ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 7, Issue 2, February 2018

Basic Principles of Quantum Particles and Higgs Boson

Manish Rohan James*

RGR Siddanthi College of Pharmacy, Jawaharlal Nehru Technological University, Hyderabad, Telangana, India

Abstract: The physical world we live in is made of all matter which occupies space. Not only matter (Electrons, Protons and Neutrons), but many other miscellaneous things do exist in the spooky world of quantum physics/chemistry. It's not just matter that matters but matter is again made of Sub-atomic particles, which are of two types, namely Composite and elementary particles. These two topics are studied in both Particle physics and Nuclear physics.

Keywords: Electrons, Protons, Neutrons

I. INTRODUCTION

Quarks [1], Leptons [2] and Bosons [3] are the smallest (Fundamental Constituents) particles that exist. Everything we see, touch and feel are made of these elementary particles. These particles differ from each other in mass, charge and spin. Particle physics [4] and Particle chemistry are the subjects that study everything about these particles. Fig. 1 shows a basic classification of elementary particles along with the masses, charges and spin of the particles.

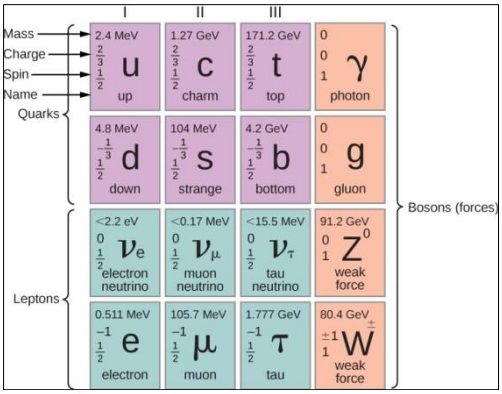

Fig. 1. Shows a basic classification of elementary particles along with the masses, charges and spin of the particles.

Elementary Particles
Matter is fundamentally classified into 3 classes whose description is as follows:

Classification of Matter:

- Quarks
- Leptons
- Bosons

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 7, Issue 2, February 2018

Quarks (q):
They combine together forming composite particles (Hadrons). The most stable and the well-known of which are protons and neutrons. Due to the phenomenon called colour confinement [5], we cannot observe these quarks directly (Under the Hagedron temperature= 2 trillion °K) when the energies are approximately between 130-140 MeV/particle. Quarks are basically of 2 types, Hadrons and Leptons.

Lepton (l):
Leptons do not undergo strong interactions. These are the particles that have a half integer spin. There are basically two types of them. Charge and Neutral. Charged are the ones that mimic electrons and neutral ones are basically neutrinos [6].

Bosons:
In general, bosons are the particles which follow the bose-einstien statistics. We are mostly familiar with few of these bosons namely: Photons (Constituents of light), Gluons (Those that bind the quarks), W and Z bosons.

Higgs Boson (H^0):
In the year 2012, in an experiment to find out the source of physical mass of any particle or to find out why exactly do things have mass. Hydrogen atoms were made to collide in an LHC (Large Hadron Collider) [7]. After the collision, the events were recorded and calculated based on the decaying of the particles. A new particle of mass 125 GeV was observed and discovered and later was confirmed to be Higgs Boson (H^0). According to this experiment, study and its results. Life time of a Higgs Boson is 1.56×10^{-22} sec approximately.

Usually it all starts in the gauge bosons that interact with the Higgs Field with some energy (Kinetic). After the interaction, they usually slow down but the motion energy is not destroyed, it is converted into mass-energy (Law of Conversation of Energy) as shown in Fig. 2. Which is how mass is created as per this theory.

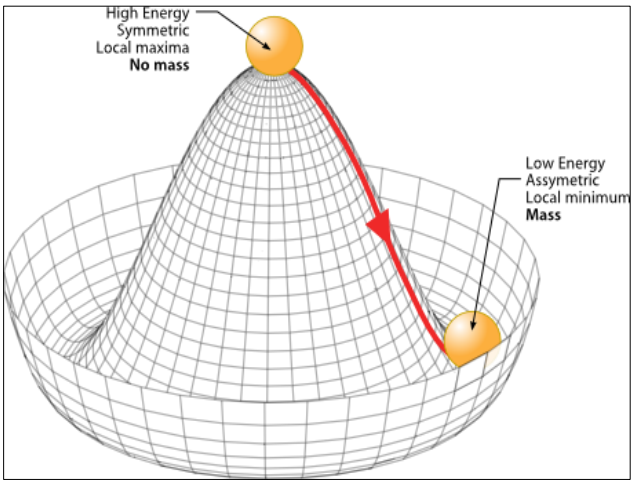

Fig. 2. Higgs mechanism in brief.

1 kg mass= 90 quadrillion Joules of the energy.

II. CONCLUSION

Quantum realm is a bizarre reality, where all the laws of physics as we know do not work. Discussing of which, Higgs boson and its discovery have changed the way we understand things forever.

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 7, Issue 2, February 2018

REFERENCES

[1] KG Wilson, "Confinement of quarks", Physical Review D. vol.10 no.8, pp.24-45, 1974.
[2] JC Pati, A Salam, "Lepton number as the fourth "color". In Selected Papers of Abdus Salam: (With Commentary)", pp. 343-357, 1994.
[3] S. Coleman, "There are no Goldstone bosons in two dimensions", Communications in Mathematical Physics, Vol. 31, no.4, pp.259-264, 1973.
[4] S. Eidelman, KG Hayes, KE Olive, M Aguilar-Benitez, C Amsler, D Asner, KS Babu, RM Barnett, J Beringer, PR Burchat, CD Carone. "Review of particle physics", Physics letters B. Vol. 592 no.1-4, pp. 1-5, 2004.
[5] J Braun, H Gies, JM Pawlowski, "Quark confinement from colour confinement", Physics Letters B, vol. 684 no.4-5, pp.262-267, 2010.
[6] Y Fukuda, T Hayakawa, E Ichihara, K Inoue, K Ishihara, H Ishino, Y Itow, T Kajita, J Kameda, S Kasuga, K Kobayashi, "Evidence for oscillation of atmospheric neutrinos", Physical Review Letters,Vol.81 no.8, pp.15-62, 1998.
[7] RA Fisher, LH Tippett, "Limiting forms of the frequency distribution of the largest or smallest member of a sample", In Mathematical Proceedings of the Cambridge Philosophical Society, Vol. 24 no. 2, pp. 180-190, 1928.