On Quantization and the Resonance Paths

Jacques Consiglio

52 Chemin de Labarthe, 31600 Labastidette, France
E-mail: Jacques.Consiglio@gmail.com

We use a mass-resonance equation to analyze the known elementary particles mass spectrum; we first show that masses and charges are quantized together and all couplings are geometry of movement. Next, the long-expected connection between gravitation and the rest of physics appears as we deduce and compute from the equation parameters the resonance corresponding to the reduced Planck mass. In this way, quantum fields and general relativity can be emergent theories where the natural law is unique.

It is in the admission of ignorance and the admission of uncertainty that there is a hope for the continuous motion of human beings in some direction that doesn't get confined, permanently blocked, as it has so many times before in various periods in the history of man. R.P. Feynman.

1 Introduction

In a celebrated paper, Dirac [8] showed that the existence of magnetic poles and quantum mechanics imply symmetrical quantization of magnetic and electric charges. This is the very first attempt to explain the observation of a universal charge quantum. Since then other theories were produced in which the magnetic charge differs. But even though charges have definite symmetry nothing imposes the charge ratio; namely the fine structure constant α.

It is often believed that the standard model (SM) of particles physics is part of a wider theory in which its free parameters are calculable — but possibly free in essence or accepting multiple solutions. One can see the seeds of this line of thoughts in Dirac's quantization: once the idea is extended to all fields, it may structure the logical constraints in such a manner that the full set of equations can be solved. Such result is expected in super-symmetry and string theory.

However, we must remind that we discuss *the parameters of a theory, not a-priori of nature*. At the other extreme, assume quantum theory incomplete or not fully understood, a possibility exists that all *known* parameters are already calculable from known physics. If so, it may be possible to decode some field characteristics directly from known data. At present time, the only rich group of parameters is the elementary particles mass spectrum as we know 12 samples, and it may be enough to understand its underlying structure.

In short, and in a general manner:

- Assume the 12 known masses correspond to solutions of a set of unknown equations.
- In the most favorable case, if no other mass exists (or close enough) all degrees of freedom are used.
- Hence it may be possible to find or approach the equations and the structure of the solution.

The approach is subtler and a lot more risky than any other since instead of building on theoretical knowledge we assume ignorance — and we do not know what we do ignore.

The object of this paper is to prove the existence of a solution, probably unique, and one of the equations in which the solution is visible. One can infer its validity in two manners; firstly by its agreement with phenomenology, and secondly, by its logical coherence, compactness and simplicity.

In a suite of papers [3, 4], we showed how the mass spectrum is structured. We found firstly that the elementary particles mass obey a simple equation, which is geometrical and based on integral resonances; secondly, two coupling constants (including α) are used in the equation while we find no specific couplings related to the SM weak and Higgs fields as they use only specific geometrical degrees of freedom; thirdly, all calculi and equations are compatible with a simple form of compositeness. On this basis, we showed [5] that the electron and muon magnetic moment anomalies can be computed from the equation parameters with no use of QED.

In the next sections, we first repeat the main demonstrations, fix some errors, and then discuss the results and implications; since the mass equation is geometrical, its use of coupling constants and the manner they combine imply that they are also geometrical; we deduce that they correspond to resonance paths and find or approach the related equations. In this way, the field is geometrically self-quantized and has no free parameter related to energy. The same applies to gravitation since, using Wheeler-Feynman absorber equations, we deduce and compute its coupling (and the reduced Planck mass) from the constants and integral resonances used in the mass equation. In this way this mass-resonance theory is linked to gravitation and cosmology; it needs no dark matter and no big bang but comes with a constant linear expansion and energy creation.

We shall use measurement data and constants from CODATA 2014 or the Particle Data Group 2014 except where mentioned. The point is of importance considering the precision reached with leptons masses, anomalies, and α. The reader should keep in mind that the initial study used older values which imposed no difference to the model.

2 Deriving a mass equation

De Broglie [2] imagined a stationary wave of length hc/E which relativistic transformation gives a phase wave of length h/p. This is the origin of the wave equations of quantum mechanics. The question of the nature of those waves is still open; in this section, we imagine how a stationary wave can be born *and ring*; then we predict some characteristics of the resonances that we shall later use as verification.

We assume that the wave is the physical exchange at the origin of mass. Energy exchange is momentum, and it gives a pressure field that "cages" the particle charges and some associated self-energy. The initial idea is similar to the Poincaré stress [11] though not identical as we split the particle.

Roughly speaking, we cage a permanent photon-like current in a box also made of currents and we guess that the box and the charge quantize each other. Assume the box size universal, it is sufficient to use a length 1. In the one dimensional case, the pressure is a simple force, and resonance implies an integral number M such that we have:

$$m = \mu + XM,$$

where m is the particle mass and X is a universal constant. The quantity μ represents a massless self-energy that necessarily propagates, and it implies a double resonance. Hence the resonance corresponds to a product $M = NP$:

$$m = \mu + XNP.$$

In the 1-dimensional case, we should have $N = P$ corresponding to identical inbound and outbound currents, but we shall need a more general equation and then we use a product. In a wave representation, it represents the number of times the inbound and outbound wave crests hit each other in a universal period of time or within a definite length.

Caging a massless particle requires symmetry, a force that opposes the particle charge to the pressure field, that is precisely the resonance N P and the self-energy μ. There must be a residual distance $d \neq 0$ between the first resonance wall and the current μ at which the force applies. It gives:

$$m = \mu + \frac{X}{d + \frac{1}{NP}}.$$

Now the distance d should also depend on N and P because energy comes from the distance (d + *1/NP*) which is equivalent to a potential. A potential is quantized and $1/NP$ is already quantized as it comes from $XNP = XM$. Then we use $d = KD$, with K an integral number and D a length. Last, in three dimensions we get a cube:

$$m = \mu + \frac{X}{\left(KD + \frac{1}{NP}\right)^3}. \qquad (2.1)$$

The equation has 6 degrees of freedom that can be reduced to 5 by division by X or μ and give unit-less quantities.

Now let us discuss the equation geometry; contrary to the one-dimensional case, we have more degrees of freedom in the resonance and the paths associated to N and P can be radial or circular; here we can use group theory arguments:

— Case 1: A double radial resonance. It needs identical inbound and outbound waves, then $N = P$, giving a stationary wave. Except for the cube, it is identical to the 1-dimensional case then it should address leptons and U(1), and also the Poincare stress in which case we should have $KD > 0$, with K increasing with mass as $1/NP$ reduces since the leptons charges are identical.

— Case 2: A double circular resonance: The resonance geometry is conserved when we invert rotation axis; hence it must be identified to SU(2) and by symmetry $N = P$. But we must change (2.1) with $X \rightarrow X/k\pi$ with k a constant integral number; this is because compared to the first case even though the resonance is circular the pressure is still applied to its geometrical center. The equation becomes:

$$m = \mu + \frac{X}{k\pi\left(KD + \frac{1}{NP}\right)^3}.$$

It addresses massive bosons, which role in nature is to carry interactions. They are similar to a photon and we must integrate to X the term μ (that would be an intrinsic mass). Therefore we will compute their masses (index b) comparatively to the full electron mass (index e) as follows:

$$\frac{m_b}{m_e} = \frac{\left(\frac{1}{N_eP_e} + K_eD_e\right)^3}{k\pi\left(\frac{1}{N_bP_b} + K_bD_b\right)^3}. \qquad (2.2)$$

- Case 3: A mixed resonance. It includes both symmetries U(1) and SU(2), it is then SU(3) and this case addresses quarks. If D is related to the strong force and asymptotic freedom ($\approx$ inverse to the Poincare stress) we should have $KD < 0$, ideally constant. It implies $N \neq P$ with a geometrical constraint between π, N and P since a phase lock between the two paths must exist; it requires to squaring a circle, then logically we should get approximate relations like:

$$NP\pi \approx \textit{an integral number}, \qquad (2.3)$$

If the logic above is valid, it follows that particles distant interactions are a manifestation of the resonance; hence we should find relations between the resonance numbers (N, P) and the known symmetries, and also between some coupling constants and the non-integral values of D, X, and μ. *De facto, and most importantly, we cannot understand mass and charge quantization separately.*

3 Massive elementary particles resonances

In this section, we shall fit the equation parameters to all known elementary particles masses; since the equation is related to symmetry, the natural strategy is to proceed by groups (leptons, quarks, massive bosons). We shall assume X universal and μ specific to leptons (where enough precision exists) and, since D addresses forces, it must be group-dependent.

Recall also that a number of relations must be verified by the fit; they can be used as verification of the geometrical constraints imposed by symmetry and by the equation.

3.1 Leptons

The Table 1 shows charged leptons resonances. It uses very small numbers, we get $N = P$ as expected. The equation parameters are given hereafter:

$$\mu = 241.67661953\,\text{eV},$$
$$D_e = 0.0008532218937, \tag{3.1}$$
$$X = 8.1451213299073\,\text{KeV}.$$

Table 1: Electron, muon, tau in MeV/c^2.

–	P = N	K	Computed	Measured
e	2	2	0.510 998 9461	0.510 998 9461(31)
μ	5	3	105.658 3752	105.658 3745(24)
τ	9	5	1 776.84	1 776.82(16)

Using α, the fine structure constant, we define a new constant that will be used later:

$$A_S = D_e/\alpha \approx 0.11692, \tag{3.2}$$

which name A_S is chosen for its value is reminiscent of the strong force coupling.

The values in (3.1) can be tuned so that all masses match exactly regardless of uncertainty; instead those values have been chosen to compute exactly the electron mass and magnetic moment anomaly (assuming the related equations developed later are good-enough for such precision).

3.2 Quarks

Using X and μ constant from (3.1) the quarks resonances are shown Table 2 (masses in the natural scheme) where a regular pattern is obvious.

As expected, the parameter D is slightly different from (3.1) to compute those masses:

$$D_q = D_e(1 + \alpha) = A_S\,(\alpha + \alpha^2). \tag{3.3}$$

Using D_e like for leptons gives the top mass out of range $\approx$ 167 GeV, and then a difference with leptons exists. Quarks masses are no more published in the natural scheme; the estimates used in Table 2 are dated 2011 except for the top [18], see also [19].

We get $N \neq P$ as expected; P and K are constant which is surprisingly simple. The constancy of $K = -6 < 0$ is reminiscent of asymptotic freedom and then also agrees with a connection between D_e and α_s. Note that varying K by ± 1 gives computed quarks masses out of uncertainty range for the four heaviest.

Table 2: Quarks resonances in MeV/c^2.

–	P	N	K	Computed	Estimate
u	3	2	–6	1.93	1.7 – 3.1
d	3	19/7	–6	5.00	4.1 – 5.7
s	3	7	–6	106.4	80 – 130
c	3	14	–6	1,255	1,180 – 1,340
b	3	19	–6	4,285	4,130 – 4,370
t	3	38	–6	172,380	172,040 ±190 ± 750

The approximate relations with $N\,P\,\pi$ (2.3) are verified for the second and third generations; they are:

$$c, s : 7 \times 3\pi \;\approx\; 65.97 \;\approx\; 66/1.0004025,$$
$$t, b : 19 \times 3\pi \;\approx\; 179.07 \;\approx\; 179 \times 1.0003954.$$

We also notice that between 1 and 19 no other integral numbers come close to verifying (2.3).

It is interesting that the multiplication of N by 2 in the second and third generations corresponds to the difference in electric charges $(1/3, 2/3)$ as it links mass and charge quantization. For the first generation the down quark needs a fraction $N = 19/7$ which is barely acceptable, and we notice that the relations with (2.3) match with $2\,\pi$ for the d and also indirectly for the u instead of $3\,\pi$ for the four heavier quarks.

Those particularities may relate to quarks mixing, which we see in the fraction $19/7 = 38/14$, and the same logic for u also holds since $2 = 38/19 = 14/7$.

$$u : 2 \times 3\pi \;\approx\; 19/1.008,$$
$$d : (19/7) \times 2\pi \;\approx\; 17 \times 1.0032.$$

Hence something unique happens to the u and d.

3.3 Massive Bosons

We assume that the $W^{\pm}$, Z^0 and H^0 acquire their masses from the same geometry; recall that we only have three geometries (or mechanisms) and then we cannot address the weak force bosons and the H^0 separately. Using (2.2), it corresponds to the same resonance, that is on the circular path we must have $N = P = constant$, and only the radial K varies (though this is not exact since we shall later find a slight difference).

A factor $k\pi$ at the denominator of (2.2) is needed since the resonance is supposed circular, but we do not find a perfect fit with k integral. We need a factor $k \approx 1$; it seems at first that we add a degree of freedom but we shall show that it is a geometrical constraint.

The analysis of those masses is iterative and leads to important reasoning which is repeated hereafter in details. In practice:

- The empirical fit gives the resonances, which are $N = P = 12$, and $K = -2, -7, -19$ for the $W^{\pm}$, Z^0 and H^0 respectively. The weak force bosons come in range but the error on the H^0 is 1 GeV. Those numbers immediately suggests the same underlying geometry as quarks and maybe leptons, then the same field combining potentials expressed by D_e and α.
- The empirical value of D for massive bosons is first approximated as $D_b \approx \alpha^2(1+A_S/2-A_S^2/6)$; it suggests an interaction term that depends on α and D_e; the former is known and the later estimated with precision.
- The expression $[D_e(1+\alpha)]^2 = \alpha^2(1+2A_S+A_S^2)$ is similar and may give $D_b \approx \alpha^2(1+A_S/2-A_S^2/6)$ depending on the effective algebra. (Doubling the forces divides the distance, then $2A_S \rightarrow A_S/2$, and the term $-A_S^2/6$ fits with the $K = -6$ in table 2.) .

On this basis we may have enough information to model the interaction; the equations (3.2 – 3.3) suggest:

- Two types of charges corresponding to the mass μ : E and C ($\approx$ electric and color) on which D depends.
- A free field (charges X), and the pressure is given by interactions: $X{\times}X$, $E{\times}X$, and $C{\times}X$, hence D_b includes 3 terms, but its expression is incomplete as we do not yet compute all masses with precision.

Now we shall complete the reasoning, compute the predicted bosons masses, and compare to experimental data.

Classification and immediate identification gives Table 3. It shows that each individual interaction adds a piece of coefficient in D_b — like simple potentials adding or subtracting. But we can only compute a radial distance (which gives a radial strength), not the orientation of the force which can be symmetry-dependent as we discuss rotations.

Table 3: Classification and minimal interpretation of the coefficients.

–	D	Coeff	Interaction	Interpretation/logic
1	D_e	αA_S	$X \times E$	*Leptons*
2	D_q	αA_S	$X \times E$	*Leptons → Quarks*
3	D_q	$\alpha(\alpha A_S)$	$X \times C$	*Quarks Charge*
4	D_b	α^2	$X \times X$	–
5	D_b	$\alpha(\alpha A_S)/2$	$X \times C$	*Quarks → Bosons*
6	D_b	$(\alpha A_S)^2/6$	$(X \times E)^2$	*Leptons → Bosons*

The important point in this table is that quarks charges resume to $X \times C = X \times (X \times E)$, and the coefficient 1/2 line 5 implies two distinct charges (augmenting the force and then reducing the distance). Interpretation details are given hereafter (referring to the line of the Table 3) and lead to understanding.

Leptons — Line 1; charge E.

- $X \times E \rightarrow \alpha A_S$: There is only one elementary interaction; it just gives us its coefficient.

Quarks — Lines 2 and 3; charges E and C.

- $X \times E \rightarrow \alpha A_S$: Same as electrons, and independent of the quark electric charge.
- $X \times C = X \times (X \times E) \rightarrow \alpha(\alpha A_S)$: This is a different interaction; it is not a new kind of charge but it has the same nature and quantum as X.

Massive Bosons — Lines 4, 5, and 6: charges E and C.

We found the same coefficients for the $W^{\pm}$ and the Z^0. One is electrically neutral but not the other. Still, we find coefficients related to electricity and color charge, and then those bosons are made of two fractional electric charges and their two color charges (as we shall see the term charge is abusive here). Then it is:

- $X \times X \rightarrow \alpha^2$: The interaction of two charges X gives a distance α^2. This is the main force on the circular path that other interactions will impact — they are secondary forces or loops impacting this path.
- $X \times C = X \times (X \times E) \rightarrow \alpha(\alpha A_S)/2$: The coefficient $\alpha(\alpha A_S)$ comes with quarks color charge; it also shows that the charges of a weak force boson are equivalent to that of two quarks, and different of that of a lepton. Increasing the force by a factor 2 reduces the length proportionally; thus the factor 1/2.
- $(X{\times}E){\times}(X{\times}E) \rightarrow -(\alpha A_S)^2/6$: This coefficient corresponds to the effect of the main resonance on separate electric charges. We recognize $D_e = \alpha A_S$ from leptons, but 1/6 is new; it is only associated to D_e^2 and this interaction is not present in Tables 1 and 2.

At this point, we understand how the interaction works and we can logically deduce all missing terms in the expression of D_b using α and A_S. For this, we need to complete the series of interaction loops with the field X:

$X{\times}X{\times}X \rightarrow -\alpha^4$: Since $X{\times}X \rightarrow \alpha^2$ positive, and $K < 0$, the force in $X \times X$ is compressive and then this coefficient is scalar (and positive), it increases the compression and then reduces the length: the coefficient is then negative $-\alpha^4$. The next coefficient is positive as it reduces $-\alpha^4$. Similarly, we must add loops indefinitely ($X \times X \times X \times X$ etc.); it gives a simple series converging to $\alpha^2/(1 + \alpha^2)$.

Last, each interaction must be augmented with any number of X where the corresponding length is modified depending on its sign; then the coefficient $-A_S^2/6$ is multiplied by $1/(1+\alpha^2)$ and the coefficient $A_S/2$ by $1/(1-\alpha^2)$. The series make a small difference in D_b which is far from negligible when it comes to computing masses. The coefficient D_b for the $W^{\pm}$ and Z^0 is then:

$$D_{WZ} = \alpha^2 \left(\frac{1}{1+\alpha^2} + \frac{A_S}{2(1-\alpha^2)} - \frac{A_S^2}{6(1+\alpha^2)} \right),$$

$$D_{WZ} = 5.62404904 \times 10^{-5}. \quad (3.4)$$

It also reads:

$$D_{WZ} = \frac{\alpha^2}{1+\alpha^2} + \frac{D_e}{2(1-\alpha^2)} - \frac{D_e^2}{6(1+\alpha^2)}.$$

But it cannot be identical for the H^0, firstly because its spin is not 1. Assuming it holds four charges organized in a tetrahedral manner, a tetrahedron has 6 lines of forces, and the last interaction term is six times stronger:

$$D_H = \alpha^2 \left(\frac{1}{1+\alpha^2} + \frac{A_S}{2(1-\alpha^2)} - \frac{A_S^2}{1+\alpha^2} \right),$$

$$D_H = 5.56338664 \times 10^{-5}. \quad (3.5)$$

Or, alternately,

$$D_H = \frac{\alpha^2}{1+\alpha^2} + \frac{D_e}{2(1-\alpha^2)} - \frac{D_e^2}{1+\alpha^2}.$$

It may also include additional loops thru the tetrahedron. The strength of a line linking two charges is $1/6$, it gives the first term A_S^2 in (3.5), but for the H^0 it propagates thru 6 lines of a tetrahedron and it gives $6\,A_S^4$. But it is not a free field, and then it may not need an infinite number of loops. We shall use a one-loop approximation since additional loops makes a small difference ($\approx -10\,MeV$):

$$D_H = \alpha^2 \left(\frac{1}{1+\alpha^2} + \frac{A_S}{2(1-\alpha^2)} - \frac{A_S^2\,(1+6A_S^2)}{1+\alpha^2} \right),$$

$$D_H = 5.55741566 \times 10^{-5}. \quad (3.6)$$

This expression is the only reason here for A_S to be physical since all others uses of this coefficient reduce to D_e.

Now let us come back to the coefficient k in (2.2). In Table 4, we have $N = P$, and then those two resonances have the same orientation with opposite paths, but we find K in $(-2, -7, -19)$ the same numbers as for the quarks N which resonance is mixed.

Consequently, there is, like for quarks (2.3), a geometrical constraint which here is between the length D_b and the circular path π/NP. Taking only the circular path into account and keeping the constraint coming from the radius, D_b should be a divisor of $\pi/NP = \pi/144$, a division that must hold with any K in $-2, -7, -19$. Since all Ks are primes numbers the constraint applies to their product. In this simplified picture (that cannot hold yet) we should have:

$$(\pi/144)/D_b = 2 \times 7 \times 19 \rightarrow \pi/144 = 266\,D_b$$

Now D_b is radial and a 3-sphere volume depends on the cube of its radius. Then we must use $D_b\pi^{1/3}$ on the right hand side; it gives a modified equation that is close to hold:

$$\pi/144 = 266\,D_b\pi^{1/3}.$$

This equation is equivalent to squaring the circle, then we miss the coefficient k which is now a logical geometrical constraint related to phase lock. In (2.2), π is multiplied by k and this equation addresses a volume; hence we must use its cube on the left hand side, and reduce π accordingly on the right-hand side; in this way we get comparable quantities and it gives the geometrical resonance constraint:

$$k^3\,\pi/144 = 266\,D_b\,(\pi/k)^{1/3}. \quad (3.7)$$

Here the interaction term D_b constrains k thru geometry. The two sides of (3.7) represent lengths, and then taking their cube we get volumes verifying:

$$(266\,D_b)^3 = k^{10}\,\pi^2\,(1/144)^3. \quad (3.8)$$

It equates the volume of a 3-cube of edge $266\,D_b$ on the left hand-side to that of a 4-ball ($V^4 = \pi^2 R^4/2$) divided by half its radius on the right-hand side, where a correction k is needed for cubing the sphere. Here D_b is an interaction term in 4D, k a geometrical wave coherence constraint, and (3.8) links a radial and a circular path in 4D. Now compute from (3.8):

$$(3.4) \rightarrow k_{WZ} = 1.00128565, \quad (3.9.1)$$

$$(3.5) \rightarrow k_H = 0.998033312, \quad (3.9.2)$$

$$(3.6) \rightarrow k_H = 0.997711845. \quad (3.9.3)$$

Using the coefficients above and (2.2), gives the masses in Table 4, where precision is impressive.

Table 4: Bosons resonances in MeV/c^2, H^0 mass in [17].

–	P = N	K	Computed	Measured
$W^{\pm}$	12	−2	80, 384.9	80, 385 ± 15
Z^0	12	−7	91, 187.56	91, 187.6 ± 2.1
H^0	12	−19	125, 206	125.090 ± 240
H^0	12	−19	125, 094	125.090 ± 240

After modeling the interaction we compute the weak force bosons masses in perfect agreement with measurement and it and confirms the validity of our reasoning. We get an effective unified theory of resonances where the forces compositeness decays from leptons and quarks and this is truly unexpected.

In this table, the last two lines correspond to the equations (3.5 – 3.9.2) and (3.6 – 3.9.3) respectively for D_H and k_H.

We can now better analyze the resonance in Table 4. Consider the length $2 \times 7 \times 19 = 266$. A phase lock between the radial and circular paths and the $K = -7$ and -19 imply two circular path lengths which are $L1 = 2\pi(1 - 7/266)$, and $L2 = 2\pi(1 - 19/266)$. Those are compatible if and only if $A\,L1 = B\,L2$, with A and B integral numbers. We must solve the following equation which solution is trivial:

$$\frac{A \times 2\pi(266-7)}{266} = \frac{B \times 2\pi(266-19)}{266},$$

$$A = 266-19 = 247, B = 266-7 = 259, B - A = 12. \quad (3.10)$$

The resonance number, 12, appears on the left hand side of (3.10); it comes from phase coherence between the circular path and the spots on the radius and we naturally get $N = P = A - B = 12$ which then depends only on K (we use only -7 and -19, but $K = -2$ is not a problem since 12 is even).

Finally all numbers and parameters used in Table 4 appear constrained; the specific degree of freedom used here is just geometry. We have two forces coefficients (α and D_e) and no specific coupling in this sector which is then emergent; this result disagrees with the SM concept and requires unification from below (as opposed to distinct fields).

3.4 Bosons widths

The expression (2.2) is a resonance equation and the computed masses correspond to the poles of the resonances. Then it should be possible to compute widths and then lifetimes; at best, the widths are the size of some working resonance "spots"; it would show that this theory gives the SM weak field. For this we have to understand the phase coherence between multiple paths. Recall that the bosons charges are found interacting and organized in a minimal manner; in 3D, it is a tetrahedron for the H^0 and a simple straight line for the Z^0 and $W^\pm$. For the weak force bosons:

With two circular phases the symmetry is loose, it has some freedom, and on the circular path it suffices that N and P hold on 1/2 phase to stabilize the resonance. It authorizes a circular phase shift $\pm\pi/12$ which extends or reduces the sphere; with two charges, it gives on the radial part $\Delta K = (\pm 1/2)(1/12) = \pm 1/24$.

In the radial direction, we have 266 slots, and the same reasoning applies; it adds $\Delta K = \pm 1$.

For the H^0, with 4 charges, the symmetry is fully constrained in 3D; N and P hold together: $\Delta K = 1/144$. A tetrahedron has 6 lines of force that can break; hence the width is reduced accordingly $\Delta K = 1/144/6$. Other loops add nothing since a tetrahedron is fully constrained in 3D.

On this basis, the resonance width is the difference in mass ΔM given by (2.2) with respect to the pole in Table 4 when we use $K + \Delta K$ in (2.2) to compute the particle mass $M + \Delta M$. We get:

$W^\pm \to \Delta K = (1 + 1/24) \to \Gamma_W = 2.0857$ GeV, a perfect match with experiment (2.085 ± 0.042 GeV).

$Z^0 \to \Delta K = (1 + 1/24) \to \Gamma_Z = 2.468$ GeV, 1% less than expected (2.4952 ± 0.0023 GeV).

$H^0 \to \Delta K = 1/(144 \times 6) \to \Gamma_H = 4.10$ MeV, which agrees with the SM prediction at 125.09 GeV.

Hence, the widths come straightforwardly from geometry. But the Z^0 width is out of range and this can only be due to the difference in charges with the $W^\pm$ that we have ignored. Reasoning simply:

$W^\pm$: The charges e/3 and 2e/3 (or opposite) repel each other with a force coefficient $2e^2/9$.

Z^0: The charges e/3 and -e/3 (or 2e/3 and -2e/3) attract each other, the force coefficient is $e^2/9$ or $4e^2/9$.

The difference in inner charges between the Z^0 and the $W\pm$ gives a difference in forces which is:

$$\frac{2e^2}{9} + \frac{e^2}{9} = \frac{e^2}{3} \text{ Or : } \frac{2\mathrm{e}^2}{9} + \frac{4\mathrm{e}^2}{9} = \frac{2\mathrm{e}^2}{3}.$$

It implies that the forces cannot be balanced in the same manner for the two bosons. Assuming the $W^\pm$ width computed value is exact, we need an additional term to compute the Z^0 width. Since the forces in the calculus of D_b depend on charges, from the equations above the missing coefficient is $1.5/137$ or $1.5\,\alpha$. It gives:

$Z^0 \to \Delta K = (1 + 1/24 + 1.5/137) \to \Gamma_Z = 2.4946$ GeV,

which agrees with the SM prediction and experimental data. However the experimental precision for the $W^\pm$ and Z^0 widths differ by one order of magnitude; hence this reasoning, which is differential, is risky and non conclusive.

3.5 Resonance terms, analysis and reduction

The resonance terms found in the previous tables (all N and P) reduce to 2, 3, 7, and 19 in the following manner:

Leptons: 2, 7 – 2, and 7 + 2.

Quarks: 3, 7, 2×7, 19, and 2×19, if we omit the u and d where we know from the CKM matrix that mixing is large as compared to the other angles.

Massive bosons: 12 = 19 – 7.

It is remarkable that $7 = 2^3 - 1^3$, and $19 = 3^3 - 2^3$; here it reduces to the three "symmetry numbers" of U(1), SU(2) and SU(3), and their cubes differences. Moreover for all quarks we get $P = 3$, including the u and d, where the polarity appears, meanwhile for leptons it seems that we have the polarity 2 in a mixed manner. In this way the radial paths are based on 2 and 3, while 7 and 19 only come with circular paths (and unstable or mixing particles).

Moreover, the difference in resonance between the electron and the muon and tau relate to the $K = -7$ of the Z^0, while the heavy quarks decays include a factor 2 in charge and resonance which fit the $K = -2$ of the $W^\pm$.

Therefore we get the strong impression that the equation relates to an intricate resonance scheme based only on the SM symmetries — or something close. The simplicity of the reasoning and numerical results suggest that the mass spectrum may be unavoidable, and since it relies on charges it also suggests the absence of free parameters in nature.

3.6 Charges ratios

The results in this section suggest a single field "below" and it is interesting to estimate charges ratios, but we can only compute their radial effect, not the forces orientation; from the analysis of Table 3 the distances building the Ds are in reverse proportions of charges. Then for the electron, $K = 2$, and for quarks, $K = -6$, and $D_e \approx D_q$.

From Table 3 and the different parameters D, taking into account the differences in K, since we have $X \times E \rightarrow 2 \times D_e$ for the electron and for quarks $X \times C \rightarrow -6\,\alpha\,D_e$; we estimate:

$$\frac{C}{E} = \frac{2\,D_e}{6\,\alpha\,D_e} \rightarrow C = \frac{E}{3\,\alpha},$$

which has a clear scent of monopole; importantly, it does not depend on the quark electric charge since the coefficient 3 (from $K = -6$) is constant in Table 2.

In Table 3, we also have $X \times X \rightarrow \alpha^2$ and $X \times C \rightarrow 6\,\alpha\,D_e$, and then we estimate:

$$\frac{C}{X} = \frac{\alpha^2}{6\,\alpha\,D_e} = 1.4254503 \approx \sqrt{2},$$

which is in the range of 1 and then the same type of charges ($\approx \sqrt{2}$ suggests geometry of the force orientation).

4 Coupling constants

4.1 Introduction

We found two real constants in the expression of the parameters D which represents a length in the equation. In the expressions (3.4 – 3.5 – 3.6) used for D_b those two constants stand on equal grounds. Hence since α is the coupling constant of QED, then D_e is also a coupling constant. It then relates directly to the strong and weak forces couplings (recall that we also have $A_S = D_e/\alpha$ in the range of $\alpha_{S(MZ)}$) and since K appears constant for quarks, D_q should be related to asymptotic freedom. Therefore it seems that the equation addresses a field below with two and only two couplings (neglecting gravitation for now).

Since all resonances are integral (N, P, K) and reduce to a few numbers, it is minimal and elegant to generalize the concept and assume that the field is entirely self-quantizing (or self-constraining) and that quantization is entirely based on geometry and integral numbers; in this way, those two coupling correspond to some counter-resonances ($1/N \rightarrow N$ or $N \rightarrow N$) and then to constant path lengths (or relative path lengths).

In practice the only known constant integral path length is that of photons for which $r^2 - c^2t^2 = 0$. At the opposite, in special relativity, massive particles obey $r^2 - c^2t^2 = const \neq 0$ which we write $r^2 - c^2t^2 - const = 0$. But now the paths of the resonance define the massive particles — *we mean entirely*; it is a repeat pattern that fits into this equation and it first implies that the path includes a rotation which is around the time axis. Then we guess that D_e (as a length) must be computed from a pseudo-norm like expression of the form:

$$n^2 + m\,\pi^2 - p^2 = D_e^{-2}$$

where the central term introduces a rotation and n, m, and p are expressions based on the resonance terms. Now of course, α must obey a similar pattern and, since α and D_e have distinct but complimentary roles, the expressions giving D_e and α should use resonance terms in a complimentary manner. Last, the bosons resonances are based on 4-dimensional paths; then n, m, and p must be seen as the coordinates of a 4-path which projection on 3-dimensional space gives real numbers.

Because of 4D resonances, we shall suppose that there is no punctual particle or 1D string and that the field is entirely fluid. It implies that some currents propagating in a direction orthogonal to the observable 3-space (possibly back and/or forth in time) are preserving and propagating the characteristics of the particle and we shall abusively denote those "time-currents". In this way the electric field of the electron is seen similar to the effect of a magnetic current propagating forward and/or backward in time with respect to the present. Here the present is seen as the surface of an expanding 4-sphere, but 4D space is assumed preexisting and permanent.

It results in an interesting minimal model where all known massive particles are composites of time-currents:

Leptons:

- e^- : $[\uparrow^-\downarrow^+]$,
- μ^- : $[\uparrow^-\downarrow^+\,\downarrow^-\downarrow^+]$,
- τ^- : $[\uparrow^-\downarrow^+\,\uparrow^-\uparrow^+]$.

Quarks:

- t^+ : $[\uparrow^+\downarrow^-\downarrow^+\uparrow^-\uparrow^+]$,
- b^- : $[\downarrow^+\uparrow^-\uparrow^+]$,
- $c+$: $[\uparrow^+\downarrow^-\downarrow^+]$,
- s^- : $[\downarrow^+]$.

Bosons:

- Z^0: $[\downarrow^+\downarrow^-]$,
- $W^\pm$: $[\uparrow^+\downarrow^-]$ and $[\uparrow^-\downarrow^+]$,
- H^0 : $[\uparrow^+\uparrow^-\downarrow^+\downarrow^-]$.

where the notations are trivial for up-time and down-time currents sign and directions (the sign is the current, not the electric charge which, by convention, is inverted for down currents); the apparent electric charge is $2/3$ for an up-time current and 1/3 for a down-current (still by convention). Several aspects of the model are of interest:

- The model is based on 4 dimensions of space; it is then coherent with the calculus of the coefficient k used for bosons, but it is also reminiscent of QCD where quarks live in 4 dimensions.
- The difference between the H^0 and the weak bosons is consistent with the calculus of D_{WZ} and D_H.
- All quarks decays consist in a separation of currents where the sum of the produced $W^{\pm}$ boson's current and quark is equal to the currents of the original quark (and of course the picture is reversible).
- The same is valid for leptons decay, but with a Z^0.
- There is no room to make a d quark except by mixing (and the d comes with resonances ratios).
- The notion of time-currents removes the need for particles "inhabiting space". In this way, the concept is minimalist and particularly elegant since, eventually, it must result in self-quantizing movement where we do not need to distinguish space and matter.
- All particles include a down-type current (taking this as strict rule implies mixing for the u and d, and the absence of FCNC). The model agree with Cramer's interpretation of quantum mechanics — though in an almost classical 4-dimensional manner. All particles are connected to and can send information to their past or receive some from their future because a communication channel exists which is the particle itself.

4.2 Coincidences

In this sub-section we discuss three numerical coincidences involving the numerical values found in section 3. In this way, we seek coherence with known but older theory.

4.2.1 Lamb shift, Bethe's equation

Bethe [1] computes the hydrogen Lamb shift; he gets:

$$\Delta E = \frac{\alpha^5\, m_e\, c^2}{6\,\pi}\, \ln\left(\frac{m_e^2\, c^2}{8.9\,\alpha^2\, m_e^2\, c^2}\right), \qquad (4.1)$$

where m_e is the electron mass; the expression in the logarithm depends on the cutoff and gives a ratio between the electron absorption and self-interaction and then in our model μ and $(m_e - \mu)$ respectively (though according to the mass-equation, self-interaction and absorption may be reversed with respect to QED,) we find:

$$\frac{(m_e - \mu)}{\mu} = \frac{1}{8.8857\,\alpha^2}. \qquad (4.2)$$

The relative difference with respect to Bethe's result is 1.6×10^{-3} (or 2×10^{-4} for ΔE) and then μ seems relevant with respect to Bethe's analysis. We notice a similar coincidence:

$$\frac{(m_e - \mu)}{\mu} \approx \frac{\sqrt{2}}{4\pi\,\alpha^2}. \qquad (4.3)$$

The relative error in (4.3) is $\approx 1.25\times10^{-5}$. Consequently, since Bethe's paper is seen as the very first step to QED, X and μ should be fundamental quantities directly linked to QED.

4.2.2 The electron mass and spin, rough analysis of the coincidences

A physical action is a product of charges or currents; then we analyze action and not energy. Accordingly, the electron mass comes as a repeated action ($E = h\nu$).

Action is a product that we first write in complex form:

$$\left(G + \frac{i\,e}{2}\right)\left(G - \frac{i\,e}{2}\right) = G^2 + \frac{e^2}{4} \rightarrow m_e, \qquad (4.4)$$

where e/2 represents the currents, not the apparent charges, and G the resonant component. Now we write (4.4) in quaternion form:

$$\left(G + \frac{i\,e}{2}\right)\left(G + \frac{k\,e}{2}\right) = G^2 - \frac{j\,e^2}{4} + (k+i)\frac{e\,G}{2}. \qquad (4.5)$$

Those equations may approach the natural algebra, but the result seems wrong. Still, assume the algebra is broken, (4.4) gives the mass and (4.5) angular momentum:

$$G^2 + \frac{e^2}{4} \rightarrow m_e;\ (k\ +\ i)\frac{e\,G}{2} \rightarrow angular\,momenta. \qquad (4.6)$$

The angular momentum splits into two components on orthogonal axis — which agrees with the idea of time-currents. Then one is the magnetic moment and the other is along the time axis; we will denote the latter "spin". Now we identify the squared charges in (4.6) with the masses in (4.3); it gives:

$$4\pi\,\alpha^2 G^2 \approx e^2\frac{\sqrt{2}}{4}.$$

Substituting G with a Dirac charge, we get $1 \approx \sqrt{(2)}/4\pi$; now multiply each side of this ridiculous result by the Planck constant we get the following correspondence:

$$h \leftrightarrow \sqrt{2}\,\frac{\hbar}{2} = \left|(k+i)\frac{e\,G}{2}\right|, \qquad (4.7)$$

which interpretation is obvious: a repeated action h is energy ($E = h\nu$) and it makes the leptons spin and magnetic moment.

4.2.3 The Dirac condition and the parameters X and μ

Dirac [8] analyzes the possibility of existence of magnetic monopoles using quantum mechanics. Based on the mathematical properties of the electron wave function interpreted as a density of probability of presence, he shows that a magnetic monopole is compatible with the existence of quantum mechanics in Hamiltonian form if and only if the so called Dirac condition is respected:

$$e\,g = \frac{(n\,\hbar\,c)}{2} \rightarrow g = \frac{n\,e}{2\,\alpha}. \tag{4.8}$$

It results in the elegant idea that the existence of magnetic poles fixes the electric charge and conversely.

Now let us assume that the electron wave is a magnetic current; since Dirac's demonstration is based on the "fields of force" acting on the electron wave then magnetic currents acting on electric charges must obey the same condition. But in our model e is an apparent charge (say e_e) and also a sum of time-currents (say e_m) and its monopole (denoted g_m).

Both must be taken into account in the condition as part of the total current; then the condition is:

$$e_e(g_m\ +\ e_m) = \frac{(n\,\hbar\,c)}{2}. \tag{4.9}$$

Now compare with our data and use $e_m = e_e$. The fundamental resonance in equation (2.1) corresponds to a theoretical half electron, that is $N = P = 1, K = 0$, and a self-energy $\mu/2$ that we shall ignore. It gives, as per (1 – 3.3):

$$m = X/1 = 8.1451213299073\,\mathrm{keV/c^2}. \tag{4.10}$$

This mass must be compared to μ as it comes from the interaction of the time-currents (not the apparent charges) and then, for an electron, as the product $e^2/4$. The rest of the electron mass (N = P = K = 2) is given by the resonance; then in (4.10) the numbers (N = P = 1) correspond to a hypothetical particle where a current G is interacting with $e/2$ which mass is given by an action corresponding to $Ge/2$.

Now we analyze how action comes as a product of currents, but not energy for which we rely on resonances. In the hypothetical resonance above, it corresponds to the products $e\,G$ and $e^2/4$, where G^2 is absent. It leads to a correspondence between action and energy:

$$\frac{e\,G}{2} \leftrightarrow m; \quad \frac{e^2}{4} \leftrightarrow \mu. \tag{4.11}$$

We divide the two expressions in (4.11) and in light of (4.9) we add $\mu/2$ that we initially ignored; we find:

$$\frac{2\,G}{e} = \frac{m}{\mu} \rightarrow 4\,G\,+\,e = 68.4051246306057\,e \approx \frac{e}{2\,\alpha}. \tag{4.12}$$

We *want* to recognize here the modified Dirac condition in (4.5), because the fine structure constant appears linked to the equation parameters.

But the result seems approximate; at first the relative discrepancy (-1.65×10^{-3}) seems acceptable since we analyze a hypothetical particle but we shall see that this numerical value holds precisely.

There is a second aspect related to the Dirac condition which comes from the time-currents model and the apparent electric charges $e/3$ and $2e/3$ going respectively down and up the time; assume their individual self interactions are squared charges. Once again, we can link action and energy:

$$(e/3)^2\ +\ (2e/3)^2 \rightarrow \mu(1/3)^2 + \mu(2/3)^2 = 5\mu/9. \tag{4.13}$$

Now from (4.10):

$$4(m + 5\mu/9)/\mu = 137.032471483434 \approx 1/\alpha \tag{4.14}$$

The relative discrepancy with respect to α is $\approx 2.26\times10^{-5}$. The coincidence can, at first sight, be seen redundant with the equation (4.12) as it is almost identical, but it comes from a different interaction and we shall see now that this value also holds.

4.3 Leptons magnetic moment anomaly

We assumed that the resonances in the previous section "construct" the leptons waves; unlike the classical wave equations the geometrical construction is not unique but lepton-dependent. Thus, even for the electron it seems hardly possible to make an exact link with the Dirac equation which, according to (2.1), should be too general; consequently we go back to de Broglie's thesis which is fully relativistic.

4.3.1 De Broglie wave geometry

In his thesis, de Broglie uses a standing wave, that we will denote the Compton wave and finds a phase wave as a result of the relativistic transformation of the former. The agreement of the stationary wave assumption with the results in Table 1 is straightforward since we get N = P for all leptons.

The change in phase of the de Broglie wave over the first Bohr orbit of a hydrogen atom is $2\,\pi$, while the Compton wavelength change in phase over this orbit is $2\,\pi/\alpha$. Then over any number of Compton wavelengths, we have:

$$\Delta\phi_D = \alpha\,\Delta\phi_C, \tag{4.15}$$

where $\Delta\phi_D$ and $\Delta\phi_C$ are the changes in phase of the de Broglie and Compton waves over any length. On the n^{th} orbit we find:

$$\Delta\phi_D = \frac{\alpha\,\Delta\phi_C}{n}, \tag{4.16}$$

There are n de Broglie wavelengths around the n^{th} Bohr orbit and we get a constant angular differential term α. The same reasoning applies in the case of a nucleus of charge $Z\,e$ and gives the same value. Hence, considering that the de Broglie wave defines the motion of the electron this term is universal in the Bohr model. As a result, and taking into account simultaneously the motion of the electron and the phase velocity of the de Broglie wave going around the proton, the

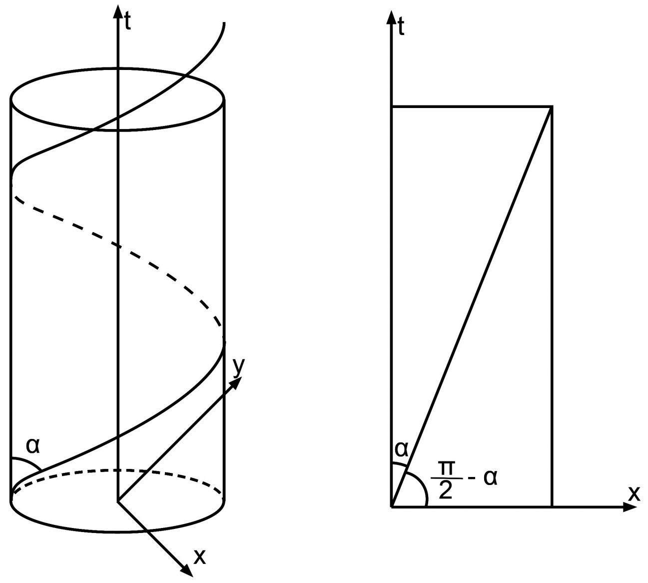

Fig. 1: Left, the electron classical Bohr orbit; right, the same cylinder unfolded (the angle is $\approx \alpha$).

phases of the two waves at any location of the electron classical trajectory are permanently identical.

Assume α is a path length based on integral and geometrical numbers. On the cylinder Figure 1, and using a system of unit where the radius of the cylinder is 1, the length of the unfolded tangent is approximated with $L \approx \sqrt{137^2 + (2\pi)^2}$. Now we know that the electron spin is 1/2, and then the rotation of the resonance is reduced to π when the electron runs one turn; we get the well-known $\sqrt{137^2 + \pi^2} \approx \alpha$.

Consider now the de Broglie wave as a shortcut permanently joining the electron with itself, but one (or n) Compton wavelength later, with an action 1/137/2 (taking again the spin 1/2 into account), it gives:

$$\alpha^{-1} \approx \sqrt{137^2 + \pi^2 - \frac{1}{137} \times \frac{1}{2}}$$

which holds with a relative precision $\approx 3 \times 10^{-8}$. Last, consider that the electron progresses in time, but that its waves are composed of two currents going up and down. If the up-time part of the waves gives a factor 1/2, the down-time part sees the electron with a charge twice lesser since in the case of quarks the down-time and up-time currents manifest fields 1/3 and 2/3 respectively. It must be augmented with a resonance length dependent on the time-velocity of the electron; twice longer for the same reason (charges 1/3, 2/3); finally it gives a factor 1/8 for the down-time part and we get:

$$\alpha^{-1} = \sqrt{137^2 + \pi^2 - \frac{1}{137}\left(\frac{1}{2} + \frac{1}{8}\right)}$$

$$\rightarrow \alpha = 72\,973\,525\,698 \times 10^{-13}$$

which is *exactly* the value of α given in CODATA 2012! Considering precision together with the simplicity of this geometry, it looks pretty much like time-currents exist.

In special relativity, one would consider the so called rapidity of the electron defined as a hyperbolic angle. However, the path length α can also be seen as a simple angle in the Euclidean coordinates $(x, y, z, i\,ct)$ as originally used by Minkowski. Moreover, one must consider this angle universal, and it implies a complimentary angle $\pi/2 - \alpha$. At first the existence of those angles can be checked numerically as it must also correspond to the coincidence (4.3); after appropriate replacements of α^2 by two coefficients corresponding to the two angles α and $(\pi/2 - \alpha)$, the equation (4.3) gives:

$$4\pi\,(m_e - \mu)\,\sin(\alpha)\left[\left(\frac{\pi}{2} - \alpha\right)\sin\left(\frac{\alpha}{\pi/2 - \alpha}\right)\right] = \mu\sqrt{2},$$

which holds with a relative precision of 2.9×10^{-8} instead of 1.25×10^{-5} for (4.3).

4.3.2 Other resonance coefficients and action

When the electron is on the first orbit there is a rotation of the time-current of a hyperbolic angle α which ratio to the space current changes in proportion of the hyperbolic tangent of this angle. As stated, the impact is a phase differential and considering resonances, a simple angle gives $tan(\alpha)$; it runs around the full Bohr orbit and then the instantaneous action term is $tan(\alpha)/2\pi$. The action given by $tan(\alpha)$ is that of a resonance going around the full orbit.

It must cycle on 1/2 quantum; hence the first correction term to the electron magnetic moment anomaly is:

$$a_0^e = \frac{tan(\alpha)}{2\pi} \approx \frac{g-2}{2} \qquad (4.17)$$

where we denote a_0 and g the correction and the g-factor respectively. Compare to the first order QED correction by Schwinger [12], the well known $\alpha/2\pi$. The difference comes from a different manner to taking into account relativistic effects. Here it suggests that taking into account together the particle resonances and special relativity in the original Minkowski manner could give an analytic solution. In facts, the difference is that we consider the electron as a 4D gyroscope which axis is bent by velocity. This axis is shown with the orientation of the resonances N, P, K in Figure 2.

Therefore in (2.1) the resonance $N\,P$ corresponds to G^2 in (4.13) while K corresponds to $e^2/4$. The product $N\,P$ makes and "absorbs" the spin and the full space-resonance cycle is then $(N\,P\ -\ 2)\,K$ which is a product G^2e^2 while the spin is given by $G\,e$. Action depends on the number of currents C (which, according to the model, is lepton-dependent) while the mass μ is constant; then we divide this coefficient by the number of currents.

We get a spin-dependent coefficient where the spin relates to the interaction of the G-currents and the apparent electric charges — which is logical. It is:

$$E = \sqrt{\frac{NP-2}{C}K}. \tag{4.18}$$

In the direction of time (K in Figure 2), the same reasoning gives NK^2 for a product $e^2/4$. But we get a spin independent coefficient which relates only to the currents and does not need a square root; it is:

$$F = \frac{N\,K^2}{4}. \tag{4.19}$$

The coefficients above are valid for an electron but for the muon and tau the coefficient a_0 corresponding to the time current rotation is not α like in (4.17), it depends on the resonance numbers. The electron is the special case because all resonance numbers are identical and even (N = P = K = 2) and then all phases are identical.

For the muon and the tau, N = P and K are odd and prime with each other, and then the action cycle is $N\,K$. Using (4.18) for an electron, the cycle uses N = K = 2 and its angle should be written $2\,\alpha/2$. Then for a muon and a tau the corresponding coefficient is:

$$\phi = \frac{tan(N\,K\,\alpha/2)}{NK/2}, \qquad a_0 = \frac{\phi}{2\,\pi}. \tag{4.20}$$

The expression mixes angles and resonance and fits with the interaction of current where action is angle-dependent; it will be the geometric form used in this section. We introduce $\alpha/2$ which we now consider as the physical angle of each time-current — it gives α for two currents of opposite directions taken together.

4.3.3 The electron

Now we want to compute the anomaly from the following picture: the electron is seen as a 4D rotation which (in all cases) has the following mathematical property: two orthogonal planes exist which are conserved by the rotation. The identifications are then obvious; the angles in the previous section define the two planes rotations and correspond to the resonances. The rotation is said double since we find distinct angles α and $(\pi/2-\alpha)$. The planes intersect at a single point (a mathematical property of any 4D rotation) where the resonances apply, and it defines the punctual particle — but we do not need to introduce anything material at this place (no particle). The planes intersection point also moves in space and in the direction of time defining a classical trajectory.

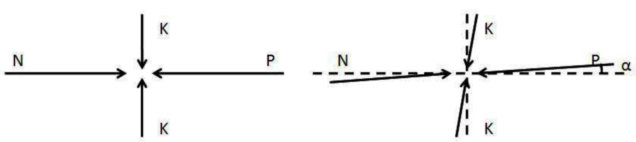

Fig. 2: Resonance geometry on N, P, and K. Left: an electron seen at rest, K on the time axis, N and P in 3-space. Right: an angle $\approx \alpha$ appears as a relativistic shift on the first Bohr orbit where axes are bent by velocity.

One plane is orthogonal to the time axis and hosts the leptons resonances N = P, and K is on the other one which includes the "time translation" of the particle. Finally those two planes are lepton-independent and then their translation and the associated angles define entirely the seemingly anomalous values in (4.8 – 4.10) as they are also lepton-independent. Consequently, the lepton-dependent resonances imply different magnetic moment anomalies. Therefore we can reverse-compute the anomaly from those two quantities. In this way, we define:

From (4.8): $4(X/\mu + 1/2) = \beta_1^{-1} = 136.810249261211$,

From (4.10): $4(X/\mu + 5/9) = \beta_2^{-1} = 137.032471483434$.

The Dirac equation gives $g = 2$ and it is known that the correction is entirely related to relativistic shifts. The quantities above correspond to distinct interactions and then distinct types of charges; hence the correction is a product $a_T = a_0\,a_1\,a_2$ where a_0 is geometrical and corresponds to the angle α in (4.17) or ϕ in (4.20), a_1 to the action of the apparent electric charges (4.10), and a_2 to the action of (magnetic) currents (4.8).

Since β_1 and β_2 are deduced from the leptons masses, they are related to the tangent of some angles part of the resonance geometry (in the same manner as $tan(\alpha)/2\pi$). The anomaly is angular and differential and then a_1 and a_2 must be computed as ratios involving α and the arctangents of some angles involving respectively β_2 or β_1, and resonance numbers. The electron correction term a_1^e is then given by an expression of following form:

$$\frac{\tan(\alpha)Y}{\tan^{-1}(\beta_2 Y)} \rightarrow a_1^e.$$

It links an action given by the angle α and another one given by β_2 and the anomaly relates to their ratio. Now β_2 relates to the apparent electric charges giving the spin; then $Y = E$ as defined in (4.18). The angle $\alpha/2$ also impacts the coefficient and subtracts from K.

Then we write:

$$E \rightarrow \sqrt{\frac{NP-2}{C}\left(K+\frac{\alpha}{2}\right)} \tag{4.21}$$

$$a_1^e = \frac{\tan(\alpha)\sqrt{2+\alpha/2}}{\tan^{-1}\left(\beta_2\sqrt{2+\alpha/2}\right)} \tag{4.21.1}$$

Now β_1 comes from the time-currents of the electron; we must make a similar reasoning involving F defined in (4.19).

Naturally, this correction will be similar in form to the equation above. The logic is:

- The first order effect is null; it is second order where the cross-products cancel.
- The angle must be α instead of $\alpha/2$ since the two angles $\alpha/2$ on the axis of K sum up.

It gives, for an electron:

$$a_2^e = \frac{\tan(\alpha) F\left(1-\alpha^2\right)}{\tan^{-1}\left(\beta_1 F\left(1-\alpha^2\right)\right)}, \tag{4.22}$$

$$a_2^e = \frac{\tan(\alpha)\left(2-2\alpha^2\right)}{\tan^{-1}\left(\beta_1\left(2-2\alpha^2\right)\right)}. \tag{4.22.1}$$

Note that in the equations (4.21 – 4.22) the angle $\alpha/2$ affects K and $-\alpha^2$ affects K^2; it is the same geometry where only K is impacted. Now from (4.17 – 4.21.1 – 4.22.1) and using the value of α in CODATA 1014 we find:

$$g_T^e/2 = 1 + a_0\, a_1\, a_2 = 1.00115965218091. \tag{4.23}$$

The values of X and μ in (3.1) were tuned to fit with CODATA 2014 which gives:

$$g^e/2 = 1.00115965218091\,(26). \tag{4.24}$$

The relative error on g_T^e in (4.23) with respect to (4.24) is less than 10^{-14}, but it can be down to $\approx 10^{-8} - 10^{-9}$ without ad-hoc tuning and keeping all leptons masses within uncertainty — the result would still be very significant.

4.3.4 The muon and tau

We get the equations needed to compute the muon anomaly in the same manner as for the electron but using (4.20) and including in (4.21) the four currents given by the model, and the resonance numbers in Table 1. We get:

$$g_T^\mu/2 = 1.00116592081. \tag{4.25}$$

The CODATA 2014 experimental value is:

$$g^\mu/2 = 1.00116592089\,(63). \tag{4.26}$$

The result is well within experimental uncertainty and independent of the adjustments of (3.1) since the precision is in the range 10^{-9}. The SM prediction disagrees with a $2-4\sigma$ discrepancy. Typically:

$$a^\mu_{SM} - a^\mu_{experiment} = (2.8 \pm 0.8) \times 10^{-9}. \tag{4.27}$$

The very short lifetime of the tau makes impossible at present to measure its $(g-2)$. The SM prediction is:

$$g^\tau_{SM}/2 = 1.00117721\,(5). \tag{4.28}$$

Using the tau resonances in Table 1 we get:

$$g_T^\tau/2 = 1.00125789. \tag{4.29}$$

But on the other hand, in the tau resonance, N = P = 9 is not a prime number, it is a square and then, perhaps, we should use 3 instead of 9 in the equations to compute its anomaly (we find a second reason later). It gives:

$$g_T^\tau/2 = 1.00117037, \tag{4.30}$$

where the difference with the SM prediction is more coherent with that of muons.

4.4 The fine structure constant

We made a first calculus of α as a simple path length. Now we shall first show that the shortcuts in this path length, namely 1/2 and 1/8, also defines the leptons resonances, and then find an immediate origin to the number 137.

4.4.1 A second view on leptons resonances

Our analysis of the resonances in Table 1 fits with the supposed geometry, and complimentary angles α and $(\pi/2 - \alpha)$. It is a quasi-symmetrical picture that suggests the existence of a second view on the leptons resonances agreeing with the equation (2.1). In this equation we use three resonance terms (N, P, and K), but the rotation is in 4 dimensions; then the resonance terms correspond to one rotation plane used completely (N, and P), while K lives in the other plane but we only use an axis (not the full plane). The second view should split oppositely; it cannot hold with $N = P$ but it must with $P = K$ because of phase coherence. Then using angular ratios, we should have a different mass: $\mu' \approx \mu\,\pi/2 \approx 380$ eV/c^2. Starting with this value, imposing P = K, and using the equation (2.1), an empirical fit to the same decimal as shown in Table 1 gives Table 5 and the coefficients in (4.31).

Table 5: Second view on electron, muon, tau in MeV/c^2.

–	P=K	N	Computed	Measured
e	2	2	0.510 998 9461	0.510 998 9461(31)
μ	3	8	105.658 3752	105.658 3745(24)
τ	4	16	1 776.84	1 776.82(16)

$$\begin{aligned} \mu' &= 385.6750521055\,\text{eV/c}^2, \\ D' &= 0.0002255984538, \\ X' &= 8.02160795579\,\text{keV/c}^2. \end{aligned} \tag{4.31}$$

$P = K$ is verified, and we can estimate:

$$\mu' = \mu\left(\frac{\pi}{2} + \frac{\pi}{137} + \left(\frac{2\pi}{137}\right)^2\right),$$

which was used to compute (4.31); it uses 1/137 and no simple fit was found with α.

The remarkable point in Table 5 is that we find for N the numbers 2 and 8, and their product 16 for the tau. Those numbers show that, in the EM field, the resonance is tachyonic and the shortcuts can ring independently or in a combined manner. The product 16 also justifies our doubts for the tau $(g-2)$ in (4.29).

4.4.2 Alpha and 137

Following the first equation giving α, assuming time-currents exist and correspond to $e/2 \rightarrow 1/274$ we find an empirical fit compatible with CODATA 2014:

$$\alpha^{-1} = \sqrt{137^2 + \pi^2 + \frac{1}{274^2} - \frac{1}{137}\left(\frac{1}{2} + \frac{1}{8}\right)}$$

$$\rightarrow \alpha = 72\,973\,525\,672 \times 10^{-13}, \qquad (4.32)$$

where the difference with CODATA 2014 is about half the standard deviation:

$$\alpha_{CODATA\,2014} = 72\,973\,525\,664\,(17) \times 10^{-13}.$$

But now, why 137? A straightforward calculus gives a possible origin; taking all integral N and P from all tables, we get a seemingly absurd suite of numbers that sums to:

$$\Sigma_{NP} = 2 + 3 + 4 + 5 + 7 + 8 + 9 + 12 + 14 + 16 + 19 + 38 = 137. \qquad (4.33)$$

Is that a coincidence, or rather the signature of a discrete wave packet? If one thinks of exponentiation, each term of the sum corresponds to a different piece of the phase of a unique signal which includes all symmetries and all the manners they combine, interact and condense (or ring). Since N and P are space currents, Σ_{NP} defines a universal oscillator. With respect to field theory, it is straightforward that such a wave includes or represents all virtual particles fields.

A complimentary result on $K \rightarrow 274$ seems doubtful; however, taking 266 from bosons instead of (-2, -7, -19), and the distinct values of K from leptons and quarks, we notice:

$$\Sigma_K = (2 \times 7 \times 19) + 2 + 3 + 4 + 5 - 6 = 274. \qquad (4.34)$$

The interpretation is less obvious and the link with known theory is nil, because this quantity addresses the effect in space of vibrations or rotations along the time axis and their participation to particles mass and interactions; there is no such concept in known theory.

In any case, those relations are complimentary to each other and provide with numerical coherence linked to the concepts developed before.

4.4.3 Splitting D_e and D'

Now, α is a 4D path length as seen in 3+1D, then the couplings D' (4.31) and D_e (3.1) should have a similar form but in a complimentary manner with respect to the resonance terms; hence they should also be expressed with similar expressions but using 3, 7, and 19 (the resonances of quarks) and $\Sigma_K = 274$; we find the following empirical fit which terms show an obvious symmetry:

$$D_e^{-1} = \sqrt{((7-3) \times (274 + 19))^2 + 7\pi^2 - \frac{19\pi}{19-1}}, \qquad (4.35.1)$$

$$D'^{-1} = \sqrt{((19-3)(274+3))^2 + 2^2 \times 3 \times 7\pi^2 - \frac{3}{3-1}}. \qquad (4.35.2)$$

Those expressions were used to compute the values in (3.1 – 4.31) and then all masses.

Several aspects are remarkable in those expressions:

- We notice that 274 + 3 = 277 and 274 + 19 = 293 are also prime numbers; hence those are not reducible. Their difference is 16 which is also $(7-3)^2$ in D_e and (19 – 3) in D'.
- The rotation term $7\pi^2$ in (4.36.1) is a perfect fit with the μ and τ resonances (5 = 7 – 2, and 9 = 7 + 2), where 7 was inferred a rotation.
- D' includes a factor 2, which can be inserted in K in Table 5, but not in P; then P and K act on the time and magnetic moment axis respectively and it must be identical to the classical g-factor = 2. This is necessary since Table 5 is in the symmetry of QED.

Importantly, the expressions above are obtained by simple divisions based on the initial empirical fit of the D_e and D'. The left term is the closest square to the empirical value of D^{-2} from which it is subtracted; the middle integral term is the division of the rest by π^2 that gives a small residual term. Then we search to express all terms with integral numbers — preferably those we expect.

5 Gravitation, the keystone

The mass equation and the time-current model are coherent with Cramer's transactional interpretation of quantum mechanics which fills the gap of non-locality (the true signature of quantum physics) but without spooky action in 3-space.

Since the reasoning to the mass equation (thru N and P) and Cramer's interpretation are relevant in absorber theory and uses a pressure field, gravity must be analyzed in a shielding manner using Wheeler-Feynman equations [13, 14]; in this way, it was shown compatible with gravitation in a recent paper [6]. It does not require the existence of dark matter to explain the observations at the origin of this hypothesis and it also explains the cosmos energy densities (visible, dark, and visible + dark). In this section, we shall not restate the piece of theory in [6] but only the logic and main results.

The absorber free energy equivalent mass M_A is given by symmetry of the absorber process in gravitation; we first write the energetic part of the Schwarzshild metric:

$$c^2\, d\tau^2 = (c^2 - 2\,G\,m/r)\,dt^2 - \frac{c^2}{c^2 - 2\,G\,m/r}(dx^2 + dy^2 + dz^2)$$

Then, in the spirit of absorber theory, we symmetrize the equation in geometry and mass terms:

$$\frac{2\,G\,m}{r} = \frac{m\,R_u}{M_A\,r} \rightarrow \frac{R_U}{2\,M_A} = \frac{G}{c^2}, \tag{5.1}$$

$$\rightarrow M_A = \frac{R_U\,c^2}{2\,G} = \frac{P_p\,T}{2\,c^2} = 9.790 \times 10^{52}\ \text{kg} \tag{5.2}$$

where $R_U = cT$, $T = 1/H$ is the age of the event horizon while H is the Hubble factor and P_p is the Planck power.

Concerning visible energies $M_V c^2$, the ratio M_V/M_A is a geometrical constant. This constant links a 4-volume and a linear interaction in 3-space; the surface of a 4-sphere is $2\,\pi^2\,R^3$, and then the factor 2 in (5.2) becomes $4\,\pi^2$ in $3 + 1D$ where visible energies interact thru the light cone. It gives:

$$\frac{M_A}{M_V} = 2\pi^2 \rightarrow M_V = 4.453 \times 10^{51}\ \text{kg}. \tag{5.3}$$

Summing, we get the total energy M_U of the visible universe:

$$M_U = M_A + M_V = 9.236 \times 10^{52}\ \text{kg}. \tag{5.4}$$

It gives to a total density $\rho = 9.91 \times 10^{-27}$ kg/m^3 and the visible energy (5.3) is 4.82% of the total. The benchmark at this time is the Planck mission results [20] which gives $\rho = 9.90\,(6) \times 10^{-27}$ kg/m^3 and 4.86 (10)% of visible matter. Hence according to the standard model of cosmology we get valid quantities. The equation (5.1) also means that the rate of dark energy creation (M_A) since the initial bang is constant and half the non-reduced Planck power: the universe energy is identical to its expansion and we do not find a big bang but a permanent process. Next, using the Wheeler-Feynman equations or Newtonian gravity this creation gives an acceleration excess up to $H\,c$ at the galaxy borders, meaning the absence of dark matter.

But now what is the relation with our analysis of mass? According to (4.34 – 4.35), the numbers 137 and 266 address space and time respectively. They interfere at the point of origin which is visible thru the solid angle 4π, and we should find there the reduced Planck mass giving the Planck power:

$$M_p = \sqrt{\frac{hc}{G}} \times \frac{1}{4\pi} = 2.43536\,(6) \times 10^{18}\ \text{GeV/c}^2.$$

Using the mass equation (2.1) with the parameters in (3.1) and taking $N = P = 137^2$, and $K = +1/266^2$ gives a mass:

$$M = 2.464 \times 10^{18}\ \text{GeV/c}^2,$$

which is very close to Mp.

Looking at (4.36.1), we find $7\pi^2$ in the expression of D_e while 19 has a role similar to 7 in the case of quarks (N, Table 2) and bosons (K, and N = P = 19 – 7 in Table 4); then in order to symmetrize the equation we take:

$$N = P = 137^2 - 19\,\pi^2;\ K = +1/266^2,$$

$$M = 2.43526 \times 10^{18}\ \text{GeV/c}^2.$$

Finally, the next two decimals are given by addition of $\approx 2/3$ to $N = P$; a small empirical term which is expected as it makes this expression homogeneous to coupling:

$$N = P = 137^2 - 19\,\pi^2 + 2/3;\ K = +1/266^2, \tag{5.5}$$

$$M = 2.43536 \times 10^{18}\ \text{GeV/c}^2. \tag{5.6}$$

Since $1/(N\,P) < K\,D$ this resonance is not permitted in 3+1D.

Considering that we now discuss reconciliation of quantum theory and general relativity through a common origin this result is keystone on top of the study. It shows that the same field also leads gravitation.

Here we can define a unit-less quantum gravitational coupling constant which reads:

$$\alpha_G = \frac{X^2}{M_p^2} = \left(\frac{1}{(137^2 - 19\pi^2 + 2/3)^2} + \frac{D_e}{266^2}\right)^6, \tag{5.7}$$

$$\alpha_G = 1.1186 \times 10^{-47},$$

where we see that the rest of quantization lives in and from a single oscillator defining gravity; it is "below" quantum theory and it does not need the existence of a graviton particle.

Unlike the classical definitions of α_G, since X is universal and represents the pressure field, (5.7) is unique and does not depend on an arbitrary choice of mass.

But now the ratio of the electron mass to the Planck mass is constant, which seems a contradiction with (5.1). On the other hand, the observable cosmos has constant atomic physic and chemistry and then its laws use relative constants varying in time and not absolute ones. Thus, only unit-less quantities are constant; since G is used with constant masses in classical theories, then hc and G vary together in the same manner as $\alpha = e^2/\hbar c$ is constant.

Therefore, here is the big picture, the minimal interpretation of all results in this paper (no doubt it can be made more complex and elegant):

- A Planck particle exists at the origin; it emits a wave of Planck length and time. This resonance exists in 4 dimensions, it is not energy but its wave defines the quantum of action.
- This wave interacts thru the light cone (and gives 137 in α), and thru a radial line (giving 266 and 274). In a symmetric absorber concept, it means that the universe and its origin are quantizing each other.

- The emission is constant and corresponds to the Planck power; it builds M_A, and the visible energies field M_V is the absorber. It creates a deficit which is gravitation (see the absorber equations in [6]).
- For complete quantization thru time-currents, 137 is the sum of all resonances in space, and 266 is the product of the bottom space-type resonances, radial or circular (2, 7, 19).
- Increasing masses and the constancy of $e^2/\hbar c$ and hc/G are equivalent to and interpreted as time dilation. It denotes the emergence of the observable time in a frame where it does not exist. The observable time is seen as a radial progression in 4D space.

6 Discussion

Firstly, what have we been discussing all along? Essentially, the reasoning to the mass equations (2.1 – 2.2) is based on the existence of a stationary wave in a universe where:

a) everything propagates,

b) mass and charges do not have a proper existence,

c) the field is self-quantizing, and consequently a unique field and mechanism exists.

We end-up with a wide picture where all (free) parameters of the SM related to energy are self-quantizing geometry of movement (at this stage, and taking all results above, only the SM parameters expressed as phases or angles are not computed); the same is valid in gravitation and cosmology. *Hence we discuss the very nature of energy*, of its forms and formation on top of a unique field; something looking like the natural reductionist path of science.

Secondly, what does it means with respect to the standard theories? In its present form QFT neither considers *definite* rotations nor signals going up and down the time. Therefore no true comparison with our results is possible. Still, we find a number of connections like coupling constants and other aspects which will be discussed in the next paragraph.

In cosmology and using general relativity, a permanent energy creation is not even envisioned. Still, energy conservation comes from time-translation invariance and Neuter's theorem; but we know that the background (R_U) increases and then there is no mathematical reason that energy is conserved in cosmology.

The third point to discuss is the possibility of a different universe (a fashion question). But it seems unlikely because, as shown before, all resonances decay from $2, 3, 7 = 2^3 - 1$, and $19 = 3^3 - 2^3$; then probably only 2 and 3. It leads to conjecturing further the role of symmetry in the mass equation; essentially how do we get 2, 3, 7 and 19, and what is the limiting factor if any? Now let us reason on this aspect.

In the mass equations, the resonances N and P should come straight from the equation geometry and group theory. We shall use 1, 2, 3 to denote U(1), SU(2) and SU(3) respectively and discuss field polarization in the resonance equation. With field polarization p we mean dipoles or tri-poles where summing p charges makes a neutral. In the following, one must just keep in mind that $U(1) \subset SU(2) \subset SU(3)$.

- At the core of a particle resonance, time currents give a charge Q constant; its polarity is p (in 2, 3). In any sphere centered on Q the sum of charges is Q. Then except for Q, the total charge separation in a scale-independent 3-sphere depends on a cube, say n^3 (since the resonance radius is arbitrary) and it is neutral.
- In the radial case, with resonance P, on each layer of the resonance the radial action is layer independent, then the radial coefficient of polarization in $1/n^2$ for each layer, with $1 \leqslant n \leqslant P$; then $P = n$. The polarity of Q is p and defines the interaction of the particle which is also radial, then on the radial path $n = p = P$. Here P defines simultaneously a radial exchange of action and polarity (the symmetry). This is immediately verified for quarks ($P = 3$), and for leptons if we decompose P as shown before.
- On a circular path, a resonance N gives N circular sectors with identical action and action coefficients. Then $N = n^3$ on this path. Since this number does not define the radial interaction of the particle, any subgroup of p is acceptable, then $1 \leqslant n \leqslant p$.

We get the following suites of numbers:

- On a radial path the polarity is p, and $P = p = 2$ or 3;
- On a circular path the polarity is n with $1 \leqslant n \leqslant p \rightarrow N = n^3$; limited to $2 \rightarrow 8, 3 \rightarrow 27$.

But the latter is a rotation, not a resonance as needed, and we need to complete the reasoning.

With geometry and currents (and nothing else), the logical manner is to combine symmetries. Say in the resonance volume we have two symmetries at work; a structural point of equilibrium needs a transformation. Therefore, on the circular path a resonance is seen as a transformer in $n \leq p$ and the subgroups of n, where coefficients are the same for n and its subgroup. Hence, on circular paths we get cubes differences 7 and 19; those come like transformer of charges or currents between a group and its sub-group. That is to say that the field polarization $n \rightarrow n^3$ is always balanced by $(n-1) \rightarrow (n-1)^3$. Importantly, there is nothing in this reasoning preventing more complex oscillators, for instance $19 - 7 = 12$.

This discussion leads to introduce U(1) which is a very special case; since $1^3 - 0^3 = 1$ it seems to be a massless field with any oscillator; the same reasoning on 0 suggests a continuous current — an amplitude according to which masses and then the observable lengths and the rate of time vary in reverse proportions.

Now why only 0, 1, 2, and 3? Within the logic above, the first mathematical explanation is Hurwitz theorem [10]. Consider two charges or currents x and y, we may need to compute the impact of y on the self-interaction of x; it is equal to the action on x of the interaction of x and y (conservation and symmetry), then:

$$(x\,x)\,y = x\,(x\,y).$$

This is the definition of alternative algebra; according to Hurwitz theorem [10], only four exist which are R real numbers, C complex numbers $\sim$ U(1), H quaternions $\sim$ SU(2), and O octonions $\sim$ SU(3). One can consider this as limiting either the symmetry spectrum, or just our ability to model with particles and charges — or both.

A peculiar case arises with $x\,X = 1$ or unitary; the impact of $x\,X$ on any other quantity of the same group does not change its amplitude. Then $x\,X$ addresses structural conservation and we find simultaneously 137, 1/137, and 274, 1/274 in the expression of couplings.

In this way those quantities are related to the monopole as quantized rotational 4D paths, like α and D_e, where only couplings can be measured in 3+1D as seemingly arbitrary real numbers.

7 Conclusions

The breakthrough to wave equations was the assumption of a stationary wave pervading all space. But how can such a wave exist in relativity without a mass of its own? How could it be distinct from the mass of the particle or system it describes? Then how could it be distinct from gravitation?

Those naive but unsolved questions are almost a century old as they address the nature of the wave, wave-particle duality, the completeness of quantum mechanics, and the physical link between gravitation and quantum physics.

The novelty here is that those questions are justified by the existence of a solution to the free parameters problem, including and linking particles physics, gravitation, and cosmology, not only by conceptual disagreements or theoretical incompatibilities.

As stated in introduction, we do not solve any equation; the existence of a solution is first seen when the mass equation is fit to phenomenology, and then extended to couplings. We find logical coherence, a reductionist concept and fantastic precision. Of course it does not look like the usual manner in modern physics where theory and principles reign; but, considering the difficulty of solving this problem from theory, it might be the only practicable way — at least at present time.

As a matter of conclusion, it looks as though the solution shown here can be found only as a whole and provided that we do not build on existing concepts (and maybe even principles); but one must first recognize the existence of a problem together with its ramifications. This situation is fantastic and terrible; if *that* solution exists, physics could remain stuck endlessly in its present conceptual state *because of this conceptual state*: whatever new particles discovered in collision machines modeled with ad-hoc SM extensions, its framework may never be contradicted by experiment.

8 Addendum

As for the 750 GeV resonance possibly detected at CERN [21], since it decays to two photons we assume the same equation and parameters as the H^0 and only K can be fit; it gives $K = -133/2$ which is immediately remarkable. However, since K is not integral the width must be reconsidered, logically to $\Delta K = 1/4$, giving from (2.2 – 3.6 – 3.9.3):

$$N = P = 12, K = -133/2 \rightarrow m \approx 744.9\ \mathrm{GeV/c^2},$$

$$\Delta K = 1/4 \rightarrow \Gamma \approx 9.6\ \mathrm{GeV/c^2}.$$

Using (3.9.2) instead of (3.9.3) adds +3 GeV/c^2 to the mass. The other candidate with $\Delta K \approx 1$ gives $\Gamma \approx 40$ GeV/c^2.

At this scale, the equation (2.2) is very sensitive to D and the model in time-currents must be identical to the H^0 otherwise the computed mass is far from the estimate. It would be very similar, but it leads to remark that there are two manners to put four distinct charges at the corners of a tetrahedron; there may be a chiral difference with the H^0, justifying distinct masses and a probable impact on the particle decays.

Last, the number 133/2 verifies (2.3) like 7 and 19, but with $P = 1$ instead of $P = 3$, since $133\,\pi/2 \approx 209/1.0004$. It is even doubly remarkable since 209 is multiple of 19.

Hence the existence of this particle, if confirmed, should not change the values of Σ_{NP} and Σ_K; it fits well and naturally with the logic and results in this paper.

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References

1. Bethe H.A. The electromagnetic shift of energy levels. *Phys. Rev.*, 1947, v. 72, 339.
2. De Broglie L. Recherches sur la théorie des quanta. *Annales de Physique* — 10e sérié — Tome III — Janvier-Février 1925.
3. Consiglio J. Below the Standard Model? *Applied Physics Research*, v. 6(2), 19–27, 2014.
4. Consiglio J. On the Field Below SM, Analysis and Predictions *Applied Physics Research*, v. 6(5), 1–17, 2014.
5. Consiglio J. Hacking the Fine Structure Constant in Leptons Geometry *Applied Physics Research*, v. 7(6), 30–46, 2015.
6. Consiglio J. On the Absorber in Gravitation. *Progress in Physics*, v. 12(1), 20–25, 2016.
7. Cramer J. The transactional interpretation of quantum mechanics. *Rev. Mod. Phys.*, 1986, v. 58(3).
8. Dirac P.A.M. Quantized singularities in the Electromagnetic Field, *Proc. Roy. Soc. A*, 1931, v. 133, 60.
9. Dirac P.A.M. (1948). The Theory of Magnetic Poles. *Phys. Rev.*, 1948, v. 74, 817.
10. Dickson L.E. (1919). On Quaternions and Their Generalization and the History of the Eight Square Theorem. *Ann. Math.*, 1919, v. 20, 155.
11. Poincaré H. Sur la dynamique de l'électron. *Rendiconti del Circolo Matematico di Palermo*, 1903, v. 21, 129–176.
12. Schwinger J. On Quantum-Electrodynamics and the Magnetic Moment of the Electron. *Physical Review*, 1948, v. 73(4), 416.
13. Wheeler J.A., Feynman R.P. Interaction with the Absorber as the Mechanism of Radiation. *Reviews of Modern Physics*, 1945, v. 17(2–3), 157–161.

14. Wheeler J.A., Feynman R.P. Classical Electrodynamics in Terms of Direct Interparticle Action. *Reviews of Modern Physics*, 1949, v. 21(3), 425–433.
15. ATLAS collaboration. Measurement of the Higgs boson mass from the $H \to \gamma\gamma$ and $H \to ZZ^* \to 4l$ channels in pp collisions at center-of-mass energies of 7 and 8 TeV with the ATLAS detector. *(*Phys. Rev. D), 2014, v. 90(5), 052004.
16. CMS collaboration. Precise determination of the mass of the Higgs boson and studies of the compatibility of its couplings with the standard model (Technical report). 2014, CMS-PAS-HIG-14-009. CERN. https://cds.cern.ch/record/1728249?ln=en
17. ATLAS and CMS Collaborations. Combined Measurement of the Higgs Boson Mass in pp Collisions at sqrt(s)=7 and 8 TeV with the ATLAS and CMS Experiments. 2015. arXiv: 1503.07589.
18. The ATLAS, CDF, CMS and D0 Collaborations. First combination of Tevatron and LHC measurements of the top-quark mass. 2014. arXiv, 1403.4427
19. The CMS Collaboration. Measurement of the top-quark mass in top-quark pair events with lepton+jets final states in pp collisions at sqrt(s)=8 TeV. 2014. CMS Physics Analysis Summary TOP-14-001. https://cds.cern.ch/record/1690093?ln=en
20. The Planck Collaboration. Planck 2015 results. I. Overview of products and scientific results. arXiv: 1502.01582
21. ATLAS note, ATLAS-CONF-2015-081, Search for resonances decaying to photon pairs in 3.2 fb-1 of pp collisions at sqrt(s) = 13 TeV with the ATLAS detector. CMS note, CMS PAS EXO-15-004 Search for new physics in high mass diphoton events in proton-proton collisions at 13 TeV.