CALCULATION OF EXACT VALUE OF THE HIGGS BOSON'S MASS

Miroslav Súkeník and Jozef Šima
Slovak University of Technology, Radlinského 9, 812 37 Bratislava, Slovakia
(*sukenik4@gmail.com)*

Abstract: *The existence of the Higgs boson produced by the quantum excitation of the Higgs field was predicted in 1964. Since this year, efforts of particle physicists have focused on theoretical predictions and experimental determination of the boson mass. Several values of the mass have been published, gradually approaching 125 GeV. Applying the fundamentals of our Expansive Nondecelerative Universe model we calculated the Higgs boson's mass as 125.39 GeV and published this result as early as May 2012. The latest evaluation (March 2020) of the data obtained at the Large Hadron Collider led to 125.38 GeV.*

HIGGS BOSON'S MASS – APPROACHING ITS EXACT VALUE

Since the prediction of the existence of the Higgs boson, its properties, mass including, have been the focus of many theoretical and experimental research groups. The existence of the Higgs boson was first postulated in 1964. Some of the key values of its mass and their development are illustrated in the following text.

Evaluation of the data concerning the Higgs boson led in 1970s to its mass higher than 18.3 MeV [1]. In July 2010, CDF (Fermilab) and DØ (Tevatron) experiments excluded the Higgs boson in the range 158–175 GeV [2]. Preliminary results announced in July 23–24, 2011 ob-tained at LHC excluded the ranges 155–190 GeV (ATLAS), and 149–206 GeV (CMS) at 95% CL [3,4].

Just a few days later, on July 27 (2011), preliminary CDF/DØ results extended the excluded range to 156–177 GeV at 95% CL [5]. On November 18, 2011 a combined analysis of ATLAS and CMS data further narrowed the window for the allowed values of the Higgs boson mass to 114–141 GeV [6]. The ATLAS collaboration following a deeper analysis of their 2011 data issued on July 2, 2012 a value of 125 - 126 GeV with significance of 2.9 sigma [7].

On July 4, 2012 CMS announced the discovery of a previously unknown boson with mass 125.3 ± 0.6 GeV (4.9 sigma) [8] and ATLAS of a boson with mass 126.5 GeV (5 sigma) [9]. On March 14, 2013 CERN confirmed that: "CMS and ATLAS have compared a number of options for the spin-parity of this particle, and these all prefer no spin and even parity. This, coupled with the measured interactions of the new particle with other particles, strongly indi-cates that it is a Higgs boson[10].

The above mentioned values are close to 125.39 GeV calculated by us and published in May 2012 [11] and in July 2015 [12]. This calculation depends only on the value of the fundamental physical constants h, c and G.

The result, 125.38 ± 0.14 GeV which is closest to our value was published in 2020 [13]. This is currently the most precise measurement of the mass of the Higgs boson, nearly identical to our value obtained in 2012.

NOTE: Within the ENU model, first time we predicted the mass of the Higgs boson to 125 GeV. Published in June 2011 [14].

References:

[1] Ellis, John; Gaillard, Mary K.; Nanopoulos, Dimitri V. (2012). "A Historical Profile of the Higgs Boson", arXiv:1201.6045.
[2] T. Aaltonen (*CDF* and DØ Collaborations) (2010). "Combination of Tevatron searches for the standard model Higgs boson in the W+W− decay mode". *Physical Review Letters*. **104** (6): 61802, arXiv:1001.4162.
[3] Combined Standard Model Higgs Boson Searches in pp Collisions at root-s = 7 TeV with the ATLAS Experiment at the LHC. 24 July 2011. ATLAS-CONF-2011-112.
[4] Search for standard model Higgs boson in pp collisions at sqrt{s}=7 TeV. 23 July 2011. CMS-PAS-HIG-11-011.
[5] The CDF & D0 Collaborations; Collaborations; the Tevatron New Phenomena; Higgs Working Group (27 July 2011). "Combined CDF and D0 Upper Limits on Standard Model Higgs Boson Production with up to 8.6 fb-1 of Data", arXiv:1107.5518
[6] Brumfiel, Geoff (18 November 2011). Higgs hunt enters endgame. Nature News. Retrieved 22 November 2011.
[7] ATLAS Collaboration (2 July 2012). "Combined search for the Standard Model Higgs boson in pp collisions at sqrt(s) = 7 TeV with the ATLAS detector". *Physical Review D*. **86** (3): 032003, arXiv:1207.0319
[8] *Taylor, Lucas (4 July 2012). "Observation of a New Particle with a Mass of 125 GeV". CMS Public Website. CERN. Retrieved 4 July 2012.*
[9] ATLAS collaboration (2012). "Observation of an Excess of Events in the Search for the Standard Model Higgs boson with the ATLAS detector at the LHC". *Atlas-Conf-2012-093*.
[10] *O'Luanaigh, C. (14 March 2013). "New results indicate that new particle is a Higgs boson". CERN. Retrieved 2013-10-09.*
[11] SúkeníkM.,, J. Šima: Nondecelerative Universe Model (9 May 2012), http://vixra.org/pdf/1205.0046v1.pdf
[12] Súkeník,M., Šima, J.: Nondecelerative Cosmology, Scholars Press, Saarsbrücken (2015), ISBN: 978-3-639-76650-9
[13] CMS Collaboration, A measurement of the Higgs boson mass in the diphoton decay channel, 2020, arXiv:2002.06398v1
[14] Šima, J. and Súkeník, M., (2011). „ Nondecelerative Cosmology: Background and Outcomes“. Pacific Journal of Science and Technology. 12(1):214-236