JULY 20, 22:32 EDT

Physicists Find Particle Evidence

By JOSEPH B. VERRENGIA
AP Science Writer

In what is being hailed as a heroic achievement in physics, scientists have found the first direct evidence of the tau neutrino, an elusive and ghostly subatomic particle that was thought to be the last missing piece in the architecture of matter.

The breakthrough, announced on Thursday, was achieved by scientists at the Fermi National Accelerator Laboratory outside Chicago.

``It's a tremendous milestone,'' said Stanford University physicist and Nobel Prize winner Martin Perl, who first theorized the existence of the tau neutrino in 1978. ``Now it has been seen and it behaves in the way we expected.''

Fifty-four scientists from the United States, Japan, Korea and Greece had collaborated on tracking down the tau neutrino since 1997 at the Fermilab.

The tau is one of the fundamental building blocks of all matter. It is the 12th and last of the impossibly tiny particles described in the Standard Model of Particle Physics to be confirmed in experiments.

The standard model seeks to encapsulate all elementary particles and forces in a single explanation. Now the bits have been identified, though the many forces that guide their interplay remain a mystery.

``We finally have direct evidence that the tau neutrino is one of the building blocks of nature,'' said Byron Lundberg, a physicist and spokesman for the international team. ``It is one thing to think there are tau neutrinos out there. But it is a hard experiment to do.''

Perl said there may be other types of neutrinos out there, but they have not been identified or even theorized.

Finding the tau has no immediate practical applications. But physicists were thrilled.

``No one doubted the existence of the tau neutrino, but finding it is a heroic accomplishment,'' said astrophysicist John Bahcall of Princeton University and the Institute of Advanced Studies.

Neutrinos are hurtling everywhere and all the time at nearly the speed of light. Every second, trillions pass through all of us and the Earth itself.

Yet they are among the shyest of all subatomic particles, carrying no electrical charge and virtually no mass — perhaps one-millionth that of an electron. They are loners, barely interacting with the world.

The tau neutrino is the third and perhaps final type of neutrino to be found. The

RESEARCH

LATEST NEWS

- Physicists Find Particle Evidence
- Light May Break Its Own Speed Limit
- Breaking Nature's Speed Limit
- Caution Urged on Gene Patent
- Cells May Restore Sight to Blind
- Ibuprofen Said Helpful to Preemies
- Medical Mistakes Data Said Flawed
- Patient Safety Office Gets New Head
- Government Proposes Research Fines
- Even a Little CPR May Help

first two types — electron neutrinos and muon neutrinos — were discovered in 1956 and 1962. Neutrino — Italian for ``little neutral one'' became part of the physicists' lexicon in the 1930s.

In 1978, tests by Perl and others at Stanford discovered the existence of another class of subatomic particle, the tau lepton. This suggested there would be a tau neutrino, too, because neutrinos are precursors to leptons. But finding the tau neutrino was more difficult.

Mathemtatical computations started in 1993. In 1997, scientists using the ring-shaped particle accelerator at Fermilab fired an intense neutrino beam into a 3-foot detector composed of iron plates coated with an emulsion. Then the scientists analyzed the 6 millions impressions left on the coating.

The researchers used computer-assisted video cameras to create 3-D images of the particle tracks. They narrowed down the field and found four clear tracks of a tau lepton that scientists say were caused by tau neutrino collisions.

The experiment was called the Direct Observation of the Nu Tau, or DONUT. Researchers celebrated Thursday by serving doughuts in their offices.

The findings have not been published in a scientific journal, but other scientists said they were confident of the results.

``Because neutrinos have no charge, you can never detect them directly,'' Perl said. ``Tau neutrinos make tau leptons, which decay very quickly. Their signature is what you detect.''

It is the latest in a series of large-scale efforts to detect the tiny cosmic bits, which scientists suspect may add up to a big chunk of the universe.

In 1998, scientists in Japan determined that neutrinos have mass, however infinitesimal — a discovery that is forcing physicists to reconsider the part of the Standard Model says neutrinos have no mass at all.

home] us news] world] business] sports] weather] search] help]