On Particle Mass and the Universons Hypothesis

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Abstract

In the logic of the Universons assumption, we deduce the nature of De Broglie wave and periodic mass variation for particles. We verify consistency with quantum mechanics, in particular the Schrödinger equation.

We analyze the hypothesis that elementary particle mass is momentum circulating at light speed. We discover resonance rules acting within elementary particles leading to a formula governing the quantization of masses.

Applying this formula to the electrons, muons, tauons and quarks, we find resonances that match with current measurements. We deduce the energy of unknown massless sub–particles at the core of electrons, muons, and tauons.

Geometrical constraints inherent to our formula lead to a possible explanation to only three generations of particles.

Based on particles geometry, we verify the consistency of the deduced quarks structure with QCD and raise the hypothesis that color charge is magnetic. We verify consistency with QCD symmetry and find that P and CP symmetry are broken by the interaction, in agreement with weak force knowledge.

Our logic leads to re–interpret the Dirac condition on magnetic monopole charge, explain why the detection of magnetic monopoles is so difficult and, when detected, why magnetic charge can depart from Dirac prediction.

We deduce a possible root cause of gravitation, resulting in the Schwarzschild metric and probable non existence of dark matter.

Keywords: universons, de Broglie wave, origin of mass, quantization, quantum chromo–dynamics, weak force, magnetism, gravitation, Podkletnov effect

1. Introduction

This study is essentially motivated by experimental results of Poher (2011), and the Universons theory as introduced in a recent publication (Poher, 2012). Some of the observed distant phenomena are consistent with experimental results previously reported by Podkletnov & Nieminen (1992), Podkletnov & Modanese (2003), Tajmar et al. (2006).

We must consider that if the universal flux predicted by Poher does exist, impacts on current physics models and concepts might be extreme; thus we like to progress step by step. Our purpose in this study is then to evaluate consequences of the Universons hypothesis at the core of current physics and to *partly* check compliance with current knowledge. We will not address gravitation since Poher & Marquet (2012) prove compatibility of some results with General Relativity, but only our deductions concerning its origin and the main immediate consequence.

At the roots of our analysis, we consider the repulsive distant acceleration created by emitters (Podkletnov & Modanese, 2003), (Poher, 2011), as evidences of unknown properties of nature and we assume that the hypothesis of a flux is appropriate to model the phenomenon.

According to Poher's definition, Universons are elementary momentum carriers, they have no charge, and their speed is c. They *exist* in the form of a universal flux, and are the source of the mass of particles and gravitation thru a specific interaction: absorption – retention – reemission.

In agreement with the mass formula of Poher (2011), we adopt the following representation of a particle's mass (using different notations enabling simplified equations):

$$m = 4\pi F_u S_0 \tau_0 / c \quad (1)$$

F_u is a constant related to the Universons flux. It is momentum per square meter per second, a pressure (N/m^2). Thus the flux can also be interpreted as a pressure field or an energy density (J/m^3); 4π is the full solid angle; S_0 is the cross–section (m^2/sr) of the particle interaction with the flux; τ_0 is a constant time (seconds); c is the speed of light (m/s). Only S_0 depends on the particle type.

The mechanism of absorption – retention – reemission imagined by Poher is permanent, enables particles to acquire energy from the flux, this is absorption. During retention, this energy is assumed static, and then accounts for particles mass. Reemission takes place after a fixed time τ_0, and then the particle mass is stable over time and depends on a cross–section.

We adopt a different approach concerning the retention phase. Since we are looking for the source of mass into massless particles, we base our analysis on the hypothesis that mass is a by–product of structure. Then, at the level of reality we analyze, all is energy/momentum moving at light speed, and massive particles are seen as conservative structures of a momentum carrying fluid in permanent exchange with the Universon flux.

2. Main Analysis

2.1 Particle Wave

We do know that massive particles energy transforms according to:

$$E = m c^2 = m_0 \gamma c^2 = h \nu = h \gamma \nu_0 \quad (2)$$

$h \nu_0 \rightarrow h \gamma \nu_0$ origin is related to the De Broglie wave.

$m_0 \rightarrow m_0 \gamma$ comes naturally in special relativity.

Then, from (1):

$$E_0 = 4\pi F_u S_0 \tau_0 c \rightarrow E = 4\pi F_u S_0 \tau_0 c \nu / \nu_0 \quad (3)$$

$$m = 4\pi F_u S_0 \tau_0 \gamma / c \quad (4)$$

In the spirit of this study, this means that the rate of energy exchange of a particle with the flux transforms like the wave frequency, and (2–3–4) shows that any particle, for any observer, exchanges a fixed quantum of momentum with the flux at each cycle of the wave. According to (1) and (2), this quantum of momentum P^0 is defined by:

$$P^0 = h / \tau_0 c \quad (5)$$

In consequence, we postulate that the interaction of massive particles with the flux (or pressure field, or energy density) is the origin of a physical wave of proper frequency $\nu = E/h$. Thus τ_0, as related to the energy exchange is also a constant of nature and does not transform as a time. We notice that the value of P^0 is the same as the Universon energy as deduced by Poher (2011) from quantum fluctuations ($E = h / \tau$); but this energy is now deduced from, and consistent with the wave frequency.

Classical interpretation of the double slit and diffraction experiments implies that the wave is a regular oscillation. It follows that the mass of a particle is variable in time and can be modeled as follows, for any observer, using $P_0 = P^0/2$:

$$m(t) = m_0 \gamma + P_0 \exp(i \omega_0 \gamma t)/c \quad (6)$$

Let us notice that (6) appears related to the Heisenberg uncertainty principle but in a classical form, in the sense that, using (5), particle energy variations verify: $\tau_0 \Delta E = h/2$. But this equation is solely a model, as it features predictable sine–shaped energy variations. We can model a unitary random *inbound* flux (F_r), null in average, which directly agrees with the uncertainty formula, but only influence the phase of the *outbound* flux, the wave; but the random energy and phase variations must not depend on the particle mass.

$$m(t) = m_0 \gamma + m_r + P_0 \exp(i(\omega_0 t \gamma + \varphi_r))/c \quad (7)$$

Our postulate implies that Universons do not have an *associated* wave, for they are assumed to be the De Broglie wave medium itself; they are not particles in the usual sense but an underlying level of reality. Therefore we will use classical physics for this study, and check our results consistency with respect to current knowledge.

2.2 Temperature

Let us assume the Universons flux momentum spectrum is wide. Relations (2–5) imply that for any type of particle, for any observer, the re–emitted flux temperature is constant. Then we can write, for any observer, $n\ T$ depending on the observer:

$$E = m\ c^2 = h\ \nu = P\ V = n\ k\ T \tag{8}$$

This defines a volume, a pressure, and a temperature. We will discuss later the meaning of $n\ T$ depending on the observer, so let us look at a particle at rest. The particle re–emits its full energy in time τ_0, then, n is the number of captured energy quanta. According to (5):

$$k\ T = P_0\ c = h\ /\ 2\tau_0 = const. \tag{9}$$

Then, from (1):

$$m_0\ c^2 = 4\pi\ F_u\ S_0\ \tau_0\ c = n_0\ h\ /\ 2\tau_0 \tag{10}$$

$$F_u\ S_0 = n_0\ P_0\ /\ 4\pi\ \tau_0 \tag{11}$$

This is consistent with our assumption of mass being proportional to a section: if F_u is constant for a particle at rest, then n_0 only depends on S_0.

But also, the entropy difference between the flux received and the flux re–emitted must be positive: $dS = dQ\ /\ T > 0$. Therefore, the momentum spectrum of the re–emitted flux is different to the spectrum of the received flux. This leads to three possibilities, or situations:

a) The interaction with matter leads to the destruction of Universons, in this case, the average energy of re–emitted Universons is higher than that of the received flux.

b) The interaction with matter creates Universons, of lesser average energy than received.

c) The interaction does not change the number of Universons, but the momentum spectrum is narrower.

In all cases, we know that the re–emitted flux momentum spectrum is the same in any frame of reference, for any particle.

Whatever happens in nature, this property is of great importance since it shows that the flux or pressure field is altered by its interaction with matter. Obviously, since the flux is carrying momentum at light speed, this alteration can be interpreted as gravitation.

2.3 Angular Momentum and Proper Frequency

As per our definition, Universons do not carry angular momentum. Let us assume that the circulation of the "mass fluid" carrying a particle angular momentum is at a *fictive* distance r from the center of mass. P being the momentum of the fluid, angular momentum is defined as: $J = P\ r$.

Or abusively, bearing in mind that we assume that mass is structured momentum, using $m = P/c$: $J = m\ r\ c$.

Between instants t and $t + dt$, a particle receives a momentum dp and an angular momentum dj, which is null or statistically null. Using classical physics, the total angular momentum of the particle does not change: $d\ (m\ r\ c) = 0$

$$dm = -\ dr\ m\ /\ r \tag{12}$$

Let us introduce (12) into the mass/energy variation of the particle:

$$dE = h\ d\nu = dm\ c^2 = -\ dr\ m\ c^2\ /\ r \tag{13}$$

Then, assuming $r = r_0$ constant, using (6):

$$J = m_0\ r_0\ c + P_0\ r_0\ exp\ (2\ \pi\ i\ \nu_0\ t) \tag{14}$$

This is still related to the uncertainty principle in the same manner as (6), and then using (7) r can be considered constant regardless of (12-13). But then from (14), $2\ \pi\ \nu_0$ is not the rotation pulsation of the mass fluid. (Also because for an electron, this would lead to a radius $r_0 = 2.42\ 10^{-12}$ m.) Since the momentum reemission is cyclic, with the proper frequency of the particle ν_0, $d\nu$ is then a cyclic phase variation, and ν_0 is the frequency of the phase variation. The phase of a mass fluid element is then:

$$\varphi\ (t) = 2\ \pi\ \nu_1\ t + \varphi_1\ exp\ (2\ \pi\ i\ \nu_0\ t) \qquad (\varphi_1\ constant) \tag{15}$$

We therefore deduce the existence of an inner circulation based on a double periodicity:

- ν_1, which defines an unknown inner movement.

- ν_0, related to the reemission pulsation, with $E = h\,\nu_0$.

Relations (12–13) then suggest a double inner resonance to particles, based on the distance r and the time r/c.

Since the radius r defines a volume, the coefficient $P_0\,r_0$ in (14) corresponds to the blowing up/down of this volume, a variation of its inner pressure P, therefore an action related to the Planck constant: $h = \Delta E\,\tau_0$.

2.4 Particles Mass

According to (8) derivate:

$$dE = d(PV) = P\,dV + V\,dP = dm\,c^2 \tag{16}$$

As a first approximation, since r can be considered constant, let us assume V constant, then:

$$V\,dP = dm\,c^2 \tag{17}$$

Now this relation should also be valid during disintegration within a family of particles, for instance the electron, muons and tauons. The flux absorption and reemission creates pressure, this pressure must be applied on an inner center where is located a second circulation specific to the particle family. Then we can postulate that for this inner circulation (index c), within a particle family:

$$P_c\,V_c = k\,T = const. \tag{18}$$

The pressure P_c is the pressure of the absorbed Universons energy, applied to the volume V_c.

$$P = P_c = k\,T / V_c \tag{19}$$

This pressure is created by the retention process, it is then proportional to the particle mass, and then (19) implies that the particle mass is in reverse proportion to the volume V_c. We can represent this volume by a radius: R. Then $V_c = 4\pi\,R^3/3$; therefore still approximating $\Delta V = 0$:

$$m = X / R^3 + \mu \tag{20}$$

X will be a constant of nature (kg.m^3), μ the mass corresponding to the energy of the inner circulation, assumed constant for a particle family. Particles of the same family are then resonance states for radii r and R, and times r/c and R/c. Now between different particles of the same family, the volume V_c is variable, and according to (18), the energy $P_c\,V_c$ is constant. This corresponds to a gas made of a single particle, and then the "mass fluid" is excluded from this volume. Then, even with r_0 constant, the volume V is not constant as V_c defines an exclusion area specific to the particle type.

We remark that (19) corresponds to the effect of a hidden thermostat as analyzed by de Broglie (1968), and the pressure P_c to the Poincaré stress (1906); but in both cases, it applies to the particle inner circulation.

3. Approaching-quantum Physics

Our intention in this chapter is to check if our deductions are compatible or consistent with quantum physics. In consequence, we will look for links between equation (6), and current knowledge. In this objective, we must follow uncharted roads.

3.1 Particle Wave and De Broglie Wavelength

The reemitted momentum is assumed light speed; using (6), if we look at the pressure or the energy density at distance r from a particle, taking into account the background flux from the opposite direction, we find a stationary wave. If S_0 is the cross–section of a particle, the flux is:

$$F(r) = S_0\,F_u\,exp\,(i\,\omega_0\,(t - r/c))\,/\,r^2 \tag{21}$$

For an observer seeing the particle with a constant speed $\boldsymbol{v}$, and an angle θ between $\boldsymbol{r}$ and $\boldsymbol{v}$, Lorentz transformation of the phase in (21) is:

$$\omega_0\,(t - r/c) \rightarrow \omega_0\,\gamma\,(t - (r - v\,t\,cos\,\theta)\,/\,c) \tag{22}$$

At first sight, the frequency is not related to de Broglie wave. Let us however cut (22) in two pieces: $\omega_0\,\gamma\,(t - r/c)$ is the phase of a stationary pressure wave of frequency $\nu_0\,\gamma$, consistent with (6-21); The second piece, $\omega_0\,\gamma\,v\,t\,cos\,\theta\,/\,c$, is a phase modulation of wavelength $\lambda(\theta) = c^2\,/\,\nu_0\,\gamma\,v\,cos\,\theta = h\,/\,m_0\,\gamma\,v\,cos\,\theta$, and phase velocity $V(\theta) = \lambda\,\nu_0\,\gamma = c^2\,/\,v\,cos\,\theta$. Their projection on the particle direction ($\boldsymbol{v}$) are $\lambda = h\,/\,m_0\,\gamma\,v$ and $V = c^2\,/\,v$, in agreement with de Broglie (1924) and the usual plane waves of quantum physics.

But what of the "particle clock" of de Broglie thesis which is subject to time contraction? Logically, it must be related to the double periodicity of our theory, and the frequency ν_1 of our unknown inner movement in (15) must transform as $\nu_1 \rightarrow \nu_1\,/\,\gamma$. This is important because time dilatation is verified with particles disintegration,

and the frequency v_1 appears naturally in (15). But then, using de Broglie (1924) phase harmony theorem: if the inner circulation (v_1) has a phase/frequency harmony with reemission (v_0), it will have the same harmony with our phase modulation. Then the wave can even host information related to the particle inner circulation.

The pressure wave "broadcasts" the classical state of the particle: energy, momentum, velocity, and possibly more. It is similar, but not identical, to de Broglie (1927) double solution theory and our concepts are compatible with Vigier-Bohm (1954) interpretation of quantum physics (this point is complemented in the next section with de-coherence).

3.2 Schrodinger Equation

From (6) and (8), the total instantaneous energy of a particle at rest is:

$$E(t) = n(t)\, k\, T = E_0 + P_0 c \exp(i\, \omega_0\, t)) = \quad k\, T\, (n_0 + \exp(i\, \omega_0\, t)/2) \tag{23}$$

Let us derivate:

$$k\, T\, dn(t)/dt = i\, k\, T\, \omega_0 \exp(i\, \omega_0\, t)/2 \tag{24}$$

Then:

$$-\, i\, \hbar\, dn(t)/dt = n_0 k\, T \exp(i\, \omega_0\, t)/2 \tag{25}$$

Let us look at the classical case of an electron of a hydrogen atom. Using index p for the kinetic energy, v for potential, the static energy of the electron will be: $E = E_0 + P^2/2m - eV = k\, T\, (n_0 + n_p(t) - n_v(r))$; $n_p(t) - n_v(r) = const. < 0$.

Then using $\omega_m = (P^2/2m - eV) / \hbar < 0$:

$$E(t) = k\, T\, (n_0 + n_p(t) - n_v(r) + \exp(i\, (\omega_0 + \omega_m)\, t)/2) \tag{26}$$

$$-\, i\, \hbar\, d\, n(t)/dt = k\, T\, (n_0 + n_p(t) - n_v(r)) \exp(i\, \omega_m t) \exp(i\, \omega_0\, t)/2 \tag{27}$$

Now we need of course a conceptual leap to the Schrodinger equation. We can define an imaginary particle of negative mass and rest energy: $E_m(t) = kT\, n_m(t) = k\, T\, (n_p(t) - n_v(r))$. The imaginary particle equations will be:

$$E_m\, (t) = k\, T\, (n_p(t) - n_v(r) + \exp(i\, \omega_m\, t)/2) \tag{28}$$

$$-\, i\, \hbar\, d\, n_m(t)/dt = kT\, (n_p(t) - n_v(r)) \exp(i\, \omega_m t)/2 \tag{29}$$

A solution will have the form:

$$\begin{aligned} n_m(t) &= E_m/kT + \exp(i\, \omega_m\, t)/2 \\ n_p(t) &= E_m \exp(i\, \varphi_c(t)) / kT \\ n_v(r) &= E_m \exp(i\, \varphi_v(r)) / kT \end{aligned} \tag{30}$$

We define a function ψ, using a function $R(r)$:

$$\psi = R(r)(n_m(t) - E_m/kT) = R(r) \exp(i\, \omega_m\, t)/2 \rightarrow d\psi/dt = R(r)\, dn_m(t)/dt \tag{31}$$

And then from (29):

$$i\, \hbar\, d\psi/dt = -\, kT\, n_p(t)\, \psi + kT\, n_v(r)\, \psi = -\, P^2/2m\, \psi + eV\, \psi \tag{32}$$

Our reasoning shows that the constraint imposed by reemission leads formally to the Schrodinger equation. Moreover our logic for splitting has a double meaning:

- If we can add frequencies like masses (or energy) to calculate the frequency of a molecule and its wavelength, then we can split, at least when splitting measurable pulsations.
- Considering a classical system, the concept of splitting is equivalent to quantum states superposition, which corresponds to linear combinations of all possible splits of observable energy. But for a classical system de–coherence is immediate.

3.3 Action and the Value of Tau

Let us rewrite (6), using (5):

$$\tau_0 E = \tau_0 E_0 \gamma + h \exp(i\, (\omega_0\, \gamma\, t))/2 \tag{33}$$

This defines an action: $A = \tau_0 E$:

$$A = A_0\, \gamma + h \exp(i\, (\omega_0\, \gamma\, t))/2 \tag{34}$$

This is a change of paradigm and not only a change in notations, as from (34) a particle appears as the sum of two actions.

We can say the constant action of its creation, $A_0\,\gamma$, and an elementary oscillation of invariant amplitude h and pulsation $\omega_0\,\gamma$.

Let us derivate:

$$dA / dt = i\,\omega_0\gamma\,h\,exp\,(i\,\omega_0\,\gamma\,t) / 2 = i\,\omega_0\gamma\,(A_0\,\gamma - A) \tag{35}$$

We integrate (35), using $\tau = 1/v$:

$$i \int (A - A_0\gamma)\,dt = A / \omega_0\gamma + const. = \hbar\,(\tau_0 + \tau\,exp\,(i\,\omega_0\,\gamma\,t) / 2) + const. \tag{36}$$

We know from quantum physics that $\Delta t\,\Delta E \geq \hbar$, and then $\Delta t\,\Delta A \geq \hbar\tau_0$. Then in (36), we can interpret $\hbar\tau_0$ as uncertainty of action integral, but there is a second important term: $\hbar\tau/2$. For any massive particle $\tau_0 >> \tau = 1/v$, and not the opposite, otherwise uncertainty would be larger than $\hbar$. This agrees with the estimated value of $\tau_0 = 7.8\ 10^{-14}$ seconds (Poher, 2012).

4. Resonances and Particles Mass

Based on our main analysis, we studied resonances for the three generations of electrons and quarks. Equation (20) does not enable us to predict absolute mass, but mass ratios are at hand. Let us first review our logic and then show our results.

4.1 Logic

We have deduced the following properties:

- Mass obeys equation (20). $m = X / R^3 + \mu$, where R is the radius of a volume defined by the inner circulation of the particle, μ is the equivalent mass of this inner circulation and should be very small.
- There is a resonance between an outer radius r, independent of particle type, and an inner radius R, type dependent.
- There is a resonance involving radius r and time r/c.
- There are two circulations, outer and inner, that create the re–emission frequency v_0.

Those relations are based on the approximation that the volume V is constant. We must then introduce an adjustment variable. Resonances are spatial, and then can be represented by integer numbers. Thus, the following logic:

- Resonance r versus r/c is represented by an integer P.
- Resonance R versus r is represented by an integer N.
- Radius $R=1/NP$. But this is an approximation: $\Delta V=0$. A correction factor ε real, of the radius: $R = 1/NP + \varepsilon$. The inner volume is then: $V_c = (1/NP + \varepsilon)^3$.
- All of nature being quantized, we assume that $\varepsilon = K\,d$, K integer, d constant within a particles family.
- The inner circulation has momentum/energy, or a mass μ equivalent to a volume μ / X in our formula, constant for electrons family. We also assume approximately the same energy for quarks and electrons.

The mass of a particle (index x) is deduced from that of the electron (index e) from (20), using:

$$R_e = (1/N_eP_e) + K_ed \tag{37}$$

$$R_x = (1/N_xP_x) + K_x\,d \tag{38}$$

Particle mass will be:

$$m_x = m_e\,(1/R_x^3 + \mu/X) / (1/R_e^3 + \mu/X) \tag{39}$$

4.2 Mass Ratios

The tables I and II present the resonances we found and the calculated mass of each particle according to (39). The analysis was hand made using a simple excel spreadsheet. The initial analysis was performed for the three electrons generations, we then found necessary to adjust the value of d for quarks. Distances, d and R, are relative.

Electrons, muons and tauons:

$d = 0.000853222$ (relative to $R = 0.25170752$ for the electron). $\mu/X = 0.029671335$ m^{-3}, mass $\mu = 0.241676613$ KeV/c^2.

Our results for these particles are presented in Table 1. Columns *P, N, K* show the values of these parameters for each particle. Columns Results and Measures show respectively the calculated and measured masses. For

instance, tauons mass, based on (39), and *N, P, K* taken from Table 1: $Mtauons = Melectrons\ (\mu/X + 1/(1/81 + 5d)^3) / (\mu/X + 1/(1/4 + 2d)^3)$.

Table I displays remarkable aspects:

1) Numbers *P, N,* and *K* are very small integers. This shows that our analysis bears sense.

2) We notice some logic between *P, N,* and *K*.

- *N=P* for all three particles, nothing in our reasoning impose such constraint. This must be related to a harmony between the two supposed circulations/resonances.
- *K* integer = *2, 3, 5*; numbers are smallest primes, ordered.

3) We notice that for generation *x+1, N(x+1) = 2 N(x) +/–1*. Although the suite is too short to define a general rule, if we guess to continue the progression of *N/P/K*, using *17/17/7*, we find *1/NP = 0.003460208*, and *Kd = 0.005972555 > 1/NP*.

We then infer that unknown geometrical or resonance constraints prevent such situation, and then no fourth generation of electron.

Table 1. Electron, Muons, tauons Masses and Resonances

Particle	P	N	K	Result (1)	Measured (1)
Electrons	2	2	2	N/A	0.5109989184
Muons	5	5	3	105.6583667	105.6583667
Tauons	9	9	5	1776.840037	1776.840

(1) MeV/c^2.

Table 1 provides with values for resonances (P, N) and integer correction factor (K) to calculate masses of electrons, muons and tauons. Column "Results" presents the calculated mass, column "Measured" is the measured mass.

Quarks:

Table 2 provides with our results for quarks; columns Min and Max provide with the current mass estimation ranges. Using the same constants as for electrons, the calculated top quark mass is $167144.57\ MeV/c^2$. This is out of range. Then we need an adjustment of the distance *d*: $d \rightarrow 0.000859593$ (+ 0.7%).

Values in table II leads to similar remarks as for electrons.

1) Numbers "*N*" range from 3 to 38 and can hardly be smaller taking into account the range of quark masses.

2) Again, we notice logic in the values of *N, P* and *K*, quite different from the electrons.

- Except for quarks up and down, *P=3*. (Although we could obtain *P=3*, with *N(up)=2, N(down)=8/3*, which is a valid non–integer resonance, we stick to integers).
- For second and third generations, values of N are in a ratio 1:2, and based on prime numbers.
- *K = –6* for all quarks. For the higher masses, *Kd* becomes dominant in the radius *R* calculus. For instance, the Top quark: $R = 1/114 - 6\ d = 0.003614371 < 6\ d$. This confirms that *K* is associated to an unknown quantized physical phenomenon. Also, if *K>0* is deduced from the assumption of an exclusion volume for electrons, muons, tauons, *K<0* must be interpreted as an additional or a super retention volume for quarks.

Table 2. Quarks Masses and Resonances

Particle	C	P	N	K	Res (2)	Min (2)	Max (2)
Up	2/3	2	3	–6	1.93	1.7	3.3
Down	1/3	2	4	–6	4.73	4.1	5.8
Charm	2/3	3	14	–6	1255.23	1180	1340
Strange	1/3	3	7	–6	106.39	80	130
Top	2/3	3	38	–6	172504	171700	173300
Bottom	1/3	3	19	–6	4286	4130	4370

(2) MeV/c^2.

Table 2 provides with values for resonances (P, N) and integer correction factor (K) to calculate quarks masses. Column C is the particle electric charge; column "Res" presents the calculated mass, columns "Min" and "Max" presents the measured mass range.

3) If we guess again, and continue the progression of *P, N, K*, we easily find that *R* becomes negative. Let us assume a fourth generation: *N* should be a prime higher than *38*, then *N=41* as a minimum, the second quark would have *N=82*, *NP=246*. This gives masses: $M_1 = 310114\ MeV/c^2$; M_2 is impossible because $R = (1/246 – 6d) < 0$.

In this logic, the absence of 4th generation of quark *pair* relates to a similar constraint as for electrons: $1/NP > |kd|$.

It would make sense however to search a seventh quark in the 310 GeV domain, and others based on higher prime numbers.

5. Geometry

5.1 Particle Geometry

A basic geometry is provided Figure 1 and Figure 2. The pictures show a simple representation of the values of K which is the important point. For electrons, muons and tauons, k > 0, and the exclusion radius *(1/NP)* is increased. For quarks K = –6 < 0; the exclusion radius is reduced. Then electrons inner circulation appears to be repelling the mass fluid, while the quark inner circulation is also attractive at short *constant* range but repelling at larger distances. The attraction range is constant, and does not depend on the quark electric charge. *Our analysis is consistent with QCD as it implies a second type of charge for quarks.* Then we understand K<0 as related to color charge.

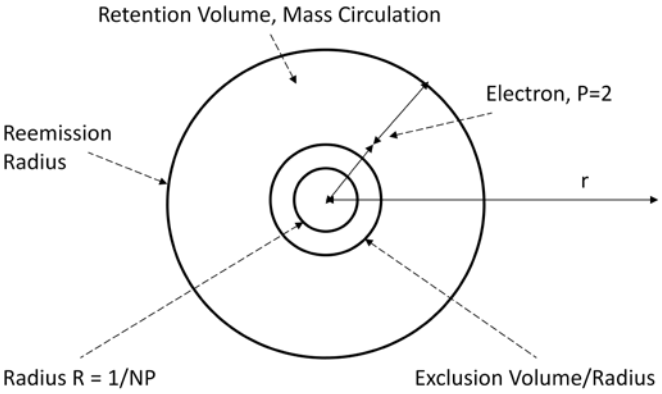

Figure 1. Simplified electron structure

The electrons, muons and tauons simplified structure is based on fictive or statistical distances: an inner radius (R = 1 /NP), an exclusion volume (defined by R + k d; k integer particle dependent), a "mass fluid" fictive

circulation radius *r*, constant, and a statistical reemission radius. Number P = 2 relates only to the electron (see Table 1).

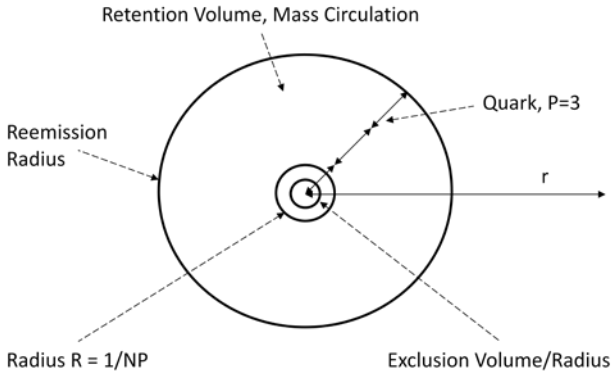

Figure 2. Simplified quark structure

The quarks structure is similar to electrons, except K is negative; this implies an exclusion volume smaller than the inner radius (R = 1/NP). Number P = 3 can be seen as constant for all quarks, or P = 2 can be used for the up and down (see Table 2).

Let us be naïve, and try to understand what the mass fluid nature can be: Based on our analysis of the value of K, the *minimal assumption* is magnetism and then massless monopoles as per Lochak (1995, 2007) theory that predicts such particles and seems compatible with an aether of neutral pairs of monopoles (Lochak, 1995). This assumption leads to three types of charges:

- Electric: Electrons, muons, tauons inner circulation.
- Magnetic: Universons, as neutral pairs of monopoles, and monopoles as the mass fluid.
- Dyon: Quarks inner circulation.

In Lochak theory, monopoles have a charge (North/South) and chirality (right/left), invariant; and magnetism is not a property of charge but of chirality. With respect to the Dirac condition ($g = m\ e / 2\alpha,\ m \in Z,$ using α the fine structure constant), also valid in the Lochak theory, this results in four particles with minimal charges ($g = +/- e / 2\alpha$; *right or left)* that we will name: Nr, Nl, Sr, Sl (North right, etc.). But the important aspect is that the particle and antiparticle have the same charge, but opposite chirality. The antiparticle of Nr is Nl; that of Sr is Sl, and this leads to interesting properties:

A). Figure 3 shows that Parity symmetry is broken in the interaction of a monopole and an electric charge. The chirality of the monopole is reversed by parity (Lochak 1995, 2007), but the angular momentum of its rotation around the Poincaré cone axis is not, and Parity transformation of the interaction is: P → –P, s → –s, and j → j. *Then magnetism implies Parity symmetry breaking.*

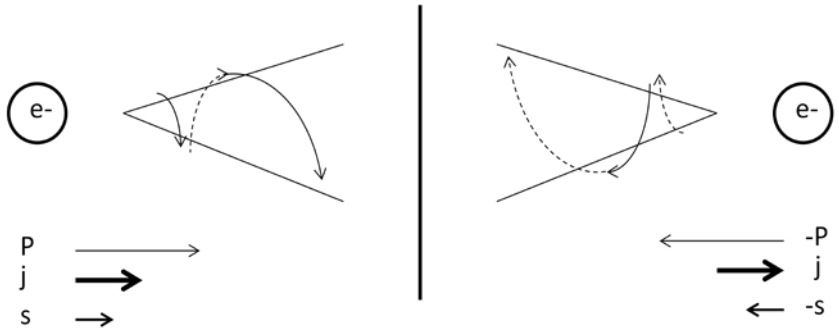

Figure 3. Parity symmetry of the interaction

B). Applying CP symmetry, we must reverse the electric charge on the right side of Figure 3; change monopole chirality and not the magnetic charge. *Then CP symmetry is also broken.*

C). CPT symmetry is respected (Lochak 1995, 2007).

D). Four particles lead to 8 charged combinations (Nr, Nl, Sr, Sl, NrSr, NrSl, NlSr, NlSl), and two neutral (NlNr, SlSr) that we interpret as Universons; instead of using the four particles and antiparticles, we can define a basis for all combinations using only three of them, for instance Nr, Sl, NlSr. If we identify the three elements of our basis to color charge (i.e. Nr = Red, Sl = Green, NlSr = Blue), the corresponding arithmetic matches that of SU(3) as shown in Table 3. *Then magnetism also has QCD symmetry.*

Table 3. Magnetic Polarity and SU (3) Arithmetic

Magnetism	SU(3)
Nr + Nl → Neutral	R + (R) → W
Sr + Sl → Neutral	G + (G) → W
NlSr + NrSl → Neutral	B + (B) → W
Nr + Sl → NrSl = (NlSr)	R + G → (B)
Nl + Sl → NlSl = (Nr)Sl	(R) + G → (R)G
Nr + Sr → NrSr = Nr(Sl)	R + (G) → R(G)
Nl + Sr → NlSr	(R) + (G) → B
Nr + NlSr → Sr = (Sl)	R + B → (G)
Nl + NrSr → Sr = (Sl)	(R) + R(G) → (G)
Nr + NlSl → Sl	R + (R)G → G
Nl + NrSl → Sl	(R) + (B) → G
Sr + NrSl → Nr	(G) + RG → R
Sl + NlSr → Nl = (Nr)	G + B → (R)
Sr + NlSl → Nl = (Nr)	(G) + (R)G → (R)
Sl + NrSr → Nr	G + R(G) → R
Nr + Sl + NlSr → Neutral	R + G + B → W
Nl + Sr + NrSl → Neutral	(R) + (G) + (B) → W

In Lochak theory of magnetic monopoles, two magnetic charges exist (N = North, S = South); magnetism is associated to chirality, resulting in four monopoles: Nl, Nr, Sl, Sr (Nr = North right, etc.). Table III shows the perfect correspondence of the arithmetic of Lochak magnetism (left column) with QCD (right column) based on the following assignments: Nr = Red, Sl = Green, NlSr = Blue. We note (X) for anti–X, and W for White. We cancel the neutral monopoles combinations and white color in this table except when the result is entirely neutral. The triplet {Nr, Sl, NlSr} is a natural basis of SU (3).

5.2 Magnetic Charge

We now consider an electron at rest and the Dirac condition defining the minimal magnetic charge, $g_0 = e / 2\alpha$. The angular momentum of such monopole in an electron field is: $\boldsymbol{J} = \hbar\, \boldsymbol{r}/2\, r$. Using the fictive radius r_0 from (14) to obtain a classical representation, one Universon energy is:

$$2\, E(g_0) = \hbar\, c / r_0 \tag{40}$$

We can complete (8):

$$E_0 = m_0 c^2 = h\, \nu_0 = n_0 P_0 c = n_0 k T = n_0 \hbar\, c / 2\, r_0 \tag{41}$$

But τ_0, P_0 and T do not depend on the observer, and then the only acceptable transformation is a constant energy and charge:

$$n_0 \rightarrow n_0\, \gamma;\ g0 \rightarrow g0;\ E(g_0) \rightarrow E(g_0) \tag{42}$$

Equation (42) means that as much as the quantum of exchange is constant momentum, $P^0 = 2P_0$ for any observer, the absolute charge exchanged in one cycle of the particle pulsation is also constant: $2g_0$ for any observer.

Assuming a free magnetic charge exists, we must reverse our logic: its charge g is linked to its momentum P, and transforms accordingly:

$$g \rightarrow g\,\gamma;\; g / P = g_0 / P_0 = const. \tag{43.1}$$

In consequence, assuming a free monopole exists, its charge depends on the observer, and then there is no specific reason to search a free particle of charge g_0. Or alternately, a magnetic charge and its momentum are invariant, but the Dirac charge g_0 is solely a quantum of reemission, *and there is still no specific reason to search a free particle of charge* g_0:

$$g \rightarrow g\;;\; P \rightarrow P \tag{43.2}$$

Consequently, the elementary charge g_0 is the root of (6), and the total absolute magnetic charge of a massive particle is:

$$g\,(t) = n_0\,\gamma\,g_0 + g_0\,exp\,(i\,\omega_0\,\gamma\,t) \tag{44}$$

More important, from (5–41):

$$2\,\pi\,r_0 = \tau_0\,c \tag{45}$$

Then the (fictive) geometry of the interaction is constant; this is consistent with a constant charge/momentum ratio and a fixed time τ_0 as the classical trajectory of such charge will not depend on its momentum.

Then using (45) in (14):

$$J = A / 2\,\pi \tag{46}$$

Our "action paradigm" is angular momentum.

$$J = J_0\,\gamma + \hbar\,exp\,(i\,\omega_0\,\gamma\,t) / 2 \tag{47}$$

6. Action and Entropy

We defined particle entropy $dS = dQ/T$; since T is constant, then $dQ = dE = dn\,k\,T$:

$$dS = k\,dn\;;\; S = n\,k \tag{48}$$

Then, from (33–34–46–48):

$$h\,S = k\,A\; = 2\pi\,k\,J = k\,\tau_0\,E \tag{49}$$

The left part of (49), $h\,S = k\,A$, was found by de Broglie (1987), using action on one period of the wave, but it now results from a constant time τ_0. From (49):

$$S = k\,(\tau_0\,v + exp\,(i\,2\pi\,v\,t) / 2) \tag{50}$$

Boltzmann constant in (50) appears to be a quantum of entropy: the flux entropy created by a particle at each cycle of its wave. Then entropy emission is proportional to particle mass, but we assume no energy is lost during the interaction: *then we interpret flux entropy creation and propagation as the origin of gravitation.*

7. Gravitation

Since gravitation is an attractive force, the reemitted flux must generate an absorption deficit on distant masses compared to the background flux (at least in our epoch). According to (1), absorption deficit will reduce particles mass and pulsation; this is equivalent to space curvature. Consequently we cannot interpret gravitation as a curvature of space-time, we must use flat space.

7.1 Equivalent Metric

We will first find a Schwarzschild metric equivalent using Newton potential and simple reasoning on the impact of the flux. Then we will show how the same result is reached using flux quantities.

The Newton potential is:

$$\Gamma = -\,m_e\,G / R + const. \tag{51}$$

Let us consider a particle at rest at distance R from a central mass; for an infinitely distant observer, from (1–51), particle energy and pulsation will be:

$$E_1 = E_0\,(1 - m_e\,G/\,c^2\,R) \tag{52}$$

$$v_1 = v_0\,(1 - m_e\,G\,/\,c^2\,R) \tag{53}$$

Then in (51) the constant is c^2.

Our assumption and analysis implies that all energies will be impacted by (52–53), and not only particles pulsations; in particular, this will impact any measurement instrument. For instance, if we imagine a photon source at a given location, in flat space, photons energy is constant but measurement instruments at different altitudes (R_0 and $R_0+\Delta r$) will be affected and a photon frequency shift will be measured; from (53): $\Delta v/v_0 = (-G m_e/R_0 c^2) \Delta r$. Then clocks and rulers will be seen differently by a distant observer:

$$dL_1^2 = dL_0^2 (v_0 / v_1)^2;\ dT_1^2 = dT_0^2 (v_1 / v_0)^2 \tag{54}$$

Using weak field ($1 >> m_e G/Rc^2$):

$$dS^2 = c^2 dT_1^2 - dL_1^2 = c^2 dT_0^2 (1 - 2G m_e / R c^2) - dL_0^2 / (1 - 2G m_e / R c^2) \tag{55}$$

Equation (55) is that of Schwarzschild metric, which we find as an emergence of the interaction with the flux.

This result implies consistency with most verified predictions of General Relativity – if not all.

We will now do the same reasoning using two main Poher (2012) results:

- A particle under acceleration does not capture Universons from a solid angle Ω in the direction opposite to the acceleration:

$$\Omega = 2\pi A \tau_0 / c \tag{56}$$

- The value of the gravitation constant G (using our notations):

$$G = c^2 / 4 \pi F_u \tau_0^2 \tag{57}$$

At distance R from a massive body of cross–section S_e, we model absorption deficit using a fictive flux $F_e < 0$:

$$F(R) = (F_u + F_e) S_e / R^2 \tag{58}$$

Using the principle of equivalence, absorption deficit due to gravitation is equivalent to the non capture angle in acceleration.

Then $\Omega S_0 F_u$ is equal to the thrust of absorption deficit $S_0 F(R)$. Using (56–58):

$$F_e S_0 S_e / R^2 = -2 \pi S_0 F_u A \tau_0 / c \rightarrow A = -F_e S_e c / 2 \pi F_u \tau_0 R^2 \tag{59}$$

Equation (59) defines a "flux potential" Γ_1:

$$\Gamma_1 = F_e S_e c / 2\pi F_u \tau_0 R + const. \tag{60}$$

But using (1) in (51), Newton potential is:

$$\Gamma = -G S_e F_u \tau_0 / R c + const. \tag{61}$$

Using (57) in (61), then comparing with (60):

$$\Gamma_1 = \Gamma \rightarrow F_e / F_u = -1/2 \tag{62}$$

Then the cross–section of a particle with the reemitted flux is half its cross–section with the background flux F_u.

Particle energy and pulsation will be:

$$E_1 = (F_u + F_e S_e / 2\pi \tau_0 c R) S_0 \tau_0 c \tag{63}$$

$$v_1 = v_0 (1 + F_e S_e / 2\pi \tau_0 c F_u R) \tag{64}$$

Using (1–57–62), $F_e S_e / 2\pi \tau_0 c F_u R = -G m_e / c^2 R$; then (63–64) are identical to (52–53), and using weak field lead to (55) which is Schwarzschild metric.

7.2 Constant Reemission Momentum

One fundamental theorem of the Newton theory is that within a spherical shell, the potential energy is null. Let us model the flux inside the sphere. The sphere intercepts a part of the universal flux coming from outside, and reemits a secondary flux that creates an absorption deficit. We will model this secondary flux as: $F_u \rightarrow F_u + k F_e;\ 0 < k < 1$.

All following equations in this section address an observer outside the sphere. From (1–62), the energy of a test particle within the sphere is:

$$E = (1 - k/2) F_u S_0 \tau_0 c \tag{65}$$

The potential within the sphere is then:

$$\Gamma = c^2 (1 - k/2) \tag{66}$$

If we add a massive body of cross–section S_e at the center of the sphere, it will transform the flux received, but not the part of flux already transformed by the shell (constant reemission momentum). Part of its mass does not create gravitation.

The potential in the sphere, from (1–62–66):

$$\Gamma = c^2 (1 - k/2) + (1 - k) F_u S_e \tau_0 G / c^2 R \quad (67)$$

Taking the mass from (65) and the potential from (67), the acceleration of a test mass in the sphere is:

$$A = (1 - k) G M_e / (1 - k/2) R^2 \quad (68)$$

Where $M_e = F_u S_e \tau_0 / c$ is the "normal" mass of the central body, as it would be outside the sphere. Then the shell has an impact on trajectories, since $k > 0$ reduces the Newtonian acceleration.

We can model a galaxy as a succession of shells, and then the closer to a galaxy center:

- The lower the gravitation flux created per cross–section unit,
- The lower the entropy creation per kilogram of matter, since absorption deficit is not null absorption ($F_e = - F_u/2$).
- The lower the acceleration per cross–section unit or per kilogram of matter.

This is equivalent to some hypothetical dark matter of density growing with the distance to the galaxy center. Contrary to some current concepts, the amount of hidden mass can be computed from our equations and not solely deduced from observation.

(Note that this is not the only effect to take into account. The expansion of the universe leads to variations of F_u and/or of the received flux reemitted by distant masses, and then of the cross-section of particles with respect to the absorbed flux.)

8. Discussing Numbers

Using the estimation of Universons energy from Poher (2012), $Eu = 8.5\ 10^{-21}\ J$, we can compute from (40–41) the charge/energy ratio of magnetism:

$$2g_0 / E_u \approx 7.75\ 10^{11}\ Cm/Js \quad (69)$$

Or, if divided by c:

$$2g_0 / E_u c \approx 2.6\ 10^3\ C/J \quad (70)$$

This ratio is huge, compared with an electron at rest: $e / m c^2 = 1.97\ 10^{-6}\ C/J$, or with electrons inner circulation:

$$e / \mu c^2 = 4.2\ 10^{-3}\ C/J \quad (71)$$

This is consistent with current knowledge as in complex particles the mass fluid detectable effects will be seen and interpreted as a field creating forces and inertia. The same reasoning is valid for an isolated magnetic charge if it exists.

From (5-45), the fictive circulation radius is:

$$r_0 = 3.71\ 10^{-6}\ m \quad (72)$$

Multiplying this radius by 2π we obtain the equivalent average wavelength of Universons $\lambda = 23.3\ 10^{-5}\ m$ (Poher, 2012), but as a consequence of (45); this results from fictive geometry and quantization. From (40–45), $2 E(g_0) = h c / \lambda$ is the monopole pairs electromagnetic energy and time $\tau_0 = \lambda / c$ their period. Logically, frequency $v_u = 1 / \tau_0$ is solely their average individual contribution to particles frequency: $E / h = v = n / \tau_0 = n v_u$.

The mass fluid temperature is quite low:

$$T = Eu / 2k = 308\ K \quad (73)$$

From (70–71), if we make the division $(2g_0/E_u c) / (e/\mu c^2) \approx 6.2\ 10^5$, we find a dimensionless number with a physical meaning: the ratio of energy to make a magnetic coulomb compared to an electric one. This is consistent with a large fictive radius r_0, as it implies a very small angle for the Poincaré cone, and then a quite long retention time τ_0. But why would there be such a huge difference between electricity and magnetism? We should rather expect 1 or a number with geometrical meaning like 2π. The immediate explanation is that the quantum of reemission does not obey Dirac condition, but rather that the total charge interacting with a particle does. The quantum of reemission should then be $g \approx eE_u / \mu c\ (Cm/s)$, or similar.

However, Poher used to compute $\tau_0 \approx 5.58\ 10^{-14}s$ (unpublished) using $E_u\tau_0 = 9h/4\pi$, from de Broglie quantum variations formula. Using precisely $\tau_0 = 5.56727\ 10^{-14}s$, we can compute a velocity that we will not interpret:

$$\sigma = (2g_0 / P^o c) / (e / \mu c^2) = 1.33654\ 10^{14} m/s \quad (74)$$

This leads to a stunning coincidence; using ε_0 and μ_0 the electrodynamics constants: $\varepsilon_0\, \sigma / \mu_0\, c = \pi$. But if this is a dimensionless equation, then:

$$Coulomb^{\,2} \leftrightarrow Joule\ x\ second \quad (75)$$

This agrees with a universe with three dimensions (time, space, and electromagnetic charge) and two types of quantified charges and energies: using (43.1) or (43.2) for magnetism, e and μ for electricity. This shows that the charge g_0 has a physical meaning.

Last but not least, (and independently of the velocity σ,) in Lochak (1995-2007) theory the magnetic current is space-like. Regarding our results, a time τ_0, a momentum P_0 and a variable magnetic charge that do not transform according to Lorentz immediately make sense with a space-like current, and then it is a possible explanation to quantum causality. But for us, the repulsion of distant matter created by emitters is the effect of a neutral magnetic current carrying momentum; then a possible verification of our theory is to measure its propagation but we find no scientific publication of a relevant value. Poher (2011) states v > 0.1 c, the limit of his setup. A direct measurement is the right and probably simplest way to test if light speed is exceeded.

9. Conclusions

In our model, charged "elementary" particles are composites, structures organized around a central massless sub–particle permanently exchanging momentum with the Universons flux. We have shown, to the extent of elementary quantum physics, charged particles mass and basic gravitation, that this hypothesis is consistent with current knowledge and leads to different models and new predictions.

A secondary hypothesis on the flux nature, pairs of massless magnetic monopoles, leads to P and CP symmetry breaking and SU(3), in agreement with main characteristics of the weak force and QCD, and to the existence of three types of charges, electric, magnetic, and dyons, in agreement with unification theories.

This secondary hypothesis leads to a possible explanation of quantum causality which can be tested.

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