Artificial Neutrino Beam Detected After Passing Through 250 km of Earth

K2K Collaboration

(Media Advisory for June 28, 1999)

On June 19, 1999, 6:42 PM, Japanese Standard Time, the K2K (KEK to Kamioka) Long Baseline Neutrino Oscillation Experiment observed its first neutrino event in the Super-Kamiokande detector by the KEK neutrino beam, the first step towards the verification of the neutrino oscillation results announced by the Super-Kamiokande experiment in June last year. This is also the first demonstration that a particle that had been produced artificially and traversed 250km in Earth was detected. The event characteristics are consistent with a neutrino interaction in water. The time of the event is within one micro-second from the expected event time. Both the direction and the time of the event is in the range of our expectation considering the detection resolution of the experiment. The probability of the event to come from an atmospheric neutrino interaction is estimated to be 0.01%, or one part in ten thousand.

KEK is a Japanese national laboratory for High Energy Accelerator Research and it is located in Tsukuba city, near Tokyo on the east coast of the main island of Japan. Super-Kamiokande is a 50000ton water Cherenkov detector, situated at the Kamioka Observatory, Institute for Cosmic Ray Research, the University of Tokyo, 250 km away from KEK.

In June 1998, the Super-Kamiokande collaboration reported the strong evidence for neutrino oscillation (muon neutrino to tau neutrino) in the atmospheric neutrino data taken with the Super-Kamiokande detector. The finding was a major discovery with a far reaching impact in the elementary particle physics, cosmology and astrophysics. The phenomenon of neutrino oscillation which requires neutrinos to have non-zero mass will alter our view of the world of elementary particles. Consequently the Standard Model, the currently prevailing theory of the elementary particles, must be modified. In the Standard Model the neutrinos are assumed to have zero mass. The finding will also make the theories of the Grand Unification more viable and attractive, and make the universe heavier than we currently assume.

To confirm the above finding by the Super-Kamiokande experiment with an accelerator-produced neutrino beam, we proposed the K2K experiment which consists of a neutrino beam line, a near detector complex inside the KEK laboratory and a far detector (Super-Kamiokande detector) at Kamioka, 250 km away from KEK.

In the K2K experiment, the neutrino beam generated by using the KEK proton synchrotron accelerator is aimed at the near and far detectors which are carefully aligned in a straight line. Then, by comparing the neutrino events recorded in these detectors, we can examine the neutrino oscillation phenomenon. For example, if the muon neutrinos oscillate into tau neutrinos on their way to Kamioka from KEK, the number of muon neutrinos observed in the Super-Kamiokande

detector will be much fewer than the number expected without oscillation. It would appear to be that the muon neutrinos has "disappeared".

The K2K near detector complex consists of sophisticated particle detectors: a one kiloton water Cherenkov detector (a miniature Super-Kamiokande detector), a scintillating fiber tracker with water targets, a scintillator veto counter, a lead glass calorimeter and a muon range detector.

The K2K near detector construction was completed in January 1999 and the neutrino beam line commissioning was started on January 27, 1999. On March 5, 1999, we started beam line tuning and we are currently (June 1999) taking data. Among all planned or proposed long baseline neutrino oscillation experiments, K2K is the first experiment to be online.

The K2K collaboration is an international consortium of institutions from Japan, Korea, and the United States. There are about 100 collaborating members from 20 institutions. KEK and ICRR, University of Tokyo are the co-host institutions of the experiment.

The K2K experiment has been built and operated from funding by the Japanese Ministry of Education, Science, Sports and Culture, Korea Science and Engineering Foundation, Korean Ministry of Science and Technology, and the United States Department of Energy.

For further information on this announcement or on the K2K experiment, please visit the following web sites and/or contact our representatives.

June 28,1999

The K2K Collaboration

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K2K Web pages:

Official K2K home page: http://neutrino.kek.jp
Super-Kamiokande official home page: http://www-sk.icrr.u-tokyo.ac.jp/

In US,
SUNY Stony Brook K2K page: http://superk.physics.sunysb.edu/k2k
U. of Washington K2K page: http://www.phys.washington.edu/~superk/k2k/

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