The Bumps in the Di-Muon Mass Spectra at 28.3 GeV in the LHC Data and 30.4 GeV in the LEP Data

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Abstract: The atom-like structure of baryons described within the Scale-Symmetric Theory (SST) shows that for colliding nucleons we should observe an excess in the di-muon mass spectra at 28.3 GeV with a natural width 1.5 GeV while for colliding electrons should be respectively 30.2 GeV and 1.6 GeV. Obtained here results are consistent with the initial results obtained in the CMS and ALEPH experiments.

1. Introduction

The Scale-Symmetric Theory (SST) shows that due to the SST inflation, from the spacetime components were created manifolds (there is torus/charge with a scalar in its centre) [1]. Around one of them, i.e. around the core of baryons, there are created shells/orbits so baryons have an atom-like structure [1]. Mass of the central scalar in the core of baryons is Y = 424.12 MeV and mass of the torus/electric-charge is X = 318.2955 MeV, [1]. Outside the core of baryons are 4 shells. In nucleons, in the $d = 1$ state is relativistic pion [1]. In the collisions of nucleons, inside the core of baryons, there can be created the muon-antimuon pairs – mass of muon calculated within SST is m_{muon} = 105.6563 MeV [1].

In collisions of electrons, near the bare electrons, there can be created the electron-positron pairs – mass of electron calculated within SST is $m_{electron}$ = 0.510998906 MeV [1].

The transition from the weak interactions of electrons to the nuclear weak interactions (the scalar Y is responsible for the nuclear weak interactions) causes that the involved energy is X_W = 19685.3 times higher [1]. We calculated as well the coupling constant for the nuclear weak interactions: $\alpha_{Weak,proton}$ = 0.0187229 [1].

We as well within SST derived the formula for natural width Γ of particles such as Higgs boson or W and Z bosons

$$\Gamma = 2^{1/2}\, \alpha_{Weak,proton}\, m_{particle} = 0.0264782\, m_{particle}\,, \quad (1)$$

where $m_{particle}$ is the central value for mass of a particle [2].

Notice that in the CMS data (LHC) we observe an excess over the background near a di-muon mass of $m_{x,1}$ = 28.3 ± 0.4 GeV and width equal to $\Gamma_{\mu\mu,1}$ = 1.8 ± 0.8 GeV [3].

On the other hand, in the ALEPH data (LEP) we observe an excess over the background near a di-muon mass of $m_{x,2}$ = 30.40 ± 0.46 GeV and width equal to $\Gamma_{\mu\mu,2}$ = 1.78 ± 1.14 GeV [4].

2. Calculations

Calculate mass of a particle M_{X1} created as a muon-antimuon pair in company of the torus/electric-charge X in such a way that its weak mass is equal to mass of the pair and X

$$M_{X1} = (2\, m_{muon} + X) / \alpha_{Weak,proton} = 28.287 \text{ GeV} \approx 28.3 \text{ GeV} . \quad (2)$$

To conserve the spin-1/2 and charge of the torus X, such objects are created as a particle-antiparticle pair so natural width of both the pair and single object is (from formula (1))

$$\Gamma_{X1} = 2^{1/2}\, \alpha_{Weak,proton}\, 2\, M_{X1} = 1.498 \text{ GeV} \approx 1.5 \text{ GeV} . \quad (3)$$

Calculate mass of a particle M_{X2} created as an electron-positron pair in company of the electron in such a way that it transits from the weak interactions of electrons to the nuclear weak interactions

$$M_{X2} = (2\, m_{electron} + m_{electron})\, X_W = 30.178 \text{ GeV} \approx 30.2 \text{ GeV} . \quad (4)$$

To conserve the spin-1/2 and charge of the torus of electron [1], such objects are created as a particle-antiparticle pair so natural width of both the pair and single object is (from formula (1))

$$\Gamma_{X2} = 2^{1/2}\, \alpha_{Weak,proton}\, 2\, M_{X2} = 1.598 \text{ GeV} \approx 1.6 \text{ GeV} . \quad (5)$$

3. Summary

Obtained here theoretical results are consistent with the CMS and ALEPH data.

Emphasize that the results are different for colliding nucleons and colliding electrons.

Within the Standard Model we are unable to explain the experimental data in a natural way so SM must be reformulated and SST shows how we can do it.

References

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