forth by scientists 50 years ago.

“This measurement opens a new era in neutrino applications, and one in which, for the first time, humans will be able to peer into the planet upon which we live. It will take some years before details will be revealed, but this is a start,” said Professor John Learned, a participating researcher of the UH Team.

Team member and UH physicist Eugene Guillian explained, “Although geologists have theories on how radioactivity is distributed throughout the earth, no direct test has ever been conducted because of the inability to access material from deep within the earth. This is the first piece of evidence regarding how radioactivity is distributed within the earth and the first time neutrinos have played a role in the study of geophysics.”

The detection was made possible by KamLAND, which stands for Kamioka Liquid scintillator Anti-Neutrino Detector. It is located beneath the mountains of Japan's main island of Honshu and is the largest low-energy anti-neutrino detector ever built.

-more-

The KamLAND experiment was conducted by an international collaboration of scientists largely from Japan and the United States. In 2002, they confirmed that neutrinos have mass and that they oscillate (change from one type to another).

The anti-neutrinos detected by KamLAND are subatomic particles that rarely interact with matter because they do not respond to the electromagnetic force. Therefore, the antineutrinos are able to travel through great depths with almost no interaction and provide direct information about the composition of the matter unavailable by other means.

Neutrinos are subatomic particles that are abundantly produced during nuclear fusion, the reaction that lights the sun and other stars. Anti-neutrinos are byproducts of radioactive decay, and are very similar in nature to neutrinos.

UH has a long history of activity in neutrino research, including playing a prominent role in the discovery of neutrinos from Supernova 1987A which resulted in the science of neutrino astronomy. Hawai'i researchers also took part in the initial announcement from the Super-Kamiokande Experiment in 1998 that provided the first compelling evidence for neutrino mass and their ability to morph.

Prior to its current use to determine the earth's composition at great depths, neutrinos were primarily used in the field of astrophysics and solar physics. The latest measurements will assist geologists in calculations to determine the heat flow of the earth, and hence determine the sources of power within the earth. The latter are known only imprecisely today. This information will contribute to our understanding of the formation and evolution of the earth, and also upon the enigma of the power source that drives earth's magnetic field, vital to life on earth.

“We have a special opportunity in Hawai'i, due to our location in the mid-ocean, away from all power reactors and above only the relatively thin ocean crust, to further our research,” said Learned. “We are planning an experiment which can make the first definitive measurements of neutrinos from the earth's mantle and core, and make a definitive search for neutrino radiation from a hypothetical reactor at the core of the earth.”

-more-

News Release – UH Scientists Part of Team to Complete First Measurement of Earth's  
Radioactivity  
Embargoed until July 27, 2005, 7 a.m., HST  
Page 3 of 3

Participating physicists from UH include: Dr. Eugene Guillian, Professor and team leader John G. Learned, Dr. Jelena Maricic, Dr. Shigenobu Matsuno, Professor Sandip Pakvasa, UH principal investigator (from which the project is supported) and Professor Stephen Olsen, and Chariman of the UH department of physics and astronomy and Professor Michael W. Peters.

The published paper in Nature is based upon the work of PhD candidates, Nikolai Tolich of Stanford University and Sanshiro Enomoto of Tohoku University.

For more information or a copy of the Nature article, please visit  
[http://www.phys.hawaii.edu/~jgl/kamland\\_news\\_7-28-05.html](http://www.phys.hawaii.edu/~jgl/kamland_news_7-28-05.html)

**About the University of Hawai'i**

Established in 1907 and fully accredited by the Western Association of Schools and Colleges, the University of Hawai'i is the state's sole public system of higher education. The UH System provides an array of undergraduate, graduate, and professional degrees and community programs on 10 campuses and through educational, training, and research centers across the state. UH enrolls more than 50,000 students from Hawai'i, the U.S. mainland, and around the world. For more information, visit [www.hawaii.edu](http://www.hawaii.edu).

###