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[Physics][International Cooperation] 37 Research Institutes in the World Including NTU Physics Discover New Model of Neutrino Oscillation in Dayabay Neutrino Experiment

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NTU Newsletter (Issue 1085) The Dayabay Neutrino Experiment research team announced a newsletter on March 8 indicating that a new neutrino oscillation model that measures the probability of the neutrino flavor alternation at the propagates, has been discovered.

Neutrino is uncharged particle which can be produced via the nuclear reaction. The big bang, the core of a fixed star and a nuclear reactor are all the sources of a large number of neutrinos. Neutrinos can easily penetrate physical bodies and even the entire globe without inducing any material reaction, so they are extremely difficult to observe. The Dayabay Neutrino Experiment aims exactly at capturing the neutrinos.

By now, the neutrinos are understood in three types named after their partner leptons in the Standard Model: electron neutrino, muon neutrino and tau neutrino, and the quantum mechanical phenomenon that a neutrino created with a specific lepton flavor (electron, muon or tau) can continuously be measured to have a different flavor during its transmission, is called “oscillation.” Neutrino oscillation is currently described with six factors, four of which are already measured in solar neutrinos, atmospheric neutrinos, reactor neutrinos and accelerator neutrinos. The last two factors, namely, neutrino mixing angle θ13 and phase angle δCP are not determined yet.

In order to measure the low-reactive anti-neutrino, the team of Dayabay Neutrino Experiment set up six neutrino detectors to observe the large volume of radiated neutrinos from the nuclear power plant. During December 24, 2011 to February 17, 2012, more than ten thousand anti-neutrinos have been captured and studied, via which the factor mixing angle θ13 has been determined and announced. By comparing the data from three different detectors, the team discovered that about 6% of the anti-neutrinos have vanished at the propagates, and with the data obtained the team obtained the value of neutrino's mixing angle θ13, viz. sin2 2θ13 =0.092+/-0.017, by which the probability for θ13 to have the value of zero is thus ruled out within five standard deviations. The findings indicated that both the vanish probability and the mixing angle θ13 are larger than how the scientists had expected. The Dayabay Neutrino Experiment team plans to further point out the behavior differences between the neutrino oscillation and the anti-neutrino oscillation, and its result is expected to explain the asymmetry between matter and anti-matter.

he experiment is conducted in the Dayabay Nuclear Power Plant in Shenzhen City, Guangdong Province, China, 55 km away from Hong Kong. The plant has three sets of nuclear generator and is one of the most efficient generating plants in the world. The rich anti-neutrinos generated from the plant plus the geographical environment make it the best neutrino experiment site in the world.

The Dayabay Neutrino Experiment is conducted by a team consisting more than two hundred members from 37 institutes from China, the U.S., Taiwan, Hong Kong, Russia, Czech, etc. The taiwan group is teamed up with scientists from National Taiwan University, National Chiao Tung University and National United University, and the group is in charge of the production of inner layer neutrino detectors, data retrieval system and data analysis.

Related Historical Message:
[Physics][International Cooperation] Taiwan's Cross-Institute Research Team in Physics Takes Part in Dayabay Neutrino Experiment, Trying to Explain the Asymmetry between Matter and Anti-matter 2011/08/25

Further Information:
NTU Newsletter Issue 1085 (Chinese)

National Science Council International Cooperation Sci-Tech Newsbrief

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