

## GOD PARTICLE OR HIGGS BOSON

The Higgs Boson is a theoretical particle that is part of the Standard Model of quantum physics. The Higgs Boson is a missing piece in a puzzle. In particle physics, **bosons are subatomic particles that obey Bose–Einstein statistics**. Several bosons can occupy the same quantum state. The word **boson** derives from the name of the Bengali physicist **Satyendra Nath Bose**.

Sometime in the 1960's, British physicist Peter Higgs got the physics community excited by proposing the existence of a particle, the Higgs Boson, as a fundamental particle of nature. This particle, he postulated, is associated with a field that pervades the entire universe and is responsible for giving all particles their mass. Physicists were so fascinated by this hypothetical entity that some of them called it the God Particle. They also persuaded governments around the world to jointly build a \$10-billion machine to look for it. Scientists have now collected enough data using this machine, the Large Hadron Collider, for them to make some significant announcements.

The Standard Model of particle physics is a simple and comprehensive theory that explains all the hundreds of particles and their complex interactions, with only six quarks, six leptons, such as the electron, and a handful of force - carrying Bosons, such as the photon. Though it's not a theory of everything – it leaves gravity out of the mix, for example – the Standard Model is a well-tested, highly successful theory, one of the great triumphs of modern physics. However, the Standard Model cannot yet explain why particles have mass. In the 1960s, a deep look at the mathematics behind the Standard Model led physicists to propose the existence of the "Higgs field," which interacts with all particles, through a process called the "Higgs mechanism," to give them mass.

The stronger a particle's interaction with the Higgs field, the larger its mass. The Higgs field is required by the Standard Model: the model absolutely will not work without it, or something like it. Without the Higgs mechanism, all particles would be massless, like the photon. We ourselves would not exist.

The Higgs Boson was first theorized in 1964 by the British physicist Peter Higgs, who expanded on the ideas of American theoretical physicist Phillip Anderson. In May 2010, evidence came to light at Fermi lab which suggested there may be as many as 5 types of different Higgs Bosons.

On 13th December, 2011 scientists announced that they have glimpsed the Higgs Boson, the so-called God Particle that is vital to our understanding of the universe.

Higgs fields give rise to particles. The Higgs Boson is the smallest possible ripple in a Higgs field, the way the photon is the smallest possible ripple in an electromagnetic field. The simplest case – the one predicted in the Standard Model - is that there would be one Higgs Boson, though it's possible that there could be several. The Large Hadron Collider (LHC) at CERN has two general purpose experiments, ATLAS and CMS, which were designed (among other things) to find the Higgs Boson.

Right now, ATLAS and CMS are concluding the first phase of their search for a Standard Model Higgs. Indeed, it fills the last likely-looking gap in the mass-spectrum where we might expect to find a Higgs. Specifically, ATLAS and CMS have been looking for a Higgs between 115 and 141 GeV. (A GeV, or giga-electron volt, is a unit of mass used by particle physicists: one GeV is about the mass of a proton.)

In other words, today's results are a first look at the last likely Higgs hiding place. Another way of saying all this is that the Standard Model, as we currently understand it, contains 18 particles, and we've found 17 of them. The Higgs is the last – the hole in the middle of the puzzle. If it is found, then we'll have good evidence that the Higgs mechanism is right, and we'll be a step closer to developing a theory to underpin both the Higgs mechanism that gives particles mass and the Standard Model itself. If no, Standard Model Higgs is found to exist, we need to re-evaluate the way the rest of the puzzle is put together. It's possible that two or more non-Standard Model Higgs particles combine to fill the hole. Or it's possible that we need to learn something entirely new.