

Physicists: After 30 years of study, rare particle confirms prediction

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High-energy physicists devoted to recreating the conditions at the beginning of the universe have for the first time observed a new way to produce those basic particles of atoms, protons and neutrons.

Confirming a decades-old prediction, the physicists with the CLEO collaboration say they observed a rare and extremely short-lived subatomic particle with the unusual name of “charmed-strange meson” decay into a proton and anti-neutron.

Detection of the event, which the collaboration made public Sunday at arxiv.org/, was attributed to John Yelton, a physicist at the University of Florida, one of many institutions that are part of the CLEO collaboration.

“It’s the sort of thing that, for many years, people have known should happen,” Yelton said. “What we have done is show that it does, and how often.”

The Cornell Electron Storage Ring accelerator, or CESR, collides electrons with positrons at energies ranging from 3 to 5 billion electron volts — producing many short-lived, elementary and rare particles of interest to physicists. CLEO, the large experimental detector designed to detect the accelerator collisions, is a joint project of nearly two dozen institutions in the U.S., Canada and England.

Among the products of the CESR collisions are the charmed-strange

mesons, which exist for less than one-trillionth of a second before decaying into other more stable particles. Although charmed mesons have been studied for 30 years, no one had ever observed one decaying into a proton or neutron, as theory had predicted. This is notable because about 10 percent of all the collisions in the accelerator produce protons and neutrons.

Yelton did not detect the anti-neutron directly but rather inferred its presence from data on energy and momentum of other particles.

All told, he found 13 instances of charmed-strange mesons decaying into protons and anti-neutrons, retrieving and identifying those events from data on millions and millions of different collisions and their aftermaths.

Yelton based his analysis on techniques developed at Syracuse University for the detection of two other types of rare subatomic particles, a muon and invisible neutrino.

“Professor Yelton did an extraordinary job of applying our techniques to a new area and extracted an excellent result in record time,” said Sheldon Stone, co-spokesman for CLEO and the physics professor at Syracuse who, with graduate student Nabil Meena, first developed the techniques. “This is what working together in an experiment is all about.”

David Asner, a physicist with Carleton University and CLEO’s other co-spokesperson, said the observation will contribute much to theoretical work on particle decay.

“Observation of these rare decays has the promise of increasing our understanding of the underlying mechanisms of how the world is put together,” he said.

When CLEO was first started in 1979, CESR was among the highest

energy accelerators operating at the time. More recent accelerators, such as the Tevatron at Fermilab in Chicago and the soon-to-be-completed Large Hadron Collider in Switzerland, operate at far higher energies. Most public attention is focused on research in these colliders — research aimed at, among other things, observing the so-called “God” particle, the Higgs boson.

Yelton said the latest result shows there remains much to be learned from collisions at lower energy in lower energy colliders. “It highlights the fact that there is still physics to be done at lower energy accelerators,” he said.

The CLEO collaboration has also submitted a paper on the discovery to the journal *Physics Review Letters*.

Source: University of Florida

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