TRIUMF | Canada's National Laboratory for Particle and Nuclear Physics
Laboratoire national canadien pour la recherche en physique nucléaire et en physique des particules

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Japan/Canada Physics Team Reaches New Milestone with Mysterious Neutrinos

After 295 km Journey Underground, Neutrinos Observed at Super-Kamiokande Detector in Japan

(Vancouver, BC) – Physicists from the Japanese-led multinational T2K collaboration announced today that they had made the first detection of a neutrino which had travelled all the way under Japan from their neutrino source at the J-PARC facility in Tokai (about an hour north of Tokyo by train) to the gigantic Super-Kamiokande underground detector near the west coast of Japan, 295 km away.

"It is a big step forward," said T2K spokesperson Takashi Kobayashi. "We've been working hard for more than 10 years to make this happen." They have constructed their new neutrino beam line, which will deliver the world's most powerful neutrino beams, to study the mysterious phenomenon known as neutrino oscillations, and the observation of this event proves that their study can now begin.

Interacting only weakly with matter, neutrinos can traverse the entire earth with vastly less attenuation than light passing through a window. The very weakness of their interactions allows physicists to make what should be very accurate predictions of their behavior, and thus it came as a shock when measurements of the flux of neutrinos coming from the fusion reactions which power our sun were far lower than predicted. A second anomaly was then clearly demonstrated by Super-Kamiokande when it showed that the flux of different types of neutrinos generated within our atmosphere by cosmic-ray interactions was different depending on whether the neutrinos were coming from above or below (which should not have been possible given our understanding of particle physics). Other experiments, such as KamLAND (also performed at Kamioka), have conclusively demonstrated that these anomalies are caused by neutrino oscillations, whereby one type of neutrino turns into another.

TRIUMF's Akira Konaka, spokesperson for the T2K Canada team, said, "We are excited about the first observation of neutrinos from the T2K beam at Super-Kamiokande. Together with the successful operation of the near detector, including time projection chambers and fine grained detectors that Canada contributed, we now enter the physics phase of T2K. It has been a very productive and stimulating time since we started developing the T2K concept almost 10 years ago with our Japanese colleagues."

The T2K experiment has been built to make measurements of unprecedented precision of known neutrino oscillations, and to look for a so-far unobserved type of oscillation which would cause a small fraction of the muon neutrinos produced at J-PARC to become electron neutrinos by the time they reach Super-Kamiokande.

University of Toronto graduate student Patrick de Perio said, "I feel very privileged to have worked on the T2K beam line, where this neutrino was created. I also spent countless nights in the Super-Kamiokande control room waiting for an event like this! This is the first of many toward my Ph. D. thesis."

The excitement was shared by Dr. Nigel Smith, SNOLAB Director, who said, "SNOLAB warmly congratulates the T2K team on this tremendous milestone for their project. The knowledge that T2K will tease out about the elusive neutrino will further our understanding of these sub-atomic particles and their role within the Universe, and why the Universe looks the way it is."

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Background

TRIUMF is Canada's national laboratory for particle and nuclear physics. Located on the south campus of the University of British Columbia, TRIUMF is owned and operated as a joint venture by a consortium of the following Canadian universities, via a contribution through the National Research Council Canada: University of Alberta, University of British Columbia, University of Calgary, Carleton University, University of Guelph, University of Manitoba, McMaster University, Université de Montréal, Queen's University, University of Regina, Simon Fraser University, Saint Mary's University, University of Toronto, University of Victoria, York University. See http://www.triumf.ca.

The **T2K** collaboration consists of 508 physicists from 62 institutes in 12 countries (Japan, South Korea, Canada, the United States, the United Kingdom, France, Spain, Italy, Switzerland, Germany, Poland, and Russia). The experiment consists of a new neutrino beam using the recently constructed 30 GeV synchrotron at the J-PARC laboratory in Tokai, Japan, a set of near detectors constructed 280m from the neutrino production target, and the Super-Kamiokande detector in western Japan.

T2K-Canada is a collaboration of about 50 scientific and technical members from across Canada and 10 students. The collaboration includes the University of Alberta, University of British Columbia, University of Regina, University of Toronto, York University, and TRIUMF. Their work is funded by the Natural Sciences and Engineering Research Council and the National Research Council. See http://t2k-canada.nd280.org/.

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