The Internal Structure of Baryons as a Source of the Higgs Boson and the Heister Vector Boson with a Mass of 30 GeV

Sylwester Kornowski

Abstract: Within the Scale-Symmetric Theory (SST), especially within the atom-like structure of baryons, we described a method that leads to groups of particles each composed of 4 particles. Such groups consist of the following particles: a quantum of the electromagnetic field, a vector boson, and two high-mass narrow composite resonances with low standard deviation both with J = 0 and J = 2. Here we show that the Heister vector boson with a mass of 30.4 +- 1.78 GeV is the constituent of such a group. Here as well we reasoned out why the Higgs-boson signal is relatively strong in comparison with other high-mass scalar bosons - just there are two, not one, independent phenomena that lead to the mass of Higgs boson equal to 125.0 GeV.

1. Introduction

In paper [1], within the Scale-Symmetric Theory (SST) [2], we described a method that leads to groups of particles each composed of 4 particles. A group consists of the following particles: a quantum of the electromagnetic field, a vector boson, and two high-mass narrow composite resonances with low standard deviation (it is their feature (!)) both with J = 0 and J = 2. Their energy/masses we can calculate from following expressions:

ΔE denotes energy of a quantum of the electromagnetic field (EM quantum),

$M_o = X \Delta E$ is the mass of the vector boson [1] where $X = 19{,}685.3$ [2A],

$8\ M_o$ and $64\ M_o$ are the masses of the two high-mass narrow composite resonances with low standard deviation ($\sim 1\sigma - 2\sigma$) both with $J = 0$ and $J = 2$ [1].

The full width Γ of the narrow resonances and vector bosons is defined by following formula [3]: $\Gamma = 2^{1/2}\ \alpha_{w(proton)} = 0.0265$ i.e. is 2.65%.

SST shows that results depend on the integral luminosity for the nucleon-nucleon collisions [1].

The energy of a quantum of the electromagnetic field can be the electromagnetic mass of a particle that is $\alpha_{em}\ m$, where $\alpha_{em} = 1 / 137.036$ [2A].

Such groups described within SST [1] are consistent with the LHC data [4], [5], [6].

On the other hand, the successive topological phase transitions of the Higgs field lead to the atom-like structure of baryons [2A]. In the d = 1 state of baryons, there is the relativistic neutral or charged pion [2A]. Mass of the relativistic neutral pion is $W_{pion(o),d=1}$ = 208.643 MeV whereas of the charged one is $W_{pion(+,-),d=1}$ = 215.760 MeV [2A].

2. Higgs boson

Within SST we showed that mass of the Einstein spacetime overlapping with an EM quantum, ΔE, is $f\Delta E$, where f = 40,363 [2A]. Electromagnetic energy of electron interacting with proton in the core of nucleons (notice that there is also the charged or neutral pion in the $d = 1$ state) is ΔE = 3.097 MeV. It causes that the Einstein-spacetime condensate related to such EM quanta is 125.0 GeV and it is the mass of the Higgs boson [2A], [7]. But notice that in the nucleon-nucleon collisions can appear the $W_{pion(o),d=1} + W_{pion(+,-),d=1}$ = 424.41 MeV pairs. The electromagnetic mass of such pair is $\alpha_{em} (W_{pion(o),d=1} + W_{pion(+,-),d=1})$ = 3.097 MeV as well. These two independent phenomena leads to the same Higgs mass – it is the reason that the Higgs-boson signal is much stronger than signals of the other Higgs-like scalar bosons.

3. The Heister vector boson [8] as a constituent of a SST group

Calculate the mean EM mass of the relativistic pions in the $d = 1$ state

$\alpha_{em} (W_{pion(o),d=1} + W_{pion(+,-),d=1}) / 2$ = 1.54851 MeV. This energy leads to the Heister vector boson which is the constituent of a SST group (Table 1).

Table 1 *Heister vector boson as the constituent of a SST group*

EM mass ΔE [MeV]	$\alpha_{em} (W_{pion(o),d=1} + W_{pion(+,-),d=1}) / 2$ 1.54851
J = 1 $X \cdot \Delta E$ [GeV] X = 19,685.3	30.483 ± 0.808 **The Heister and SST vector boson** [8] and SST
J = 0, J = 2 8 $X \cdot \Delta E$ [GeV] 1σ – 2 σ	243.86 ± 6.46 **SST prediction** Can overlap with $H + Z^o \approx 216$
J = 0, J = 2 64 $X \cdot \Delta E$ [GeV] 1σ – 2 σ	1950.9 ± 51.7 **SST prediction** Very weak signal

4. Summary

The internal structure of baryons described within SST leads to the strong signal for the Higgs boson (it is due to the two independent phenomena that lead to it) and to the Heister vector boson (30.40 ± 1.78 GeV [8]) in the opposite sign di-muon spectra of Z recorded by the ALEPH experiment at LEP which is the constituent of a SST group described in Table 1..

References

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