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The God Particle: A Brief Idea

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***Abstract*—Standard model of particle physics describes that the matter is made up of quarks and leptons. The basic interacting forces between these Fermions are Electromagnetic force, weak force and strong nuclear force. These forces are mediated by photon, W and Z bosons and gluons. All the above mentioned particles predicted by standard model of particle physics were observed experimentally except the one boson, which plays a vital role in acquiring the mass to these above mentioned constituent particles. This particle was first proposed in the 1960s by the English physicist Peter Higgs. After decades of careful experiment, physicists found the existence of the Higgs boson, a subatomic particle so important to the understanding of space, time and matter that the physicist Leon Lederman nicknamed it "The God Particle".**

I. INTRODUCTION

During the last five decades, all the experimental investigations on particle physics validate the theoretical predictions of the standard model of particle physics. Standard model describes that the matter is made up of six quarks and six leptons. Quarks and Leptons are Fermions, since they follow Ferm-Dirac statistics. The basic interacting forces between these Fermions are Electromagnetic force, weak force and strong nuclear force. The electromagnetic force is mediated by a photon, the weak force is mediated by W and Z bosons and the strong nuclear force is mediated by gluons. These mediators or force carrying particles follow Bose-Einstein statistics hence called as bosons. According to the standard model, the Higgs boson is the particle manifestation of a force field which is prevailing around us. This force field is also called as Higgs field. The quarks and leptons and force carrier particles predicted by standard model have now been observed experimentally except the Higgs boson. The Higgs boson particle was first proposed in the 1960s by the English physicist Peter Higgs. The international effort to find it has taken decades.

II. THE LARGE HADRON COLLIDER (LHC)

The Large Hadron Collider (LHC) is the world's largest and highest-energy particle accelerator built by the European Organization for Nuclear Research (CERN) from 1998 to 2008, to test the predictions of different theories of particle physics and high-energy physics, and particularly prove or disprove the existence of the hypothesized Higgs boson. The LHC is expected to address some of the most fundamental questions of physics, advancing human understanding of the deepest laws of nature. It contains six detectors each designed for specific kinds of exploration.

The LHC was built in collaboration with more than 10,000 scientists and engineers from over 100 countries, as well as hundreds of universities and laboratories. It lies in a tunnel 27 kilometres in circumference, as deep as 175 metres beneath the Franco-Swiss border, Geneva, Switzerland.

Large Hadron Collider's synchrotron is designed to initially collide two opposing particle beams of up to 7 TeV per nucleon, or lead nuclei at an energy of 2.76 TeV per nucleon-pair. Collision data was also anticipated to be produced at an unprecedented rate of tens of petabytes per year, to be analysed by a grid-based computer network infrastructure connecting 140 computing centers in 35 countries (by 2012 the LHC Computing Gridwas the world's largest computing grid, comprising over 170 computing facilities in a worldwide network across 36 countries).

III. OBSERVATIONS:

By November 2012 the LHC had discovered two previously unobserved particles (χb (3P) bottomonium state and a massive boson awaiting identification but suspected to be a Higgs boson), created a quark–gluon plasma, and recorded the first observations of the very rare decay of the Bs meson into two muons (Bs0 → μ+-), a major test of supersymmetry.

After decades of careful experiment, physicists say they have found the "strongest indication to date" to prove the existence of the Higgs boson -- a subatomic particle so important to the understanding of space, time and matter that the physicist Leon Lederman nicknamed it "the God particle."

Roser, a Fermilab physicist, said he expected the CERN scientists to offer more evidence of the Higgs particle, though they will also be cautious. "The Higgs

particle, if it's real, will show itself in different ways. We need for all of them to be consistent before we can say for sure we've seen it". Scientists who used the Tevatron have been sifting through the masses of data they collected by sending subatomic particles crashing into each other at nearly the speed of light.

"During its life, the Tevatron must have produced thousands of Higgs particles, if they actually exist, and it's up to us to try to find them in the data we have collected," said Luciano Ristori, a physicist at Fermilab and the Italian National Institute for Nuclear Physics, in a statement. "We have developed sophisticated simulation and analysis programs to identify Higgs-like patterns. Finding the Higgs particle would not be of practical value, at least not yet, but Roser argued that when the electron was first discovered in 1897, nobody guessed how it would lead to the high-tech, wired world we have today.

Physicists say the Higgs boson would help explain how we, and the rest of the universe, exist. It would explain why the matter created in the Big Bang has mass, and is able to coalesce. Without it, as CERN explained in a background paper, "the universe would be a very different place…. no ordinary matter as we know it, no chemistry, no biology, and no people."

IV. CONCLUSION:

The collection of the data from the Large Hadron Collider experiments predicts that there they observed a new particle, which could be Higgs Boson. The collection of further data will enable a more rigorous test of the conclusion that the newly observed particle is standard Model Higgs Boson.

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