The Strong-Interaction Coupling Predicted within the Scale-Symmetric Theory Confirmed in LHC Experiments

Sylwester Kornowski

Abstract: The strong coupling alpha_s for energy equal to the mass of the Z boson is one of the fundamental parameters of the Standard Model (SM). By 2014 this value was 0.1185 +- 0.0006. But the recent LHC experiments (paper was submitted on December 16, 2015) changed this value to a new world average: 0.1177 +- 0.0013 (arXiv:1512.05194). The new value is consistent with the value predicted within the Scale-Symmetric (SST) already 3 years ago: 0.1176 +- 0.0005. This result was published in vixra on December 16, 2012 (vixra:1212.0105). Moreover, the interval +- 0.0005 predicted by SST does not follow from uncertainties but from natural processes so uncertainties defined in LHC experiments cannot be lower than this interval. Notice that the SST result as a whole lies inside the interval defined by the new LHC experiments and that the central values differ by 0.0001 only. We can say that at high energies, the SM mimics the SST results but at low energies, contrary to SST, the SM does not lead to precise values, for example, within SM we cannot calculate the exact mass and spin of proton.

The Scale-Symmetric Theory (SST), [1], leads to following formula for the strong-interaction coupling [1A], [2]

$$\alpha_{sw} = \alpha_{sw,central\text{-}value} \pm \Delta\alpha_{sw} , \quad (1)$$

$$\alpha_{sw} = \{\alpha_{w(proton)}\beta^2 + b\,\beta + c\} \pm (b - b_l)\,\beta, \quad (2)$$

where

$\alpha_{w(proton)} = 0.0187229$,
$b = 0.36255$,
$c = 0.1139$,
$b - b_l = 0.04415$.

In the collisions of nucleons there are produced the Z bosons that change the interactions of the colliding nucleons. The SST shows that the new phenomenon causes that there appears following correction but this correction does not change the $\alpha_S(M_Z)$

$$\alpha_{W,proton,Z\text{-}production} = \alpha_{W,proton}\,[1 - (E / M_Z)^{1/3}]. \qquad (3)$$

where E is energy of a condensate composed of interacting partons (it is due to the confinement [1A]), whereas $M_Z = 91.2$ GeV.

We can rewrite formula (2) as follows

$$\alpha_{SST} = \alpha_{S,experiment} = \alpha_{sw} + \alpha_{W,proton}\,[1 - (E / M_Z)^{1/3}]. \qquad (4)$$

Table 1 *[1A], [2]*

Q [GeV]	$\alpha_{SST}(E = Q)$
2,000	0.080
1,000	0.091
91.2	0.1176 ± 0.0005
50	0.1241 ± 0.0008
20	0.1316 ± 0.0021
10	0.1579 ± 0.0041
5	0.1943 ± 0.0083
1	0.4854 ± 0.0415

The LHC paper with the new world average of the strong-interaction coupling for energy equal to the mass of Z boson (0.1177 ± 0.0013) was submitted on December 16, 2015 [3]. We can compare this value with value that appeared in my paper titled "The Reformulated Asymptotic Freedom", [2] (and in paper [1A]):

In the version 1 published on 16 December 2012 (i.e. 3 years earlier) is 0.1176 ± 0.0005.

In the version 2 published on 25 January 2014 (i.e. about 2 years earlier) is 0.1176 ± 0.0005.

In the version 3 published on 8 December 2015 (i.e. 8 days earlier) is still 0.1176 ± 0.0005.

Formula (2) is derived in paper [1A] (pages: 33-36) published on 25 November 2015 i.e. 21 days earlier than paper [3]. This derivation was in my book published on vixra already in 2012 but I rewrote it so instead the book there were published the 4 separated papers [1]. It is not important because the derivation appeared 3 weeks before the LHC paper.

References

[1] Sylwester Kornowski (2015). *Scale-Symmetric Theory*
[1A]: http://vixra.org/abs/1511.0188 (Particle Physics)
[1B]: http://vixra.org/abs/1511.0223 (Cosmology)
[1C]: http://vixra.org/abs/1511.0284 (Chaos Theory)
[1D]: http://vixra.org/abs/1512.0020 (Reformulated QCD)

[2] Sylwester Kornowski. "The Reformulated Asymptotic Freedom"
http://vixra.org/abs/1212.0105

[3] D. d'Enterria and P. Z. Skands (eds.). "High-precision α_s measurements from LHC to FCC-ee"
arXiv:1512.05194 [hep-ph] (Submitted on December 16, 2015).