

Higgs boson: [Proposed by Peter Higgs in 1964]

Definition:

A carrier particle of Higgs field, which is responsible for the origin of mass in elementary particles (leptons and quarks), is called as Higgs boson.

In standard model of elementary particle, the Higgs particle is a massive scalar boson with no electric charge, no color charge and have zero spin. [$mass = 125.35 \text{ GeV}$]

The Higgs boson is an excitation of the Higgs field that helps other particles (leptons and quarks) to pass through the field and hence provide mass to the particles.

Properties of Higgs boson:

1. It is the **carrier** (mediating particle) of Higgs field.
2. Higgs boson **provides mass** to other fundamental particles.
3. It has **zero electric charge**.
4. It is nicknamed as Goddamn particle- God particle.
5. It has very short life (*predicted to be 1.56×10^{-22} seconds*).
6. It has **zero spin**.

Candidate of Higgs boson events was observed from collisions between two protons in Large Hadron Collider (LHC) in 2012.

- ✓ Higgs boson is very unstable, that decays immediately into other particles (decays into Z bosons, which then decays into an *electron plus positron and muon plus anti muon*).
- ✓ The nickname "God Particle" for Higgs Boson is suitable in the sense that it provides mass to the elementary particles like electrons and quarks.

Nobel Prize-winning physicist Leon Lederman referred to the Higgs as the "Goddamn Particle". The name was meant to poke fun at how difficult it was to detect the particle. Later, the word is paraphrased as "God particle".

Some physicists think there could be several different types of Higgs bosons and this is just the first one we've detected.

Higgs Field:

Alert!!!

Gravitational field and Higgs field are different.

The Higgs field is a field of energy that is thought to exist in every region of the universe, even throughout the empty space.

The field is mediated by a fundamental particle known as the Higgs boson, which is used by the field to continuously interact with other particles, such as the electrons and quarks.

As particles (leptons and quarks), move through the Higgs field, they interact with the Higgs bosons, which cling to or cluster around the matter particles, and give them their mass. The more Higgs boson particles that interact with the other particle, the more mass it attains.

Only photons and gluons do not interact with the Higgs boson.

- ✓ Neutrinos, the lightest particles with almost zero mass, barely interact with a Higgs boson.
- ✓ Top quarks, which have about the mass of a gold atom, have the strongest interaction with a Higgs boson.

The existence of Higgs boson revealed that" mass is an acquired property (via interaction with Higgs field) but not an intrinsic property of particles.