

Likely discovery of the Higgs particle at CERN

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On July 4, 2012, scientists at the European particle physics laboratory CERN, at Geneva, announced the observation of a new elementary particle which is probably the long-sought "Higgs particle". It required a high energy proton accelerator, the Large Hadron Collider, that generated proton beams with enough energy and intensity to produce this very massive object. The discovery was twenty years in the making and involved very considerable sums of money and large teams of scientists and engineers from all over the world.

Why the big fuss?

The Higgs particle was thought up in the 1960's, and the ideas were contributed by several theorists including Peter Higgs himself, who works at Edinburgh. The goal was to provide a means by which the most elementary particles that make up the universe - electrons, quarks and so on - can have mass. Otherwise, they would be massless and travel always at the speed of light, which would make for a relatively dull universe.

The Higgs particle is a manifestation of the "Higgs field", which pervades all of space and "clings" to all the other particles. This effect slows them down and gives them their various masses, depending on how strongly the particles interact with the Higgs field. An electron is relatively light because its interaction with the Higgs field is not very strong - other particles have stronger interactions and are heavier. (Nuclear particles such as protons do not directly rely on the Higgs for their mass, since it arises from the very strong nature of the nuclear force so that the quarks in the proton are confined to a very small volume of space and so have a high energy.) The mass of the electron makes it possible for atoms, as we know them, to form.

So, although it does not actually create the other particles, the Higgs particle does give them their different masses, and this makes it possible for atoms, molecules, stars, planets and life to exist! It has been called the "God" particle, a metaphor that does not please everyone, but which does have a certain degree of suitability given its crucial role in making the universe suitable for ordinary matter to exist, and in the end, life.

The Higgs particle took so long to find because it is very heavy and not produced very often in high energy particle collisions. But I should add a small caution - what was found shows every indication of being the Higgs, but it will still be necessary to study the properties of the new particle in detail over the coming years to make sure that everything checks out. There is a theory of elementary particles, known as the "standard model", which describes nearly everything we know at present, but which is believed not to be complete. The Higgs particle fits nicely into this theory, but if its properties are not quite what the theory predicts, then this may point us towards new things to look for.

It was a historic occasion, because it showed that some very abstract mathematical theoretical ideas were apparently actually on the right track. The term "God particle" was apparently introduced by a publisher to help sell a book; physicists are not too keen on it, but journalists certainly seem to like it!

It is at best a metaphor, and was never intended to be taken too literally. But it does indicate that we live in a very cleverly set up universe!

This, seen from a Christian point of view, may be the chief message to take away. Everything described in this ingenious theory fits together and enables a life-giving universe to operate. All particles are God's particles, but this one certainly seems to show in very subtle detail the wonders of creation.

Psalm 147, v 5: "Great is our Lord and mighty in power; his understanding has no limit."

Dr Bussey is emeritus Reader in Physics in the School of Physics and Astronomy at the University of Glasgow. He is currently working on the ATLAS experiment which, among many other things, has been involved in the search for the Higgs boson at the Large Hadron Collider at CERN. He is a member of Christians in Science.