

Evolution and Existence of Higgs Boson

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ABSTRACT: Higgs boson is an elementary particle which gives mass to all the particles in the universe. After theoretical prediction of Higgs boson there was lot of evolution. In this study we are going to see how Higgs boson determines mass and how its existence have been proved. This discovery will lead to many new advanced technologies more than that of technologies developed after the discovery of electron.

KEY WORDS: Higgs boson, CERN, Higgs field, Large Hadron collider, protons

I. INTRODUCTION

We generally find our weight using weight machine. We know that gravity is responsible for determining weight. What determines mass? That's one of the most-asked, most-hotly pursued questions in physics today. That question is answered by Peter Higgs, a British theoretical physicist. He along with five scientist theoretically proposed the existence of Higgs boson. But the particle's existence has been confirmed only on 4th July 2012 at CERN (European organisation for nuclear research)

II. HOW HIGGS BOSON DETERMINED MASS?

Bosons are particles responsible for all physical forces except gravity. Other bosons are the photon, the W and Z bosons, and the gluon [9,10]

As all know, Electromagnetic field stretches throughout the universe. Similarly according to Peter Higgs there is another field called as Higgs field and it prevails throughout the space. Every matter in the universe interacts with the Higgs field and gets its mass. The one which has less interaction with the Higgs field will have less mass. One which has more interaction with the Higgs field have more mass. For example Photon which has zero mass will never interact with Higgs field. Higgs field was created after big bang explosion. [1]

III. WHEN IT WAS EXPERIMENTALLY DISCOVERED?

Since after the theoretical proposal of Peter Higgs about Higgs boson, many measures were taken by the scientists all over the world tried to discover Higgs boson experimentally. They failed at many circumstances because finding Higgs boson is a tough one as it has a very short life time. At last on July 4, 2012, scientists working in CERN claimed that they discovered this particle while working with large hadron collider [2-4]

IV. LARGE HADRON COLLIDER (LHC)

The Large Hadron Collider is the highest-energy particle collider ever made and is considered as "one of the great engineering milestones of mankind. Large hadron collider is a tunnel with a circumference of 16.5 miles. In this LHC, the protons are allowed to move with a velocity nearly equal to that of the velocity of light. Protons moving in opposite direction collide with each other and bosons are produced. Created Higgs boson has a mass between 125 and 127 GeV/c²



Fig 1 Large Hadron Collider

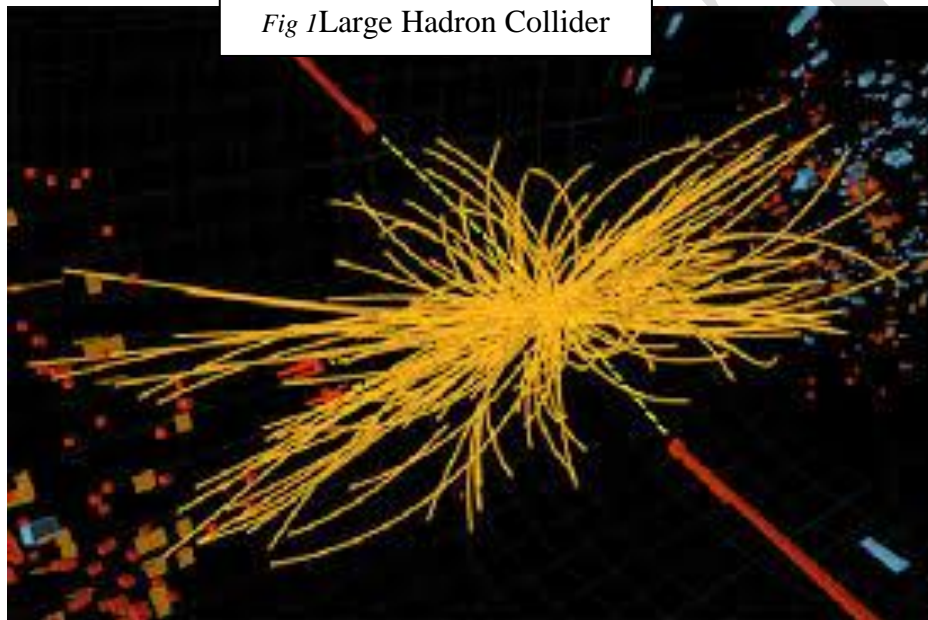


Fig 2 creation of Higgs boson

CHARACTERISTICS OF HIGGS BOSON

Composition	Elementary particle
Statistics	Bosonic A Higgs boson of mass ~ 125 GeV has been tentatively confirmed by CERN on March 14, 2013
Symbol	H^0
Theorised	R. Brout, F. Englert, P. Higgs, G. S. Guralnik, C. R. Hagen, and T. W. B. Kibble (1964)
Discovered	Previously unknown boson confirmed to exist on July 4 2012, by the ATLAS and CMS teams at the Large Hadron Collider; tentatively confirmed as a Higgs boson of some kind on March 14 2013
Mass	125.3 ± 0.4 (stat) ± 0.5 (sys) GeV/ c^2 , 126.0 ± 0.4 (stat) ± 0.4 (sys) GeV/ c^2

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Mean life time	1.56×10^{-22} s (predicted in the Standard Model)
Decays into	(observed) W and Z bosons, two photons. (Others still being studied)
Electric charge	0
Colour charge	0
Spin	0 (tentatively confirmed at 125 GeV)
Parity	+1 (tentatively confirmed at 125 GeV)

NOBEL PRIZE

On 8th October 2013, the Nobel prize for Physics was awarded jointly to Peter Higgs and Francois Englert for their discovery of theoretical existence of Higgs boson[5-8].

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V.CONCLUSION

Higgs boson, an elementary particle which gives mass to all the particles in the universe. After theoretical prediction of Higgs boson there was lot of evolution. Though immediate use of Higgs boson is unknown, in future there may be many number of technologies will be created using Higgs boson. Its invention has made the fact simple that universe is made up of common field called Higgs field and is responsible for producing mass. This discovery will lead to many new advanced technologies more than that of technologies developed after the discovery of electron.

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