The Exact Fermion-Boson Empirical Equation

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Abstract: The exact fermion-boson formula (within experimental error) binds masses of neutron, proton and electron with masses of pions and W and Z bosons. Such formula gives us the opportunity to decrease the experimental uncertainty for the W boson - we obtained 80.3813(11) GeV instead 80.379(12) GeV.

The exact fermion-boson formula looks as follows

$$[(n + p) / 2] / e^{\pm} = [2(W^{\pm} + \pi^{\pm}) + Z] / [(\pi^{\pm} + \pi^{o}) / 2] , \qquad (1)$$

where

$n = 939.565413(6)$ MeV,
$p = 938.272081(6)$ MeV,
$e^{\pm} = 0.5109989461(31)$ MeV,
$\pi^{\pm} = 139.57061(24)$ MeV,
$\pi^{o} = 134.9770(5)$ MeV,
$W^{\pm} = 80.379(12)$ GeV,
$Z = 91.1876(21)$ GeV [1].

On the left side L in formula (1) are fermions which are the constituents of atoms, while on the right side R are bosons.

Introduce following symbols

$N_{mean} = (n + p) / 2$,
$\pi_{mean} = (\pi^{\pm} + \pi^{o}) / 2$.

We can rewrite formula (1) by using the introduced symbols

$$N_{mean}\, \pi_{mean} / e^{\pm} = 2(W^{\pm} + \pi^{\pm}) + Z , \qquad (2)$$

The left side is equal to $L = 252.2294$ GeV. On the other hand, the right side is equal to $R = 252.2247(261)$ GeV. We can see that both sides are equal within experimental error $L = R$. Lowest accuracy has the mass of the $W^{\pm}$ boson so we can use formula (2) (or (1)) to decrease uncertainties – instead the experimental value $W^{\pm} = 80.379(12)$ GeV, we obtain $W^{\pm}_{model} = 80.3813(11)$ GeV.

How we can interpret formula (1)? We can see that transition from electrons to nucleons is equivalent to transition from pions to pions and $W^{\pm}$ and Z bosons, i.e. the $W^{\pm}$ and Z bosons do not concern electrons directly as it is in the Standard Model (SM).

The exact fermion-boson formula and the last conclusion are the main elements in this paper.

In the Scale-Symmetric Theory (SST), mass of the $W^{\pm}_{SST}$ boson is defined as follows

$$W^{\pm}_{SST} = 4(e^{+} + e^{-})_{bare} X_W + e^{\pm} = 80.3806 \text{ GeV}, \qquad (3)$$

where $e^{\pm}_{bare} = 0.510407011$ MeV is the bare mass of electron, and $X_W = 19685.3$ is the ratio of coupling constants for weak interactions of protons and electrons [2].

Applying the value from formula (3) and using formula (2) we obtain $Z = 91.1891$ GeV.

We can see that the predicted masses of the $W^{\pm}$ and Z bosons within SST are respectively 80.3806 GeV and 91.1891 GeV.

Notice that we can replace the right side for $R = 2(H^{o} + n) = 252.24(32)$ GeV, where $H^{o} = 125.18(16)$ GeV is the mass of Higgs boson [1].

References

[1] M. Tanabashi *et al.* (Particle Data Group).
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[2] Sylwester Kornowski (23 February 2018). “Foundations of the Scale-Symmetric Physics (Main Article No 1: Particle Physics)”
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