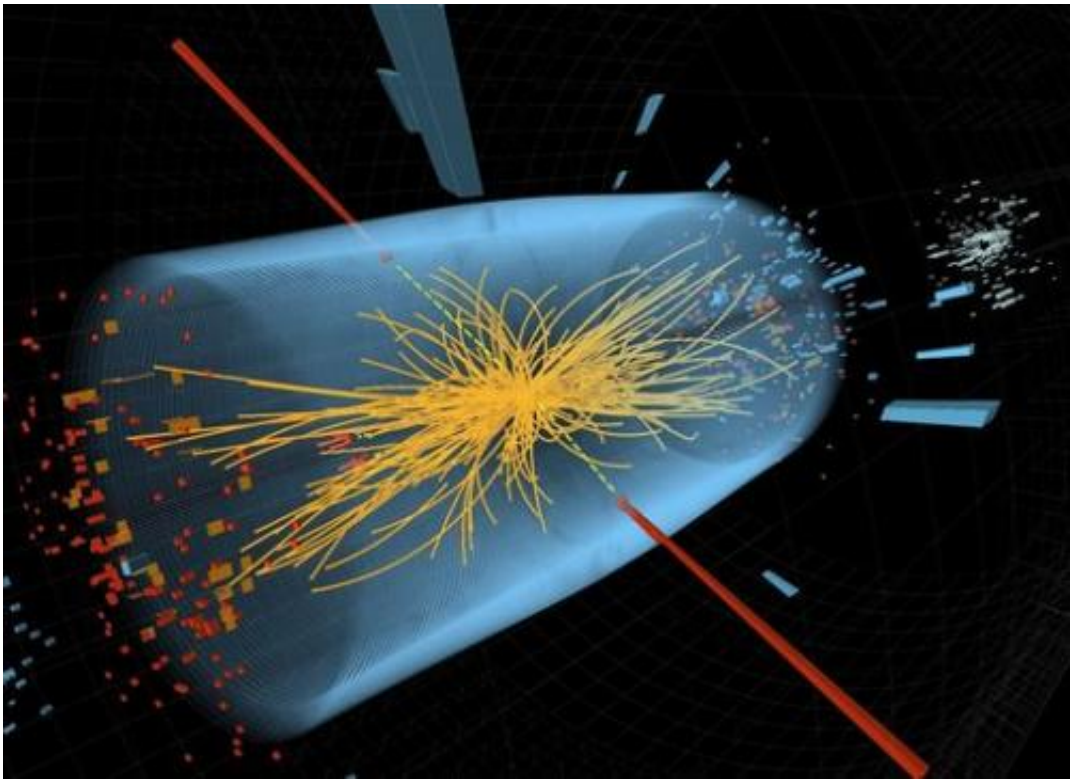
A closer look at the Higgs boson

July 4 2012, by FRANK JORDANS



This undated image made available by CERN shows a typical candidate event including two high-energy photons whose energy (depicted by red towers) is measured in the CMS electromagnetic calorimeter. The yellow lines are the measured tracks of other particles produced in the collision. The pale blue volume shows the CMS crystal calorimeter barrel. (AP Photo/CERN)

Scientists working at the world's biggest atom smasher near Geneva have announced the discovery of a new subatomic particle that looks remarkably like the long-sought Higgs boson. Sometimes called the

"God particle" because its existence is fundamental to the creation of the universe, the hunt for the Higgs involved thousands of scientists from all over the world.

WHAT IS THE HIGGS BOSON ANYWAY?

School physics teaches that everything is made up of atoms, and inside atoms are electrons, protons and neutrons. They, in turn, are made of quarks and other subatomic particles. Scientists have long puzzled over how these minute building blocks of the universe acquire mass. Without mass, particles wouldn't hold together and there would be no matter.

One theory proposed by British physicist Peter Higgs and teams in Belgium and the United States in the 1960s is that a new particle must be creating a "sticky" field that acts as a drag on other particles. The atom-smashing experiments at CERN, the European Center for Nuclear Research, have now captured a glimpse of what appears to be just such a Higgs-like particle.

WHY IS THIS IMPORTANT?

The Higgs is part of many theoretical equations underpinning scientists' understanding of how the world came into being. If it doesn't exist, then those theories would need to be fundamentally overhauled. The fact that it apparently does exist means scientists have been on the right track with their theories. But there's a twist: the measurements seem to diverge slightly from what would be expected under the so-called Standard Model of particle physics. This is exciting for scientists because it opens the possibility to potential new discoveries including a theory known as "super-symmetry" where particles don't just come in pairs — think matter and anti-matter — but quadruplets, all with slightly different characteristics.

HOW MUCH DID IT COST?

CERN's atom smasher, the Large Hadron Collider, alone cost some $10 billion to build and run. This includes the salaries of thousands of scientists and support staff around the world who collaborated on the two experiments that independently pursued the Higgs.

WERE THERE ANY PRACTICAL RESULTS FROM THE SEARCH?

Not directly. But the massive scientific effort that led up to the discovery has paid off in other ways, one of which was the creation of the World Wide Web. CERN scientists developed it to make it easier to exchange information among each other. The vast computing power needed to crunch all of the data produced by the atom smasher has also boosted the development of distributed — or cloud — computing, which is now making its way into mainstream services. Advances in solar energy capture, medical imaging and proton therapy — used in the fight against cancer — have also resulted from the work of particle physicists at CERN and elsewhere.

WHAT'S NEXT

"This is just the beginning," says James Gillies, a spokesman for CERN. Scientists will keep probing the new particle until they fully understand how it works. In doing so they hope to understand the 96 percent of the universe that remains hidden from view. This may result in the discovery of new particles and even hitherto unknown forces of nature.

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