Electrical Moonshine

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Abstract. The electrical constant *a* and its Eddington approximation 137 are both 10 ppb connected with the dimension *d* = 26 of bosonic string theory and the Witten 'moonshine entropy' ln*D*, with *D* = 196883 = 59(59²-12²). The involved pi-approximations implies a 0.3 ppb formula for *a*, and, using the first Mathieu group order, this confirms the Coherent Cosmology value $G \approx 6.67544 \times 10^{-11}$ kg^-1m^3s^-2, compatible with the BIPM measurement, but at 4 sigma from the controversial tabulated one. The monstrous fifth number in the fractional development of pi is clearly involved. Direct connection between *a*, 137, *d* and *D*, implies the string central number 496, very close to the 20th root of the Monster order, whose square corresponds to 125.6 GeV (BEH Boson), directly tied to the Monster order entropy via the tau and muon masses, which are connected by an holographic relation, confirming the Eddington tau-proton symmetry and the symmetrical Koide relation. The Monster order correlates with canonical economic numbers, leading to a value for the tau mass, from its approximation $59^2 m_e$, so directly tied to *D*, and compatible with the Koide relation in the 10 ppb range, confirming again the BIPM value for *G*. The fifth power of the Monster order is directly connected to *D* and *d* via the number 24 of transverse dimensions, involving the economic number 3^(24²+1). This confirms the arithmetical character of Physical laws.

A bridge was established between two very different mathematical domains : the group theory and the conformal field one, which is related to the string theory [1]. The starting common point is the dimension of the Monster group *D* = 196883. In its treatment of the bosonic string theory, of dimension *d* = 26, Witten [2] considers the corresponding entropy ln*D*, and compare it with the natural term 4π. But there are two 10^{-8} precise relations implying 137 and the electric constant [3] *a* ≈ 137.035999138(31).

$$6d\ln D \approx (137/\pi_{(4)})^2 \approx (a/\pi)^2 - 1$$

$\pi_{(4)}$ being the classical approximation 355/113, *confirming the arithmetical character* of Physics revealed by the Monster Group [4], Topological Axis [5], and the Eddington number 137 [6][7]. *As predicted [8] the physical constants are tied to rational approximations of π.* Indeed, with $6\pi^5$, the Lenz-Wyler approximation for *p, the proton/electron mass ratio, and H the Hydrogen/electron mass ratio*, the

computer shows, *in the measurement ppb range*:

$$\sqrt{(6\pi^5 H)/p} \approx (\pi_{(4)}/\pi)(a/137)$$

Moreover, writing $a^2 = 137^2 + \pi_a^2$, one finds a value corresponding, in the Lenz-Wyler [9] formula to the whole number $1834 \approx 6\pi_a^5$. This corresponds to the value :

$$a_{1834} \approx 137.035999098$$

at -3.0×10^{-10} ($-1.3\ \sigma$) from the above measured value [3]. In the measured 30 ppm range, the main strange mesons are given by :

$$a/(\pi_a - 3) \approx 972.80 \approx K_0 - 1$$
$$a/(\pi' - 3) \approx 966.10 \approx K_\pm$$

where $\pi' = 443/141$, corresponding to $\sqrt{(Hn/d_e)}$ within 0.3 ppm, where H and n are the Hydrogen/electron and neutron/electron mass ratio, and $d_e \approx 1.001159652$ is the electron magnetic factor [3]. With $u \approx 0.23129(5)$ the weak-mixing angle, one observes that

$$7 + 2u^2 \approx (\pi_u - 3)^{-1}$$

induces a value π_u compatible with $p_G + 2$ where $p_G = P/2^{127/2}$, with P the canonical mass ratio Planck/electron. Introducing the order of the first Mathieu group $O_1 = 7920$, one observes :

$$(p_G + 1)/O_1 \approx 0.23138 \approx e/\sqrt{(\sqrt{137}a) + 1)}$$

This is a 1 ppm connexion between electricity and gravitation, corresponding to $G \approx 6.675441 \times 10^{-11}$ $kg^{-1}m^3s^{-2}$, at 2 ppm from the Coherent Cosmology value, confirming the BIPM G measurement [10], at 4 σ the controversial tabulated value (200 ppm). Introducing the neutron mass, the above gravitational G value is confirmed to 0.2 ppm and 1.3 ppm by :

$$\sqrt{(pH)} \approx p_G (n/6\pi^5)^2 \approx \sqrt{(p_G^2 + a^2)}$$

Noting $x^x = x^{(2)}$, one finds that the order of the Monster O_M enters:

$$O_M \wedge O_1 \approx (H\sqrt{(n/6\pi^5)})^{(2)f} \approx \exp(e^{2\pi}\sqrt{(pn/d_e)}$$

where *f* is the inverse strong coupling constant defined by Bizouard [4] and d_e the electron magnetic moment excess factor. This huge number is of the same order that the following one:

$$e^{5D} \approx \sqrt{(pnd_e^3)}^{(2)f^2}$$

while to 0.4 ppm :

$$D \approx \ln a \times (a^2/137)\sqrt{(pn/d_e^3)}/2\pi$$

The shows that the monstrous fifth number in the fractional development of π is involved, to 0.3 ppm :

$$\pi_{(5)} = 292.63491 \approx n/2\pi_p$$

where $\pi_p = (p/6)^{1/5}$. The ratio of the above huge numbers verifies:

$$e^{5D} / O_M \wedge O_1 \approx \exp(W^2Z^2/\pi F^3)$$

inside the imprecision on *W and Z*, the weak boson masses, by respect to the electron one, while *F* is the Fermi mass. Moreover, at 5 ppm :

$$(\pi \quad 3)^{-2}/(1 + \pi/a) \approx 4 \ln(D)$$

Detailed analysis shows that, in the ppb range :

$$D = 12d(136 + 496 - 1) + 11 \approx 12d(a + 496 - 2) - u \approx H(8H/a - 1/12)$$

where 496 the third perfect number, central in string theory [11], whose square is very close to *s*, the 10th root of the Monster order, corresponding, by respect to the electron energy, to 125.6 GeV, nearly compatible with the BEH mass 125.09(24) GeV [3].

Also the mass ratio Muon/Electron μ and Tau/Electron τ appear in the entropy of the Monster order O_M:

$$\ln O_M /137 \approx e/3 \approx \ln\tau/9 \approx 10\mu \ln D/8\tau$$

involving $\ln O_M /10 = \ln s$:

$$137/8 \approx \tau \ln s/\mu \ln D$$

So τ is tied to the cube of the 'economic number' $e^{(2)} = e^e$. In fact the measured value 3477.22(23) is compatible with the following values,

involving : $e^{(3)} = e\hat{}(e\hat{}e)$:

$$\tau \approx 137^2\, e^{(3)}/(2a)^3 \approx 3477.439674 \approx e^{3e}(137/a)(p/H)(H-p)^{-1/2}$$

implying that the square root of $r_H/\lambda\!\!\!^{-}_e = aH/p$, the ratio of the Bohr radius to the electron wavelengt is close, to (4 ppm) :

$$\sqrt{(r_H/\lambda\!\!\!^{-}_e)} = (2e^{(2)}\sqrt{a})^3/e^{(3)}$$

Moreover $\tau \approx 59^2$ shows a direct 2 ppm connexion with $D = 59(59^2-12^2)$:

$$(1+ 1/\sqrt{a})\, D^2 \approx \tau^3\ (H/p)$$

where $1+1/p \approx H/p$ is the above effective mass correction and $\sqrt{a}$ is the Feynman's Quantum Electrodynamics constant.

This τ value enters the following relation, to 0.4 ppm:

$$(2^{127}d_e)^{1/4} \approx Pa^4/(\pi\tau/3)^6$$

not containing the term 137. This τ value is also compatible with the 2.2×10^{-8} precise μ value ≈ 206.7682836(47), in the Koide relation [12], specified by the prolongating term $4\pi(apH)^{1/4}$:

$$(1+\mu+\tau)/2 \approx (1+\sqrt{\mu}+\sqrt{\tau})^2/3 \approx 4\pi(apH)^{1/4}$$

It is significant that the best easily determined particle mass is that of the tau, whose existence and correct order of magnitude was predicted by Eddington [6], 35 years before its surprising discovery. Albeit the Koide formula have already corrected a 3 sigma error for tau mass measurement, it is *always not taken seriously.* This shows how the particle standard model is disconnected from the profound physics behind. In fact, there is a 1.2 ppm holographic relation tying τ and μ:

$$(\pi/3)(\mu/ad_e)^3 \approx \tau^2/pH$$

specifying an already noted relation, found from the forgotten Eddingtons's symmetry tau-proton [13].

Also, within 40 ppb: $\tau \approx ae^{(3)2}/e^{(2)}fpD\ln D\sqrt{(a-136)}\sqrt{(H-p)} \approx 3477.43954$, implying the following relation:

$$8(a^2/137)^2\ e^{(3)}/e^{(2)} \approx fpD\ln D\sqrt{(a-136)}\sqrt{(H-p)}$$

illustrating the importance of 136, the first Eddington's approximation for *a* [6]. Indeed, the computer shows that:

$$a/(a-136)(a-137) \approx 2H$$

precise to 19 ppm.

The economic numbers play also a decisive role in the *incredible* connexion (0.2 ppm) of the Monster group order with that of the pariah group J_3 [4] :

$$O_M \approx J_3^7 d_e\sqrt{(p/6\pi^5)}$$

Also, the economic numbers appears in :

$$e^{(4)/4} \approx (4a^2/3\pi^2)P^{(a-1)^2} \approx (\pi/6)\ (4n/\pi d_e^2)^{s/2} \approx (6/\pi)\hat{}(e^{(2)2}\ (a/d_e)^{3/2})$$

$$e^{(3)}/(2e^{(2)})^3 \approx 137$$

$$e^7/2^3 \approx a^2/137$$

$$2e^{(3)3/2}/e^{(2)5} \approx a\ (a-1)$$

$$e^{(3)/2}/fe^{(2)2} \approx 1 + e^{(2)}/p_G \approx d_e^4 H^2/pp_G$$

$$e^{(3)}/e^{(2)} \approx a\sqrt{(pH)} \approx \sqrt{(\pi/3)}\ sa/137 \approx \sqrt{(a^d d_e(H-p))/P}$$

where *P* is the mass ratio Planck/electron. The last relation corresponds again, as above, with *d* = 26, to a value for *G* both compatible with the Coherent Cosmology one and BIPM measurement.

The following relation may be useful, since 24 is the number of transverse dimensions, and *D*+1 appears in the moonshine correlation :

$$(D+1)^{2\times 26} \approx 3^{24^2+1} \approx (e^3\ O_M/\sqrt{2})^5$$

precise to 5×10^{-5} and 9×10^{-6} on a number of 275 decimal digits. The term $O_M/\sqrt{2}$ appears directly in c-free dimensional analysis [4], as well in the relation :

$$O_M/\sqrt{2} \approx (a/137)^{3aW^2/4\pi F}$$

inside the imprecision on *W*, the charged weak boson mass, by respect to the electron one, while *F* is the Fermi mass, while in the ppb range :

$$a/137 \approx 3^{a/F} \approx (P\sqrt{(3/2)})^{1/(D+11)}$$

This confirms that *a*/137 is a mathematical ratio.

As well as mathematicians take profit of computer, they could be guided also by those formula, obtained by the *physical approach method* i.e. to look for direct connexions between pertinent numbers.

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