THE ORANGE COUNTY REGISTER

July 5, 2012

A NEW KEY TO THE UNIVERSE

By Pat Brennan

Scientists have found signs of a particle matching those of the long-sought Higgs boson, though they stopped just short of declaring an actual discovery.

First proposed as a theory in the 1960s, the Higgs had been hunted by at least two generations of physicists who believed it would help shape our understanding of how the universe began and how it fits together – thus its sometimes-used nickname, the "God particle."

As the findings were announced Wednesday by two independent teams involving more than 5,000 researchers, the usually sedate halls at the European Center for Nuclear Research on the French-Swiss border erupted in applause and some tears of excitement.

"That level of excitement – standing ovations for various people, applause – that is highly unusual," said Jonathan Feng, a UC Irvine physicist, astronomer and theorist who worked on aspects of the research. "Physicists are trained to be reserved, trained to be skeptical."

The particle appears to share many qualities with the one predicted by Scottish physicist Peter Higgs and others and is perhaps the biggest accomplishment at CERN since its founding in 1954.

Rolf Heuer, director of CERN, said the particle is a boson, but he stopped shy of claiming outright it is the Higgs boson itself – an extremely fine distinction.

"As a layman, I think we did it," he said. "We have a discovery. We have observed a new particle that is consistent with a Higgs boson."

The Higgs, which had been purely theoretical, is regarded as key to understanding why matter has mass, which combines with gravity to give all objects weight.

In the study, trillions of protons were smashed together in 2011 and 2012 at CERN'S Large Hadron Collider, which forms a 16-mile ring that makes it the world's largest machine.

Most of the particles that result from the collisions exist for only the smallest fractions of a second and finding a Higgs-like boson was one of the biggest challenges in physics: Out of some 500 trillion collisions, just several dozen produced "events" with significant data, said Joe Incandela of UC Santa Barbara, leader of the team known as CMS, with 2,100 scientists.

"This is indeed a new particle," Incandela said in the statement. "We know it's a boson, and it's the heaviest boson ever found."

The data were so strong that the chance that the find is an accident, or a random fluctuation, is one in a million, UCI's Feng said.

The scientists must now gather more data from the collider to determine whether the particle really is the Higgs or some other, more exotic particle. A clearer picture should emerge later this year, the CERN statement said.

Discovery of the Higgs particle would be evidence of the Higgs field, which is thought to permeate the universe and to endow other particles with mass. The more a particle interacts with the field, the more mass it acquires – a process that could be compared to rolling a bowling ball through a tub of molasses.

Peter Higgs, who was in the audience, said the discovery appears to be close to what he predicted.

“It is an incredible thing that it has happened in my lifetime,” he said, calling it a huge achievement for the proton-smashing collider.

Finding the Higgs meant accelerating protons in opposite directions at nearly the speed of light through the collider ring, then crashing them together and examining the traces left by the resulting fragments.

The Higgs is predicted by the standard model of quantum physics, considered the most successful scientific theory ever because it can predict the behavior of subatomic particles to many decimal places. If it were shown not to exist, it would be big trouble for the standard model – with effects that would ripple around the world.

“Either way is very significant,” Daniel Whiteson, an assistant physics professor at UC Irvine, said in an email from CERN, where he works on the ATLAS experiment, though not directly on the Higgs search.

“If it doesn't exist, it means a lot of our current thinking is wrong,” Whiteson wrote. “That would be almost more exciting.”

In Orange County, Chapman University physicist Jeff Tollaksen stayed up late to learn the results. He said in an email later that the experimenters had “confirmed a major discovery of a new particle.”

“I believe everybody concluded that this was one of the biggest discoveries in particle physics in about 40 years,” Tollaksen wrote. “It was the first time this general category of particle was ever seen.”

In a BBC interview, the world's most famous physicist, Stephen Hawking, said Higgs deserved the Nobel Prize. He said he had bet another scientist that the Higgs boson would never be found. “It seems I have just lost $100,” he said.

The term “God particle,” meant to indicate that its existence would be fundamental to understanding the creation of the universe, was coined by Nobel Prize-winning physicist Leon Lederman but isn't widely used among scientists.