

Mass Ratio of W and Z Boson

Branko Zivlak, bzivlak@gmail.com

Abstract: The formula for the mass ratio of W and Z bosons is defined.

Ključne reči: Weinberg, Bošković, Boson

1. Uvod

Let's quote from Wikipedia [1]:

... θ_W is the angle by which spontaneous symmetry breaking *rotates* the original vector boson plane, ... *The weak mixing angle also gives the relationship between the masses of the W and Z bosons (denoted as m_W and m_Z),...*

*Because the value of the mixing angle is currently determined **empirically**, in the absence of any superseding theoretical derivation it is mathematically defined as*

$$\cos(\theta_W) = m_W / m_Z = x \quad (1)$$

2. Mathematical solution

Let's propose a *mathematical* solution, where x is the ratio of masses of W and Z bosons, (2):

$$\left[\left(x^{-2} - 1 \right)^{1/2} + 1 \right]^{-1} = 1 - \left(2 - 2^{1/2} \right) * \sin(x)^2 \quad (2)$$

Which resulted: from the assumption that the mentioned *rotation* in the introduction is created by changing the basic mathematical operations (here square, square root and sine), over the bit "2", and the constant x . The four occurrences of "1" are also not accidental, but are the result of thinking in the manner from Bošković's "*Philosophiae naturalis*" [2].

Solving (2) with WolframAlpha, [3], we get:

$$x \approx \pm 0.881483626062767..$$

Codata value is from [4]: W to Z mass ratio 0.881 53 0.000 17

For the obtained value of x , both sides in (2) have the value of g :

$$g = \left[\left(x^{-2} - 1 \right)^{1/2} + 1 \right]^{-1} = 0.651167015661142 \quad (3)$$

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3. Conclusion

- An exact *mathematical* value was obtained for the mass ratio of W and Z Bosons, from which some other physical constants can be obtained, [1].
- If the value obtained from (2) is true, it is the only exact value of the physical constant, not counting defined physical constants in natural systems of measurement units, [5].
- One may say that the agreement with the measured data is a coincidence. In any case, there are many coincidences and they attract attention.

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4. References:

- [1] https://en.wikipedia.org/wiki/Weinberg_angle, last edited on 30 August 2023, at 09:58 (UTC).
- [2] Boscovich J. R.: (a) "Theoria philosophiae naturalis redacta ad unicum legem virium in natura existentium", first (Wien, 1758) and second (Venetiis, 1763) edition in Latin language; (b) "A Theory of Natural Philosophy", in English, The M.I.T. Press, Massachusetts Institute of Technology, Cambridge, Massachusetts and London, England, first edition 1922, second edition 1966.
- [3] <https://www.wolframalpha.com/>
- [4] <https://physics.nist.gov/cuu/Constants/>
- [5] https://en.wikipedia.org/wiki/Natural_units