News Release | Embargoed until July 19, 2013, 05:30am PDT

Canadians Help International Team Catch Neutrinos "In the Act"

(Vancouver, BC) --- Today at the prestigious European Physical Society meeting in Stockholm, Sweden, TRIUMF's Michael Wilking announced a new breakthrough in understanding neutrinos, nature's most elusive particles. Together with Canadian, Japanese, and other international colleagues as part of the T2K collaboration, Dr. Wilking confirmed definitive observation of a new type of neutrino oscillation, in which muon neutrinos transform to electron neutrinos. It has been known that neutrinos transform from one kind into another, but this particular transition had never before been conclusively observed.

Scott Oser, UBC professor of physics and astronomy and spokesperson for the Canadian team known as T2K-Canada, commented, "Canada has been an international leader in neutrino research since the success of the Sudbury Neutrino Observatory (SNO). T2K was the logical next step after SNO in our quest to understand neutrino oscillations, and Canada was in fact the first international partner to join T2K. These new results are the culmination of a decade of work, and open the door to future studies of how both neutrinos and anti-neutrinos oscillate."

In the T2K experiment in Japan, a beam of muon neutrinos is produced in the Japan Proton Accelerator Research Complex, called J-PARC, located in Tokai, Ibaraki prefecture, on Japan's east coast. The neutrino beam is monitored by a nearby detector complex (much of which was built in Canada) and aimed at the gigantic Super-Kamiokande underground detector in Kamioka, near the west coast of Japan, 295 km (185 miles) away. An analysis of data from Super-Kamiokande associated with the neutrinos from J-PARC reveals that there are more electron neutrinos (a total of 28 events) than would be expected (4.6 events) without this new process.

In 2011, the collaboration announced the first hints of this process; now with 4.5 times more data this transformation is firmly established. The probability that random statistical fluctuations alone would produce the observed excess of electron neutrinos is less than one in a trillion. This T2K observation is the first of its kind to explicitly see a unique flavor of neutrinos appear at the detection point from a beam initially consisting of a different type of neutrino.

Neutrino oscillation is a manifestation of a long-range quantum mechanical interference. Observation of this new type of neutrino oscillation leads the way to new studies of charge-parity (CP) violation which provides a distinction between matter and antimatter. This phenomenon has only been observed in quarks (for which Nobel prizes were awarded in 1980 and 2008). CP violation in neutrinos in the very early universe may be the reason that the observable universe today is dominated by matter with no significant antimatter, which is one of the most profound mysteries in science. Now with T2K firmly establishing this form of neutrino oscillation that is sensitive to CP violation, a search for CP violation in neutrinos becomes a major scientific quest in the coming years, and T2K will lead the way. The T2K experiment expects to collect 10 times more data in the near future, including data with antineutrinos for studies of CP violation in neutrinos.

Mike Wilking said, "I chose to work on T2K because of the very important role it had to play in the search for CP violation. Now that the transition from muon neutrinos to electron neutrinos has been measured, and is quite large, the search for CP violation in neutrinos becomes very compelling. We are all now looking forward to the next phase of T2K, where we will begin to probe the CP asymmetry between neutrinos and antineutrinos."

For more information and media resources, please see http://triumf.ca/t2k.

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About T2K

The T2K experiment was constructed and is operated by an international collaboration. The current T2K collaboration consists of over 400 physicists from 59 institutions in 11 countries [Canada, France, Germany, Italy, Japan, Poland, Russia, Switzerland, Spain, UK and US]. The experiment is primarily supported by the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT). Additional support is provided by the following funding agencies from participating countries: NSERC, NRC and CFI, Canada; CEA and CNRS/IN2P3, France; DFG, Germany; INFN, Italy; Ministry of Science and Higher Education, Poland; RAS, RFBR and the Ministry of Education and Science of the Russian Federation; MICINN and CPAN, Spain; SNSF and SER, Switzerland; STFC, U.K.; DOE, U.S.A. This discovery was made possible with the unyielding and tireless effort by the J-PARC staff members and the management to deliver high quality beam to T2K after the devastating March 2011 earthquake in eastern Japan which caused severe damage to the accelerator complex at JPARC, and abruptly discontinued the data-taking run of the T2K experiment. More detailed information on the T2K experiment and collaboration can be found from the T2K public webpage: http://t2k-experiment.org.

About T2K Canada

The Canadian T2K group consists of 40 scientists from eight institutions (University of Victoria, University of British Columbia, TRIUMF, University of Alberta, University of Regina, University of Winnipeg, York University, University of Toronto). Canada was the first international partner to join the T2K collaboration, and has contributed to several parts of the experiment, including beamline monitoring, construction of a new near detector for T2K, and analysis and calibration of the Super-Kamiokande detector at the far end of the experiment. Canadian participation in the T2K experiment is funded from the Natural Sciences and Engineering Research Council of Canada, the Canada Foundation for Innovation, TRIUMF, and Compute Canada. With TRIUMF and ComputeCanada resources at SciNet and WestGrid, Canada also provides a large fraction of the computing resources required to analyze data from the experiment.

About TRIUMF

TRIUMF is Canada's national laboratory for particle and nuclear physics. Together with its partner AAPS, Inc., TRIUMF also seeks to commercialize its technologies for the benefit of all Canadians. Located on the south campus of the University of British Columbia, TRIUMF receives operating support from the Government of Canada through a contribution agreement via National Research Council Canada; the Government of British Columbia provides capital for new buildings. TRIUMF is owned and operated as a joint venture by a consortium of the following Canadian universities: University of Alberta, University of British Columbia, University of Calgary, Carleton University, University of Guelph, University of Manitoba, McGill University, McMaster University, Université de Montréal, University of Northern British Columbia, Queen's University, University of Regina, Saint Mary's University, Simon Fraser University, University of Toronto, University of Victoria, University of Winnipeg, and York University. For more information, please visit us at http://www.triumf.ca.