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[Physics][International Cooperation] NTU Physicists Participate in FNAL's Searching for Fourth Generation Quark

[Physics][International Cooperation] NTU Physicists Participate in FNAL's Experiment Searching for Fourth Generation Quark (Chinese Version)

NTU Newsletter (Issue 1042) Fermi National Accelerator Laboratory, which belongs to the U.S. Department of Energy (DOE) and is often called for short as "Fermilab" or "FNAL", released a report on its web magazine Fermilab Today recognizing the excellent performance of its research team consisting of six members from NTU.

Source: Fermilab Today

The report says, although the present investigation has not yet found any proof for the existence of a fourth generation quark, the researchers' performance shows strong ability to “quickly search for very complicated experimental signatures” in the decay.

The report says: there are many fascinating measurements that have been made at particle colliders over the years. The one made by LEP accelerator at CERN is the most widely known. After varying the beam energy, physicists made a plot showing the production of Z bosons in comparison to theoretical curves for the existence of two, three and four neutrinos. The data essentially demonstrated that the number of different types of neutrinos into which the Z boson could decay is identically three.。

Physicists already know at least three types of neutrinos exist and that each neutrino is associated with its own specific lepton and two quarks. Each grouping of these particles is called a generation, with generation one consisting of the electron neutrino, the electron and the up and down quarks. Generation two includes the muon neutrino, muon and charm and strange quarks. Generation three consists of the tau neutrino, tau and top and bottom quarks. The precise value of three neutrino types suggested that there are exactly three different generations.

However, digging a little deeper, physicists find that the data actually only demonstrated that there were three light neutrinos into which the Z boson could decay. Additional heavy neutrinos were possible. Given that we see such a huge range of masses in the various quarks (for instance the top quark is about 100,000 times heavier than the up quark) it is at least conceivable that there could be a fourth generation with a heavy neutrino. Naturally, the only way to be sure is to look for heavier particles of the fourth generation.

Using the 2010 dataset, although the analysis showed no evidence for the existence of a fourth generation, it nevertheless demonstrated CMS’ ability to quickly search for very complicated experimental signatures.

Related Website:
http://www.fnal.gov/pub/today/archive_2011/today11-03-11.html

Reference:
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National Science Council International Cooperation Sci-Tech Newsbrief
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