Closer by a Factor of Six

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UT's physicists are part of a scientific team that keeps coaxing neutrinos to reveal their role in the universe.

The KamLAND (Kamioka Liquid Scintillator Antineutrino Detector)-Zen collaboration recently published findings in *Physical Review Letters* describing how they've upgraded their experiment with unprecedented sensitivity to look for neutrino-less double beta decay. In double beta decay, two neutrons simultaneously become two protons, with two neutrinos emitted in the process. In neutrino-less double beta decay, the theory is that those two neutrinos might not be emitted at all, and if they are they could annihilate one another.

"This process, if it exists, can open up the possibility to measure neutrino mass," said UT Physics Professor Yuri Efremnko. "Up to now we still do not know the value of neutrino mass and therefore how neutrinos affect the dynamics of the universe."

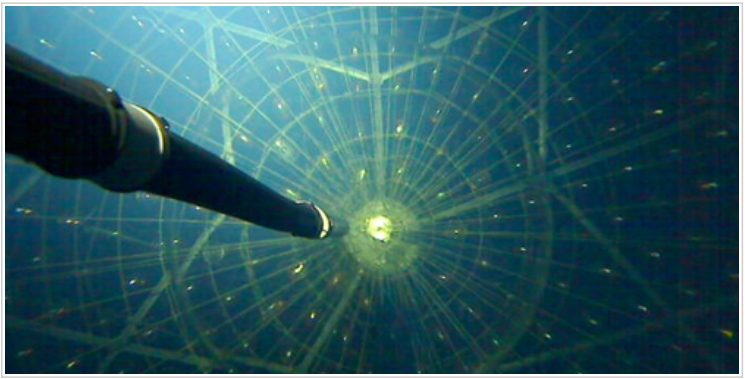

Image credit: KamLAND-Zen Collaboration

Scientists have long looked for signs of the process using isotopes that experience double-beta decay, but to no avail. The KamLAND-Zen team devised a strategy to improve their odds using upgraded KamLAND detector and huge amounts of purified xenon-136. They were able to increase the sensitivity of the experiment, stationed under the mountains of Japan, by a factor of six. These latest results, as Efremenko said, "exceed in sensitivity, by far, all other measurements."

Editors of *Physical Review Letters* ranked the paper among their "Editors' Suggestions," an honor reserved for outstanding letters that are important, interesting, and well-written. The designated publications are selected to encourage scientists to look beyond the scope of their own research into different areas of discovery. Efremenko said that while the KamLAND collaboration was preparing this publication, they made another significant upgrade to the experiment that will allow increased sensitivity in the future, "approaching a region were one expects to see a positive signal of neutrino mass."

Efremenko explained that UT has been part of the KamLAND experiment for 20 years, literally helping build and run it. The project has made key discoveries in neutrino oscillations and in 2015 was awarded a **Breakthrough Prize (http://www.phys.utk.edu/news/2015/news-11162015-breakthrough.html)** with the following UT affiliates named as laureates:

- Mikhail Batygov (PhD Graduate, 2006; now with Carleton University, Canada)

- William Bugg (Professor Emeritus)
- Yuri Efremenko (Professor)
- Yuri Kamyshkov (Professor)
- Alexandre Kozlov (Former Postdoc at UT; now at Kavli IPMU in Japan)

More Information

- Read the paper: **Search for Majorana Neutrinos Near the Inverted Mass Hierarchy Region with KamLAND-Zen (http://journals.aps.org/prl/abstract/10.1103/PhysRevLett.117.082503)** (*Physical Review Letters*)
- See the **Paper Synopsis (http://physics.aps.org/synopsis-for/10.1103/PhysRevLett.117.082503)** from *Physics*