The Extraordinary Mathematical Properties Of The Fine Structure Constant By Its Relation To The Monster Group And Some Mathematical Constants

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Abstract

As R. P. Feynman said: the fine structure constant is the probability that an electron emits or absorbs a photon. In this work several equations are shown; the majority of empirical heuristic character, by which the precise value of the fine-structure constant (its inverse) is obtained. Far from being pure numerology, we think that they are not accidental. We rely to affirm this in that in all there appear repetitively either mathematical constants such as Pi, e, etc, and / or quantum corrections due to the masses of the leptons with electric charge and the masses of the W and Z bosons (and its entropies). This rules out its casual character. That there are so many possible equations and that they are related to very relevant aspects of mathematics, such as the monster group and others; allows us to demonstrate the extraordinary mathematical properties of this dimensionless constant.

1 Introduction

Feynman's Conjecture: A general connection of the quantum coupling constants with p was anticipated by R. P. Feynman in a remarkable intuitional leap some 40 years ago as can be seen from the following much quoted extract from one of Feynman's books.
"There is a most profound and beautiful question associated with the observed coupling constant, e, the amplitude for a real electron to emit or absorb a real photon. It is a simple number that has been experimentally determined to be close to -0.08542455. (My physicist friends won't recognize this number, because they like to remember it as the inverse of its square: about 137.03597 with about an uncertainty of about 2 in the last decimal place. It has been a mystery ever since it was discovered more than fifty years ago, and all good theoretical physicists put this number up on their wall and worry about it.) Immediately you would like to know where this number for a coupling comes from: is it related to p or perhaps to the base of natural logarithms? Nobody knows. It's one of the greatest damn mysteries of physics: a magic number that comes to us with no understanding by man. You might say the "hand of God"

http://www.feynman.com/science/the-mysterious-137/

The most precise experimental value known of the fine structure constant will be used to compare (see bibliography Value Fine Structure Constant): $\alpha^{-1}(0) = 137.035999046$ (zero momentum)

We will divide the content starting with the simplest equations and at the same time as precise as the rest. The mathematical constants that are used are: π , e , φ , δ ($Feigenbaum's\ Constant$) and γ

Values, as ratios relative to the mass of the electron, the masses of electrically charged leptons :

$\frac{m_\tau}{m_e} = 3477.1507634$ (Tau mass)

$\frac{m_\mu}{m_e} = 206.768283$ (Muon mass)

$m_{PK} =$ Planck mass

We will end up with several equations directly related to the monster group.

2 The mathematical constants and $\alpha(0)$

2.1 Feigenbaum´s constant and $\alpha(0)$

This equation is based on a previous article in vixra.In it the theoretical heuristic explanation is given.

Feigenbaum´constant

$$2\pi\delta^2+\frac{1}{4\delta}-\frac{1}{137^2-137}-\frac{1}{3\pi\cdot\left(\frac{m_\tau}{m_e}\right)\cdot\left(\frac{m_\mu}{m_e}\right)}=\alpha^{-1}(0)=137.035999045926$$

2.2 The base of the natural logarithms e and $\alpha\,(0)$

$$\left(\frac{e}{2}\right)^{16}+e^{1/e}+\frac{1}{6\cdot\left(\frac{m_\tau+m_\mu+m_e}{m_e}\right)}-\frac{1}{\left(\frac{8^2}{e^4}\right)\cdot\left(\frac{m_\tau+m_\mu+m_e}{m_e}\right)^2}=\alpha^{-1}\,(0)=137.035999046072$$

2.3 The number 7, e, and $\alpha\,(0)$

$$\sqrt{7!+1}=71=\ln\left(E_{plank}/E_{vacuum}\right)$$

$$\left[\left(7!-\sum_{n=1}^{7}n^2+2^7-1\right)\cdot 2^7\right]^{1/e}-\frac{2}{\left(\frac{m_\tau-m_\mu-m_e}{m_e}\right)^2\cdot\left(2e+e^2\right)}=\alpha^{-1}\,(0)=137.035999045998$$

2.4 The number 6 (number of leptons or the number of electrically charged lepton antilepton pairs), π and $\alpha\,(0)$

$$6^{4/3}\cdot 4\pi+\frac{1}{6^2}+\frac{1}{\pi\cdot\left[\left(\frac{\pi^2}{3}-2\right)^4\right]\cdot\left(\frac{m_\mu}{m_e}\right)}+\frac{\pi^2}{4\cdot\left(\frac{m_\tau}{m_e}\right)^2}=\alpha^{-1}\,(0)=137.035999045979$$

2.5 The three-dimensional fractal, the golden number or one-dimensional fractal, Pi, e, the Euler-Mascheroni constant and $\ln\left[\alpha^{-1}\,(0)\right]$

$$[3;3,3,3\cdots,3]=3+\frac{\sqrt{13}-3}{2}$$

$$[1;1,1,1\cdots,1]=\frac{1+\sqrt{5}}{2}=\varphi$$

$$([3;3,3,3\cdots,3]+\varphi)-\frac{1}{\pi\cdot e\cdot\left(\frac{m_\mu}{m_e}\right)}+\frac{1}{e^\gamma\cdot\ln\ln(7!)\cdot\left(\frac{m_\tau\cdot m_\mu}{m_e^2}\right)}=\ln\left[\alpha^{-1}(0)\right]=4.92024365807539$$

2.6 The integer part of $\alpha^{-1}(0)$, 137 and $\alpha^{-1}(0)$

$$137+\frac{1}{\ln^2(137)+e^{4/\pi}}+\frac{\ln\varphi}{\ln(137)\cdot\left(\frac{m_\tau\cdot m_\mu}{m_e^2}\right)}=\alpha^{-1}(0)=137.035999045695$$

2.7 The integer part of $\alpha^{-1}(0)$, 137, various entropies of charged leptons, π, e and $\alpha^{-1}(0)$

$$137+\frac{\ln 137}{137}+\frac{1}{\left[2\cdot\ln\left(m_{PK}/m_e\right)\right]^2\cdot 2\cdot(2/e)^2}-\frac{40\pi\cdot\ln\left(m_\tau/m_\mu\right)}{137\cdot\left[\left(m_\tau+m_\mu+m_e\right)/m_e\right]^2}=\alpha^{-1}(0)=137.035999046002$$

2.8 π, e, γ and $\ln\left[\alpha^{-1}(0)\right]$

$$\pi e\gamma-\frac{1}{\ln^2\left(2\cdot 137^2\right)}-\frac{1}{2\cdot\left(m_\mu/m_e\right)^2}+\frac{1}{4\cdot\left(m_\tau\cdot m_\mu/m_e^2\right)}+\frac{1}{\exp(\pi e\gamma)\cdot\left(\frac{m_\tau+m_\mu+m_e}{m_e}\right)^2}=\ln\left[\alpha^{-1}(0)\right]=\cdots$$

4.92024365807199

2.9 Sum of roots of the four dimensions and $\alpha^{-1}(0)$

$$\exp\left(\sum_{n=1}^{4}\sqrt[4]{n}\right)+\frac{1}{\ln\left(\sum_{n=1}^{4}\sqrt[4]{n}\right)+\ln\left(m_\tau/m_e\right)}+\frac{e+2}{2\cdot\left(m_\tau\cdot m_\mu/m_e^2\right)}=\alpha^{-1}(0)=137.035999046032$$

3 The Monster group and $\alpha^{-1}(0)$

As it is known, the order of the Monster group is the product of the powers of prime numbers: $O_r(M) = 2^{46} \cdot 3^{20} \cdot 5^9 \cdot 7^6 \cdot 11^2 \cdot 13^3 \cdot 17 \cdot 19 \cdot 23 \cdot 29 \cdot 31 \cdot 41 \cdot 47 \cdot 59 \cdot 71$

The minimal degree of a faithful complex representation is 196883, which is the product of the three largest prime divisors of the order of M. $196883 = 47 \cdot 59 \cdot 71$

Below are several equations derived from functions of the prime divisors of the Monster group, 196883 and $\alpha^{-1}(0)$

1.
$$\sum_{p/O_r(M)} \sqrt{p} + 71 - \frac{71}{3^2 \cdot \pi} + \frac{1}{2 \cdot 3^2 \cdot 71^2} = \alpha^{-1}(0) = 137.035999042042$$

2.
$$2 \cdot \sum_{p/O_r(M)} \sqrt{p} - \frac{1}{\ln^2(71) - 1} + \frac{1}{4 \cdot \gamma^2 \cdot 137^2} = \alpha^{-1}(0) = 137.03599904275$$

3.
$$\left(\pi^2/2\right) - \frac{2}{136 + \exp\left(\frac{1+\ln\ln\ln 196883}{6}\right)} + \frac{1}{13 \cdot \left(\frac{m_\tau + m_\mu + m_e}{m_e}\right)^2} = \ln\left[\alpha^{-1}(0)\right] = 4.92024365806874$$

4.
$$\sum_{p/O_r(M)} \ln^2(p) + \exp(4/\pi) + \frac{1}{137 \cdot (18 + \sqrt{\pi})} = \alpha^{-1}(0) = 137.035999045277$$

5. **Planck mass electron mass ratio**
$$\frac{\sqrt{O_r(M)} \cdot \alpha^2(0)}{2 + \left(\frac{2}{\ln 103 \cdot \ln[O_r(M)] - \frac{2}{\pi^2}}\right)} = \frac{m_{PK}}{m_e}$$

$103 = \lfloor 2 \cdot \ln(m_{PK}/m_e) \rfloor = 240 - 137$

4 Conclusions

In almost all equations the masses of the charged leptons appear, either as ratios with respect to the mass of the electron or as entropies. Likewise, the most important mathematical constants are also present. This leads us to the conclusion that these equations cannot be random or accidental at all, but rather the opposite: they are the manifestation of a unifying physical-mathematical structure that must still be discovered.

Contents

References

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