Study finds there may be multiple 'God particles'

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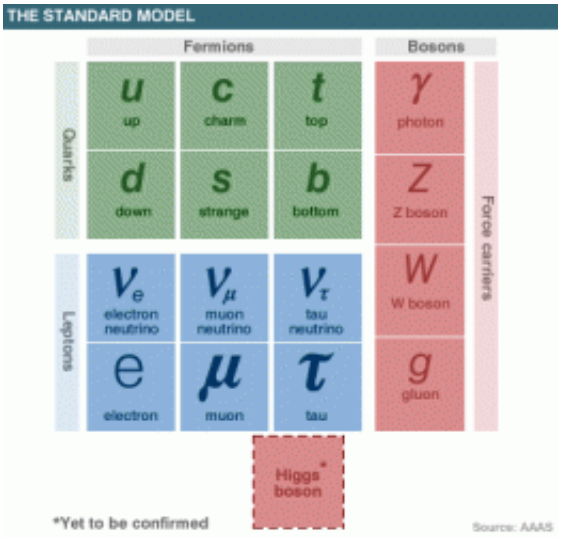

The Standard Model. Image credit: AAAS

(PhysOrg.com) -- Recent research in the US suggests there may be five versions of the theorized Higgs boson.

The Higgs was dubbed the "God particle" by Nobel laureate Leon Lederman because its discovery could unify our understanding of the universe and help us “know the mind of God”.

The Higgs is extremely important to the accepted theory of physics, known as the “Standard Model”, which was developed in the 1970s to incorporate everything known at the time about interactions between sub-

atomic particles. The Higgs boson is thought to be the sub-atomic particle that mediates the force through which all other sub-atomic particles acquire their mass.

Scientists have been trying for five decades to detect the Higgs boson, but have so far failed. Now theoretical physicist Adam Martin and colleagues at the Fermilab's Tevatron particle accelerator near Chicago in Illinois in the US have analyzed results from the DZero experiment and suggest there may be multiple versions of the Higgs boson.

The DZero experiment set up and observed collisions protons and anti-protons and was designed to examine the reason why the world is composed of normal matter rather than its opposite: anti-matter. They found the collisions resulted in pairs of muons one percent more often than anti-muon particles. The asymmetry could explain why matter has come to dominate over anti-matter, rather than the two annihilating each other.

This effect, called CP violation, had been seen before but not to the same degree as seen in DZero, and the degree of asymmetry found in the latest results is greater than can be accounted for by the Standard Model. The researchers said the results could be explained by the existence of five Higgs boson particles with similar masses, with one having a negative electric charge, one negative and three neutral. The theory is called the two-Higgs doublet model.

The two-Higgs doublet model is not the only possible explanation for the results, but Dr Martin said fitting a new effect in the Standard Model without disrupting its fit with other tests is difficult. The Standard Model accommodates only one Higgs doublet, and while scientists think of the Higgs as a single particle, Dr Martin said it "actually comes in a package of four". Only one is seen because the other three are seen as W and Z bosons. Adding another Higgs doublet adds four more particles.

Many physicists have come to regard the Standard Model as incomplete since it does not explain gravity or describe dark matter. An extension to the Standard Model, known as "supersymmetry," proposes that each particle has a more massive "shadow" partner particle, effectively doubling the number of known particles. Such a scheme could accommodate the two-Higgs doublet model. So far no experimental evidence has been found for the existence of the "shadow" particles.

The search for the Higgs boson is one of the main aims of the Large Hadron Collider (LHC) near Geneva in Switzerland. The facility, the world's largest particle accelerator, could also find experimental evidence for supersymmetry.

The results of the US research is published at arXiv.org.

More information: Bogdan A. Dobrescu, Patrick J. Fox, Adam Martin: CP violation in B_s mixing from heavy Higgs exchange, arXiv:1005.4238, arxiv.org/abs/1005.4238