The Calculated value of the Fine Structure Constant from Fundamental Constants

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Abstract

This paper is an extract from more extensive paper on Vacuum Polarization [1], from which the details of the calculation of the Fine Structure constant α may be obscured.

Main

The derived value of the constant from Eq.(31), and Eq.(32), of the paper is:

$$\alpha = \frac{\sqrt{2}\,\lambda\!\!\!^{-}_{PL}}{\lambda\!\!\!^{-}_{e}}\nu_e = \frac{\sqrt{G\hbar/2c}}{\pi\left(\lambda\!\!\!^{-}_{e} g_A\right)^2} \tag{1}$$

The fundamental constants in this expression are the Planck particle radius, the Compton radius of the electron, and the electron frequency ν_e. The frequency is the ratio in number of times a photon passes a point orbiting in the electron verses the number moving in a straight line. Numerically is equal to the Compton frequency of the electron. The Planck radius is $\lambda\!\!\!^{-}_{PL} = \sqrt{G\hbar/c^3}$. The g_A, constant is the precise Electron Magnetic Moment, $g_e/2$, and the QED correction to the Compton radius of the electron.

The value of the fine structure constant, Alpha is:

$$\alpha = 1/137.035999710 \tag{2}$$

The value of the gravitational constant is set to be 6.6755052700E-8 (CGS). The Codata Gravitational Constant is a consensus value having about a tenth of a percent scatter. The value found here is within the error bars of all the measurements taken by the Bureau of International Weights and Measurements [19], and the BIPM* measurements are one of the measurement sets used in the consensus value.

The predicted value calculated here is thus testable to the experimental accuracy of the Gravitational constant

$$G = \frac{\alpha^2 2\pi^2 c\left(\lambda\!\!\!^{-}_e g_A\right)^4}{\hbar} = 6.6755052700E-8 \qquad \text{(CGS)} \tag{3}$$

Reference values of Constants and sources used in the calculation (CGS units)

c = 2.9979245800E+10*	$g_A = g_e / 2$ = 1.00115965218 †
$\hbar$ = 1.054571817646E -27 *	$\lambda\!\!\!^{-}_e = \hbar / m_e c$ = 3.8615926794E-11
α = 1/137.035999710(96) †	m_e = 9.1093837015(28)E -28 ⊕

* Definition † Gabrielse et. al. [2][3][4] ⊕ 2018 Codata Recommended Values

BIPM* and Codata consensus values (CGS)

Calculated value	G = 6.6755052700E-8
BIPM 01-32-2001	G = 6.67559(27) x 10-8
BIPM weighted mean 2014	G = 6.67554(16) x 10-8
BIPM Sep, 2015	G = 6.67545(18)) x 10-8
Codata Consensus Value	G = 6.67430(15) x 10-8

*BIPM- Bureau of International Weights and Measurements, [5].

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