International Journal of Engineering Research and Development
e-ISSN: 2278-067X, **p**-ISSN: 2278-800X, www.ijerd.com
Volume 6, Issue 10 (April 2013), PP. 36-49

The Mechanics of Electron-Positron Pair Creation in the 3-Spaces Model

André Michaud
SRP Inc Service de Recherche Pédagogique Québec Canada

Abstract:- This paper lays out the mechanics of creation in the 3-spaces model of an electron-positron pair as a photon of energy 1.022 MeV or more is destabilized when grazing a heavy particle such as an atom's nucleus, thus converting a massless photon into two massive .511 MeV/c^2 particles charged in opposition. An alternate process was also experimentally discovered in 1997, that involves converging two tightly collimated photon beams toward a single point in space, one of the beams being made up of photons exceeding the 1.022 MeV threshold. In the latter case, electron/positron pairs were created without any atom's nuclei being close by. These two observed processes of photon conversion into electron-positron pairs set the 1.022 MeV photon energy level as the threshold starting at which massless photons become highly susceptible to become destabilized into converting to pairs of massive particles.

Keywords:- 3-spaces, electron-positron pair, 1.022 MeV photon, nature of mass, energy conversion to mass, materialization, sign of charges.

I. EXPERIMENTAL PROOF OF ELECTRON-POSITRON PAIR CREATION

In 1933, Blackett and Occhialini proved experimentally that cosmic radiation byproduct photons of energy 1.022 MeV or more spontaneously convert to electron/positron pairs when grazing atomic nuclei ([3]), a process that was named "materialization".

Moreover, a team led by Kirk McDonald at the Stanford Linear Accelerator (SLAC), confirmed in 1997 that by converging two sufficiently concentrated photons beams toward a single point in space, one beam being made up of photons exceeding the 1.022 MeV threshold, electron/positron pairs were created without any atomic nuclei being close by.

It was also exhaustively demonstrated that positrons and electrons are totally identical, except for the sign of their charges, both particles having the exact same invariant rest mass of 9.10938188E-31 kg, that is 0.511 MeV/c^2, which is exactly half the energy of the lowest energy photon that can convert to a pair of these particles.

When a photon being converted possesses more than this 1.022 MeV energy threshold, the energy in excess directly determines the relative velocities in opposite directions of both particles in space after materialization ([4], p. 174).

II. THE MECHANICS OF CONVERSION

We will now examine the mechanics of materialization of such a pair in the 3-spaces expanded geometry that was the object of a previous paper ([1]).

Before proceeding however, let's recall that in the 3-spaces geometry, free fall acceleration induced kinetic energy will appear massive to an observer located in normal space when it occurs in either of the other two spaces, but would locally be perceived as non massive. For example, as perceived from normal space, magnetostatic and electrostatic spaces are the realm of massive states, while normal space is, as far as we observers located in this same space are concerned, the realm of free fall acceleration induced unidirectional quantities of kinetic energy between bodies.

Let's first recall the dynamic inner motion of energy within the dynamic structure of the de Broglie localized photon.

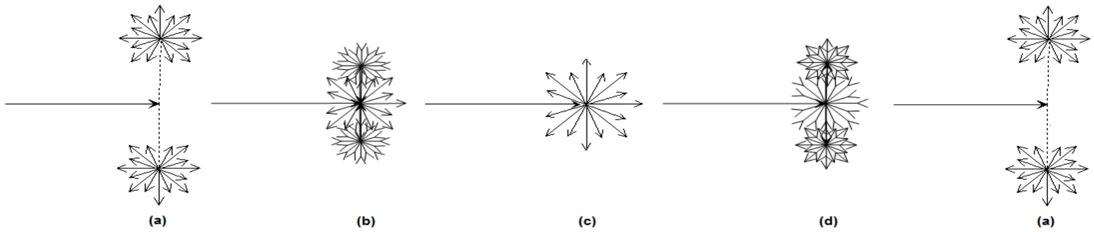

Fig.1: The complete cycle of energy circulation within the dynamic structure of the de Broglie photon.

As described in ([1], Sections XXII), this motion can be described as with 4 distinct steps: (a) The de Broglie half-photons (making up half the total complement of the photon's energy) having reached the farthest distance of their reach within electrostatic space. (b) The half-photons closing in toward each other in electrostatic space as their energy starts transferring omnidirectionnally into magnetostatic space. (c) The total complement of energy of the two half-photons having now completely crossed over into magnetostatic space. (d) The energy present in magnetostatic space starting to cross over back toward electrostatic space as two separate half-photons. And (a) again as the cycle completes, poised to start the whole sequence again.

All through this process, the other half of the photon's energy, permanently located within normal space, remains in unidirectional motion, propelling the oscillating half at the speed of light in normal space vacuum.

But since the total complement of energy of a photon of 1.022 MeV is known to convert to a pair of .511 MeV/c^2 massive particles, this means that nature has found a way for the unidirectional half of the photon's energy located in normal spaces to mechanically transfer to electrostatic and/or magnetostatic spaces for the total energy of the photon to be perceived as massive after conversion of photon to a pair of electron-positron.

So, let's see how all of this unidirectional half of the energy of a 1.022 MeV photon can mechanically leave normal space during the conversion process to end up, as we will soon see, in electrostatic space.

III. STABILITY BEFORE CONVERSION

To clearly understand the mechanics of the pulsating photon energy described in paper ([1]), there was need to become aware of the Y-y/Y-z plane within electrostatic space, the only plane on which the pair of half photons can move in opposite directions in that space for all stable photons, a plane orthogonal to normal space from within electrostatic space, itself orthogonal to normal space by structure.

Now, to understand how the dual-particle photon can convert to a pair of separately moving massive particles, there is now need to also become aware of dimension Y-x, which is at the same time perpendicular to the Y-y/Y-z plane and parallel by definition to conventional direction of motion of photons in normal space (X-space), that is, parallel to dimension X-x of normal space even though it belongs to electrostatic space.

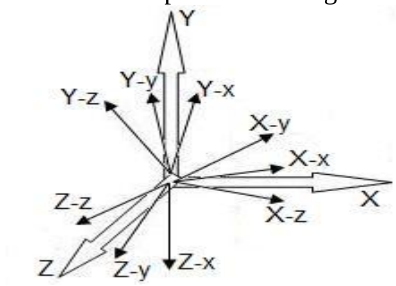

Fig.2: The orthogonal structure of the 3 spaces model.

Referring to Figure 2, let's remember the 3-ribs umbrella metaphor representing the mental opening from 0^o to 90^o of the inner dimensions of each space to allow easier visualization.

Previous paper (**[5]**) described how the equal density mutually orthogonal electric and magnetic fields generated by the cyclically moving half of a photon's energy serves to "self-guide" the photon in straight line in normal space as it is self-propelled at the speed of light by the unidirectional half of its energy permanently residing within this normal space as illustrated with Fig.1.

Let us now mentally consider a pulsating 1.022 MeV dual-particle photon. We can now rather easily visualize how stable it must be, boring at the speed of light through normal space, as half its energy locally oscillates in a perfectly stationary manner with respect to its local tri-spatial junction, between a state of single spherically expanding and regressing event in magnetostatic space, coupled to a state of double particles moving to and fro in diametrically opposite directions on the Y-y/Y-z plane of electrostatic space.

We can easily visualize that no force other than an interaction internal to the photon can locally strongly interact with the half-photons. Considering the speed at which photons circulate, it can easily be understood that interactions between photons whose trajectories could possibly intersect at the speed of light will generally be too fleeting to really do anything other than possibly mutually affect the axial orientation of their relative polarity on their respective Y-y/Y-z planes.

For simplicity's sake, we will assume by definition from this point on that both half photons are moving in opposite directions exactly along the Y-y axis on the Y-y/Y-z plane of electrostatic space.

So, in the process of locally moving away from their junction to as far as their energy will allow along the Y-y axis, the half-photons usually don't have any choice but to accelerate right back in a straight line toward the junction, to ultimately fuse once again into a single quantity as their energy crosses over to expand into magnetostatic space.

IV. ELECTROSTATICALLY DESTABILIZING SCATTERING

Let's consider now what is likely to occur when a photon grazes very closely a heavy atom's nucleus at the precise moment when both half-photons have reached the farthest distance possible on either side of their local junction, along the Y-y axis.

We know since de Broglie, that all charged physically scatterable elementary particles are electromagnetic in nature, which includes of course the up and down quarks that make up the inner structure of nucleons (protons and neutrons) that atomic nuclei are made of.

This clarifies why these electromagnetic elementary particles (charged up and down quarks) making up the nucleus can enter into homo- and/or heterostatic interaction with the charges of the half-photons while the latter are in their electrostatic phase, and it becomes just as obvious that these interactions will be intense in relation to the inverse square of the distance between them in accordance with the Coulomb law during very close grazing encounters, a process represented in Quantum Electrodynamics by the following Feynman graph ([14], p. 203):

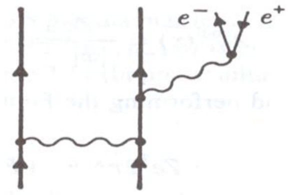

Fig.3: Photon-nucleus grazing pair creation Feynman diagram.

Similarly, pair creation by close grazing of two photons, one of which exceeding the 1.022 MeV threshold without any atomic nuclei being close by, such as was first experimentally confirmed by Kirk McDonald and his team at the Stanford Linear Accelerator in 1997, is represented by the following Feynman graph ([14], p. 203):

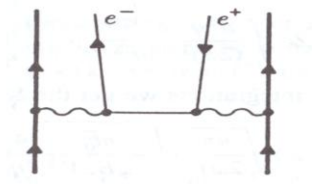

Fig.4: Photon-photon grazing pair creation Feynman diagram.

V. MISSING THE TRISPATIAL JUNCTION RENDEZVOUS

It can thus be easily imagined that any substantial Coulomb interaction between the half-photons and the up and down quarks of the nucleus may destabilize the motion of the half-photons, pulling and pushing them in directions that could cause them to miss, so to speak, their usual rendezvous with the local 3-spatial junction.

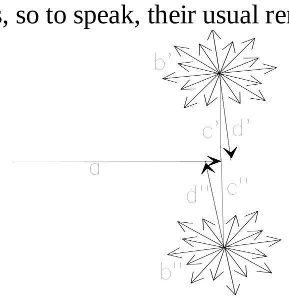

Fig.5: Both half-photons failing to meet the 3-spatial junction.

Vector **a** in Figure 5 represents the quantity of kinetic energy in unidirectional motion in normal space required to maintain the speed of the photon in that space.

Dotted lines **c'** et **c"** represent the occurrences of attraction that permanently seek to attract half-photons **b'** and **b"** toward trispatial junction **o** within electrostatic space.

Vectors **d'** and **d"** symbolize the deflected directions that the half-photons will tend to follow within electrostatic space on either side of the junction as an outcome of any destabilization of the normally rectilinear trajectory of their cyclic return motion toward the junction, and that would send them on an elliptical orbit on the Y-y/Y-x plane that, in the case of photon of 1.022+ MeV, initiates the decoupling process.

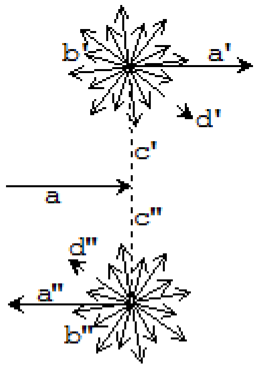

Fig.6: Both half-photons tenting to initiate an elliptical orbit.

VI. INITIATING ELLIPTICAL ORBIT WITHIN ELECTROSTATIC SPACE

Now, being forced to accelerate diagonally with respect to the straight line that normally lets them meet at the junction, the half-photons will unavoidably enter into an elliptical orbit within electrostatic space about the junction on the Y-y/Y-x plane, that is on a plane parallel to the major X axis representing normal space, while their local mutual interaction retains its intensity, since the half-photons will not set about decreasing in quantity as they do when they actually start crossing the junction on their way to magnetostatic space.

In Fig.6, vectors **d'** and **d"** are represented with a 45^{o} deflection angle to symbolize that from the moment the half-photons enter elliptical orbit within electrostatic space following initial destabilization, this orbit will tend to become rounder and rounder due to the half-photons' inertia, thus forcing half-photons **b'** and **b"** to accelerate more and more on that orbit.

It is here that things become more than interesting, considering that the farthest distance from each other that half-photons reach in electrostatic space is exactly sufficient to allow them to re-accumulate all their energy when they re-accelerate back toward the junction, this very precise amount of energy is insufficient by structure within electrostatic space proper to fulfill the increased energy requirement for the half-photons to maintain this forced elliptical orbit about the junction.

We know besides, from experimental measurements, that no additional energy is transmitted from the heavy nucleus to the photon during such encounters. Experimental results show that after they separate, both particles share uniquely the energy of the initial photon. The photon is thus forced to manage on its own, so to speak, to provide the additional energy now required within electrostatic space for the now forced elliptical orbit to be sustained.

VII. ENERGY CROSSING OVER FROM NORMAL SPACE TO ELECTROSTATIC SPACE

Considering that kinetic energy appears to locally behave like an incompressible material when it is in excess or shortage in one of the three spaces and that the three orthogonal spaces behave like communicating vessels, the half-photons will have no other choice but to start borrowing through orthogonal translation from the only reserve of additional energy at the photon's disposal, which is the unidirectional energy that maintains the speed of light of the photon in normal space, which can only result in a corresponding slowing down the group in normal space.

So, after having left their usual straight line trajectories, as the half-photons arrive on either side of the junction, but without actually meeting it, a shortage of energy will develop that will obviously be sufficient to trigger the entry through the junction of the required supplementary energy available in normal space.

The only energy source locally available to support this acceleration being unidirectional kinetic energy **a** that maintains the speed of light of the photon in the vacuum of normal space, this available energy will have no choice but to progressively transfer to electrostatic space to support this acceleration, which is symbolized here by vectors **a'** and **a"** of the half-photons on their elliptical orbit (Fig.6).

As the orbit of the half-photons becomes rounder and rounder in electrostatic space on account of their inertia, as they continue drawing on the photon's reserve of energy from normal space, the photon itself will have no choice but to start slowing down in normal space as its X-space unidirectional energy is being drained into electrostatic space (Y-space).

Finally, the slowing photon will come to an almost complete standstill in normal space, as its constituting half-photons now streak at the speed of light in electrostatic space in opposite directions on the Y-y/Y-x plane, momentarily on a stable orbit about the junction point, at right angle with respect to the direction that would have permitted them to dive again into magnetostatic space.

VIII. SPEED OF LIGHT = TRANSVERSE ESCAPE VELOCITY OF THE PAIR

But since the pair of particles is known to physically separate into normal space as the final stage of the process, we might hypothesize at this point that the speed of light could be the "escape velocity" of the half-photons in electrostatic space. We can certainly speak of a "decoupling" velocity of the pair. We will see later the mathematical confirmation of this apparently quite bold conclusion.So the question now is: What could possibly cause the decoupling of the half-photons when they reach the speed of light on their electrostatic space ultimately circular orbit about the tri-spatial junction?

IX. WHY CIRCULAR ORBITS ABOUT CENTRAL MASSES ARE IMPOSSIBLE

Let's consider Newtonian gravitation for a moment, and let's suppose that a hypothetical planet is suddenly placed on an ideally stable and perfectly circular orbit about a star. If it possessed sufficient energy to maintain itself on this orbit, it would be difficult to challenge the fact that the inertia of both planet and central star would momentarily perfectly counterbalance their mutual attraction as a function of the inverse square of the distance between them, in relation with their respective effective masses.

Let's now consider Newton's never challenged Principle of Inertia, that is *Principia*'s First law, that he formulates as follows: *"<u>left to themselves</u>, the planets would follow a uniform rectilinear motion"* ([15], p. 98)!

Now back to our hypothetical planet, which is momentarily in a perfect state of equilibrium on its theoretically perfect circular orbit, it is difficult not to conclude that it could be in a perfect state of free fall at the precise moment when this equilibrium is reached, inertia and attraction being in a state of complete mutual cancellation, and that it could momentarily be "*left to itself*" at this very precise moment.

It consequently seems impossible that at this precise moment, the planet will not immediately obey this principle and tend to continue its route in a straight line, thus initiating a tendency for the orbit to become elliptical, which possibly explains why the orbits of all bodies in the solar system are elliptical, considering that perfectly circular such orbits are deemed to be forever impossible to maintain.

X. VELOCITY ON CIRCULAR ORBITS WITHOUT CENTRAL MASS

Let's consider now the two half-photons at the very moment that they reach the speed of light as their orbit finally becomes perfectly circular on the Y-y/Y-x plane when all of the unidirectional kinetic energy previously available in normal space has just finished completely crossing over into electrostatic space to propel the half-photons.

Contrary to what happens in the Solar System, where the attractive force of the solar mass does not diminish when a planet draws away from it, when both half-photons initiate this seemingly equilibrium induced unavoidable motion away from each other caused by their tendency to move in a straight line, the attractive force will instantly slightly and irreversibly decrease, precisely because there is no stable central mass between them to maintain a permanent and stable attraction, which will have as an immediate result that the inertia of the two half-photons will dominate the now irrecoverably weakened attractive force due to the however slight increase in mutual distance involved and will allow them to escape and travel separately!

Consequently, in the case of the materialization process of electron/positron pairs, the velocity of establishment on a circular orbit on the Y-y/Y-x plane about the obviously massless tri-spatial junction and the escape velocity of the particles turn out to be exactly the same: the speed of light.

Now if the speed of light being reached by both particles on such a circular orbit is the actual escape velocity of the pair in opposite directions within electrostatic space, then the known invariance of the "opposite charges" of electrons and positrons may well have a direct relation with the decoupling radius (the distance between momentary circular orbit and the central junction).

This may shed an entirely new light on what charge may really be. Charge could then possibly be defined as **the intensity of the return potential** toward a common junction reached when this potential is exactly counterbalanced orthogonally by the inertia of the two particles now moving at the speed of light in opposite directions within electrostatic space, a momentary equilibrium that would induce the decoupling of the pair.

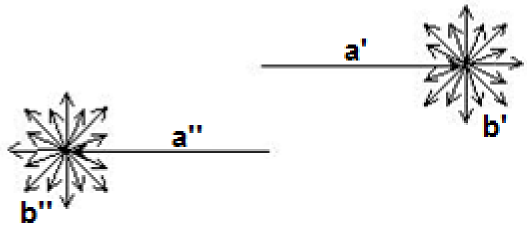

Fig.7: The freshly decoupled electron and positron pair moving away from each other.

At this stage, all of unidirectional kinetic energy **a** that was required to maintain the speed of light of the photon in normal space (see Fig.5), has completely transferred to electrostatic space, which allowed both half-photons **b'** and **b"** to decouple and move separately at the speed of light **a'** and **a"** in opposite directions within electrostatic space, while appearing to us as being two massive particles, an electron and a positron, moving separately within normal space at a velocity corresponding to the energy that the initial decoupling photon had in excess of the 1.022 MeV that converted to two .511 MeV/c^2 rest masses.

Let us note here that Quantum Electrodynamics also considers the sign of electron and positron charges as being a <u>relative property</u> as they define the electron as *energy propagating <u>forward</u> in space-time* and a positron as an electron with *energy moving <u>backward</u> in space-time* ([14], p. 41).

By comparison, the 3-spaces model associates the positive sign of the charge of a positron to the fact that in this expanded space geometry, its energy is by definition moving <u>forward</u> within electrostatic space, that is, in the positive direction along the Y-x axis, while the negative sign of the charge of an electron is by definition moving <u>backward</u> within electrostatic space, that is, in the negative direction along the Y-x axis. Both models however define the sign as an extrinsic property of charges.

XI. RELATING PLANCK'S CONSTANT TO INTENSITY CONSTANT H (HC)

Before mathematically confirming the decoupling radius of the electron-positron pair in electrostatic space, the direct relation between Planck's time-dependant constant and the 3-spaces model distance-dependant *electromagnetic intensity constant* defined in a previous paper ([1], Section J), needs to be brought to attention.

A fundamental constant was established more than a century ago by Max Planck that allows calculating the energy of a photon from its frequency. Let us note that contrary to the speed of light constant (c) that stems from Maxwell's electromagnetic theory, Planck's constant (h) is a constant of kinetic nature that rightly belongs to thermodynamics.

It is however very directly related to electromagnetism by association with the speed of light. Just like the speed of light can be calculated from theory only from Maxwell's equations, Planck's constant could until now be calculated from theory only from Planck's thermodynamics black body equation. But we saw in a previous paper ([1], Section J) that it can also be calculated in the 3-spaces model by dividing the newly defined electromagnetic intensity constant (H) by the speed of light (H/c = h).

As he analyzed Wien's experimental results on the black body, Planck determined that the luminosity of the black body could be calculated with precision only if each cycle of any frequency of light always corresponded to the same amount of energy: 6.62606876E-34 Joules, that is:

$$L_\lambda = \frac{c_1}{\pi\lambda^5}\frac{1}{e^{c_2/\lambda T}-1} \tag{1}$$

Where $c_1 = 2\pi hc^2$ and $c_2 = hc/k$ (where k is the Boltzmann constant)

In other words, whatever its frequency, that is, its number of cycles per second, the energy of a photon is always equal to the product of that frequency (*f*) by Planck's constant (h):

$$E=hf \tag{2}$$

or as an alternate definition, within the 3-spaces model, the energy of a photon is always equal to ***electromagnetic intensity constant*** H divided by the wavelength of a photon (λ)

$$E = \frac{H}{\lambda} \tag{3}$$

From the definition of H in ([1], Section J, Equation 17a), that is:

$$H = hc = \lambda E = \frac{e^2}{2\varepsilon_0\alpha} = 1.98644544E-25\ J \bullet m \tag{4}$$

Planck's constant can be equated to a very specific combination of other fundamental constants:

$$h = \frac{e^2}{2\varepsilon_0 \alpha c} = 6.62606875 7E-34\ J \cdot s \tag{5}$$

In reality, all of the energy of the photon is present at each cycle, which is clearly put in perspective by the *electromagnetic intensity constant*, and the cycling speed of each cycle is directly proportional to the quantity of energy of the photon. The reader may appreciate that this continuous presence at maximum of the energy of a photon becomes much more obvious in the harmonic oscillator formula if we replace the time based h*f* relation with the transverse amplitude based H/λ relation:

$$E = (n+1/2)H/\lambda \quad \text{instead of} \quad E = (n+1/2)hf \tag{6}$$

This continuous presence of the photon's energy at maximum is also perfectly represented by the projection of its electric and magnetic amplitudes as symmetric stationary waves on the plane that accompanies the photon at the speed of light as analyzed in a previous paper ([1], Section VI).

XII. CONFIRMING THE 1.022 MeV CONVERSION THRESHOLD

We will now mathematically analyze how the energy of a 1.022 MeV photon (non massive) can convert to 2 massive .511 MeV/c^2 particles (very precisely 0.5109989027 MeV/c^2 each) according to the decoupling mechanics just examined. Let us first establish the frequency of the energy of each half-photon of the photon in the process of decoupling from that energy in Joules, that is 8.18710414E-14 J.

$$f = \frac{E}{h} = 1.235589976\ E20\ Hz \tag{7}$$

According to equation λf=c, the wavelength of that half-photon energy will be

$$\lambda = \frac{c}{f} = 2.42631021\ 5\ E-12\ m \tag{8}$$

Which turns out to be the electron Compton wavelength as well as the wavelength of a free photon that would have the same energy, and that corresponds to the distance that such a free photon would cover in normal space at the speed of light during each of its cycles.

Let us also recall de Broglie's inspired idea to the effect that for the orbital motion of the electron on the ground orbit of the Hydrogen atom, an "orbital wavelength" could be calculated with equation λ=h/m_ev, and that this wavelength corresponded exactly to the length of the orbit on which the electron moved in the Bohr model, which is the same as the averaged out rest orbital that can be calculated with the wave function applied to the hydrogen atom.

Knowing the long established rest mass of the electron (9.10938188E-31 kg) as well as the speed that the half-photons must have to allow the decoupling of the pair, that is, the speed of light within electrostatic space (v = c = 299 792 458 m/s), let's apply de Broglie's equation to the present "orbital" case to find the "orbital wavelength" applicable to the amount of energy corresponding to the rest mass of the electron, a wavelength that would of course be equal to the length of the decoupling orbit.

$$\lambda_o = \frac{h}{m_e c} = 2.42631021\ 5\ E-12\ m \tag{9}$$

So we discover here by comparing equations 8 and 9 that the decoupling orbit of a 1.022 MeV photon would be very precisely equal to the wavelength of a photon of same energy as an electron, and by the same token that the velocity of the half-photons on that orbit will be exactly equal to the speed of light.

In fact, the equality of the linear wavelength and of the orbital wavelength for that level of energy, which is the only level that allows it, directly explains why .511 MeV is the lowest energy level that allows reaching an orbital velocity equal to the speed of light. All half-photons of lesser energy can by structure reach only orbital velocities lower than the speed of light, which prevents them from decoupling.

Let us recall that the product of the rest mass of the electron by its theoretical classical velocity on the Bohr orbit by the length of the Bohr orbit is equal to Planck's constant:

$$mv\lambda_B = h \tag{10}$$

We can also see that the product of the mass of the electron by its velocity on the Compton orbit and by the length of the Compton orbit is also equal to Planck's constant

$$mc\lambda_o = h \tag{11}$$

Which reveals, among other implications, that for a given mass, the product of its orbital velocity by the length of the orbit is a constant, known as the *quantum of circulation*.

Let us note that this law applies to all orbiting electrons, even electrons in stable electrostatic orbits, even those that are forced to remain stationary due to local electromagnetic equilibrium. Although physically null, the "virtual mathematical velocity" of the latter case still remains a valid working parameter since the energy that would support this velocity if it could be expressed is still present and would cause the related electron to move at this velocity if local electromagnetic equilibrium allowed it to circulate freely at that distance from the nucleus.

So from the electron *quantum of circulation*:

$$v\lambda_B = c\lambda_C = \frac{h}{m} = 7.273895032\,E-4\,m^2/s \tag{12}$$

We can see that the angular momentum of the decoupling half-photon is the same as that of the electron on the Bohr orbit

$$mc2\pi r_c = h \quad \text{and consequently} \quad mcr_C = \frac{h}{2\pi} = \hbar \tag{13}$$

From the equality of the orbital wavelength and the linear wavelength, we can thus draw the following relation:

$$\lambda_o = \lambda = \frac{h}{m_e c} = \frac{c}{f} \tag{14}$$

from which we can directly derive the following equation regarding the energy of a half-photon of a photon of energy 1.022 MeV destabilizing as it grazes a nucleus, that shows how the decoupling energy allows to smoothly transfer from equation E=h*f* for pure energy to the famous equation $E=mc^2$ for massive particles:

$$\frac{h}{m_e c} = \frac{c}{f} \quad \text{and finally} \quad E = hf = m_e c^2 \tag{15}$$

Let us recall here, that ***the energy of the electron (or positron) rest mass is the only energy level for which this direct equality is possible***.

And we find here again from this unique relation of equality between the energy of the electron and that of a photon of same energy, the *quantum of circulation* already mentioned:

$$\frac{h}{m_e} = \frac{c^2}{f} = 7.273895032\,E-4\,m^2/s \tag{16}$$

XIII. INVERSE SQUARE DISTANCE FROM THE TRI-SPATIAL JUNCTION

On the other hand, the Coulomb law indicates that the electrostatic force is inversely proportional to the square of the distance between charged particles. In the case of the decoupling pair however, a process where the source of the force would by definition be the tri-spatial junction about which the pair momentarily orbits, it would be the energy induced at any distance from that source that would be inversely proportional to the square of the distance between an elementary particle and the source considered, a distance that we will symbolize with r. So let us take this postulate as a starting point:

$$E = \frac{1}{r^2} \quad \left(\text{where } r = \frac{\lambda_o}{2\pi} = 3.861592642\,E-13\,m\right) \tag{17}$$

This means that product $E \bullet r^2$ is a constant. Interestingly, this radius happens to also be equal to the Bohr radius (α_o) divided by 137.0359998, which is the inverse of the fine structure constant (α).

We will now define this constant, symbolize it with capital letter K and name it the ***Electrostatic Energy induction Constant***, and whose value we can now determine:

$$K = E \bullet r^2 = m_e c^2 r^2 = 1.22085259\ 6\,E-38\,J \bullet m^2 \tag{18}$$

This constant will be useful to explore nucleons in a coming paper, a distance-based constant, just like ***electromagnetic intensity constant*** H defined in ([1], Section J) and previously used in Section XI.

Another point of interest is the electrostatic amplitude of the cyclic harmonic oscillating motion of the energy of the decoupling electron. Let us first establish the angular velocity of this cyclic motion in radians per second:

$$\omega=2\pi f = 2\pi \times 1.235589976\,E20 = 7.763440783\,E20 \text{ rad/s} \tag{19}$$

Given that full amplitude can be obtained at a quarter of the sinusoidal representation of the cycle, let us calculate the time required to reach this maximum:

$$t = T/4 = 1/4f = 2.023324929\text{E-}21 \text{ s} \tag{20}$$

From the equation for kinetic energy of a body in harmonic oscillation, adapted to the present case, where v = c, we can pose $mc^2 = m\omega^2 A^2 \sin^2(\omega t)$. Isolating A, we obtain the amplitude of the motion:

$$A = \frac{c}{\omega \sin(\omega t)} = \frac{c}{\omega \sin(\pi/2)} = 3.86159264\ \ 18\,E - 13\,m \tag{21}$$

A value that exactly matches the decoupling radius obtained by means of the de Broglie relation (see equation 17). What an intriguing coincidence, that confirms that the linear motion of the initial photon converted to a perfectly circular motion of both half-photons without any loss of energy!

XIV. WHY PHOTONS WITH LESS THAN 1.022 MEV CANNOT DECOUPLE INTO PAIRS

Taking into account all of a localized photon's energy, we can now pose:

$$E_{[1.021997805\,MeV]} = hf = \frac{2K}{(a_o\alpha)^2} = 2m_e c^2 \tag{22}$$

That establishes a very clear link between the non-massive energy of a 1.022 MeV photon E=h*f* and the energy of the two massive particles $E=mc^2$ produced as this photon destabilizes while grazing a heavy nucleus.

All photons of lesser energy seem to resolve, upon destabilizing, to circular wavelengths allowing only velocities lower than that of light, thus preventing decoupling, while all photons of higher energy, upon destabilizing, will reach the speed of light at Compton radius circular orbits and decouple before all their energy can orthogonally transfer to electrostatic space, the untransfered energy causing the now separating particles to move in opposing directions in normal space at a velocity related to that remaining energy.

And it is here that we can link up with Special Relativity, since we know that for any electron in motion: $E=\gamma mc^2$. We can thus pose with certainty that for photons of energy between 1.022 MeV and 211.317 MeV destabilizing in the Coulomb field of a heavy nucleus:

$$E_{[1.022MeV \to 211.317MeV]} = hf = 2\gamma m_e c^2 \tag{23}$$

and since photons of energy equal to 211.317 MeV or more, seem to systematically produce muon/antimuon pairs, we can also tentatively pose :

$$E_{[>211.317MeV]} = hf = 2\gamma m_\mu c^2 \tag{24}$$

XV. THE STABLE ELECTRON INNER ELECTROMAGNETIC EQUILIBRIUM

Since it is experimentally established that all electrons and positrons are universally identical and that any electron indifferently attracts any positron and *vice versa*, it can also be concluded that any given electron attracts all positrons existing at the same moment in the universe and *vice versa*, in perfect conformity with the Coulomb law.

The fundamental material of the two particles, whose mechanics of materialization we just examined, and that now travel separately, can also not be dissociated from each its own internal tri-spatial junction, because of the fact that a magnetic field of fixed intensity estimated at 1,00116 is associated to all electrons, and that magnetic properties belong exclusively to magnetostatic space in this expanded geometry.

One can wonder now how the quantity of kinetic energy that the electron is made up of can maintain the local stable equilibrium that we know it possesses.

Any notion of equilibrium about a 3-spaces trispatial junction implies of course the idea that the particle's energy will tend to distribute about the junction in search of such an equilibrium. This implies in turn that the energy of the electron must mandatorily constantly be distributed into two equal parts that oppose in such a manner that they mutually maintain this equilibrium, one half of which must mandatorily constantly move unidirectionally in electrostatic space for electrons and positrons as we just analyzed, as opposed to half of non-massive photons' energy being unidirectional within normal space.

XVI. OSCILLATION BETWEEN MAGNETOSTATIC AND ELECTROSTATIC SPACES

During the decoupling process, we saw how the unidirectional amount of 0.511 MeV of energy of the destabilized photon was progressively being transferred from normal space to electrostatic space as it splits evenly between the two half-photons as the latter accelerated on their decoupling orbit, allowing them to eventually reach the speed of light within electrostatic space and finally decouple to move as separate entities in the vacuum of normal space.

The result was then two 0.2555 MeV half-particles now moving in opposite directions on straight line trajectories parallel to the Y-x axis within electrostatic space and to the normal space X-x axis, and whose speed of light in opposite directions was now maintained for each of them by a locally constant unidirectional quantity of kinetic energy of 0.2555 MeV, which when added to the half-particle energy restitutes of course the well known complete amount of energy corresponding to an electron or positron rest mass, that is 0.511 MeV.

XVII. OSCILLATION BETWEEN MAGNETOSTATIC AND NORMAL SPACES

But since that in the dynamic photon configuration in the tri-spatial geometry, the energy constantly unidirectional that totally occupies one of the spaces (normal space), it seems a given that if this constantly unidirectional energy, that is 0.2555 MeV for each separating particles, moves to electrostatic space, it will now permanently occupy this space in a stable manner, preventing the other half of the particles energy from oscillating between an electrostatic space now saturated and magnetostatic space, as the energy of the initial photon was doing.

This other normally oscillating half, that is the remaining 0.2555 MeV of the particle's energy will then have no other possibility but to start pulsating in a stable manner, orthogonally to electrostatic space, through the internal junction, between the two remaining unsaturated spaces, that is magnetostatic space and normal space, at the frequency associated to the electron.

We established already that in magnetostatic space the energy had to enter omnidirectionally as the photon pulsates ([1], Section XXII). So it seems logical to think that the same would hold true for the energy of electrons and positrons.

So when this energy will reenter normal space instead of electrostatic space as it starts pulsating according to this new tri-spatial distribution, similarly to the behavior already analyzed for photons, it would also logically do so bi-directionally, which means that streams of electrons may be polarizable just like light, although in a manner that remains to be identified, in relation with the phase of the amplitude and axial orientation of this bi-directional motion of half its energy within normal space, on plane X-y/X-z perpendicular to the direction of motion X-x.

This would then mean that electrons and positrons have exactly the same dynamic structure as photons, the only difference being one of localization of the unidirectional half of their energy, that is, within normal space for photons and within orthogonal electrostatic space for electrons and positrons, forcing the electromagnetic half to oscillate between the two remaining orthogonal spaces, magnetostatic space being common to both.

XVIII. THE ELECTRON GENERAL LC EQUATION

In other words, electrons and positrons turn out to simply be 0.511 MeV photons that could be seen as traveling at the speed of light orthogonally to normal space! Consequently, given that the cyclic passage between electrostatic and magnetostatic spaces proceeds without any resistance by definition, the electron and positron can be represented by exactly the same equation involving a discrete LC oscillation that was defined for photons in a previous paper ([1], equation 16), that is:

$$E\,\vec{\mathbf{I}}\,\vec{\mathbf{i}} = \left(\frac{hc}{2\lambda}\right)_X \vec{\mathbf{I}}\,\vec{\mathbf{i}} + \left[2\left(\frac{e^2}{4C}\right)_Y (\vec{\mathbf{J}}\,\vec{\mathbf{j}}, \vec{\mathbf{J}}\,\overleftarrow{\mathbf{j}})\cos^2(\omega t) + \left(\frac{L\,i^2}{2}\right)_Z \overleftrightarrow{\mathbf{K}}\sin^2(\omega t)\right] \tag{25}$$

Where X, Y, and X respectively represent normal, electrostatic and magnetostatic spaces, but with the following subtle difference, which is that the pair of unsigned charges of the photon ($|e|^2$) has now "pivoted" over into normal space to become potential neutrino material (To be described in a coming paper) and that we will momentarily identify here as ($|e'|^2$) (neutral e prime squared), and that the kinetic energy that propelled the photon at the velocity of light in normal space ($hc/2\lambda$) has now "pivoted" over into electrostatic Y-space to remain in a stable manner in that space, having become unable to contribute a velocity in normal space but contributing the "sign of the charge" and half the transverse inertia (mass) associated to the particle.

On its part, the inductive component L of the particle simply remains in magnetostatic space, contributing the particle's "spin" and the other half of its transverse inertia (mass), while henceforth LC oscillating between magnetostatic Z-space and normal X-space.

Let us recall that in a photon, as the energy sphere decreased in volume in magnetostatic space, two half-quantities begin to grown and move away from each other and from point zero in diametrically opposite directions on the Y-y/Y-z plane within electrostatic space, thus maintaining perfect equilibrium ([1], Section VI, Fig.4).

This transfer to electrostatic space is now impossible for the re-oriented energy of the massive electron and positron. The only option for this energy moving out of magnetostatic space is now to transfer to normal space now empty of energy, as two half-quantities moving away from each other and from the tri-spatial junction in diametrically opposite directions on the X-y/X-z plane, thus re-establishing perfect equilibrium. For simplicity's sake, we will assume that they align exactly with the X-y axis on this plane.

So, here is possibly the most detailed and general LC equation that can be established for the energy of an electron at rest in this model:

$$E\,\vec{\mathbf{0}} = m_e c^2\,\vec{\mathbf{0}} = \left[\frac{H}{2\lambda_C}\right]_Y \vec{\mathbf{J}}\,\vec{\mathbf{i}} + \left(2\left[\frac{(e')^2}{4C_C}\right]_X (\vec{\mathbf{I}}\,\vec{\mathbf{j}}, \vec{\mathbf{I}}\,\overleftarrow{\mathbf{j}})\cos^2(\omega t) + \left[\frac{L_C {i_C}^2}{2}\right]_Z \overleftrightarrow{\mathbf{K}}\sin^2(\omega t)\right) \tag{26}$$

And for a positron:

$$E\,\vec{\mathbf{0}} = m_e c^2\,\vec{\mathbf{0}} = \left[\frac{H}{2\lambda_C}\right]_Y \vec{\mathbf{J}}\,\overleftarrow{\mathbf{i}} + \left(2\left[\frac{(e')^2}{4C_C}\right]_X (\vec{\mathbf{I}}\,\vec{\mathbf{j}}, \vec{\mathbf{I}}\,\overleftarrow{\mathbf{j}})\cos^2(\omega t) + \left[\frac{L_C {i_C}^2}{2}\right]_Z \overleftrightarrow{\mathbf{K}}\sin^2(\omega t)\right) \tag{27}$$

The reader is invited to carefully compare the changes in orientation of the complete set of directed unit vectors in these equations for the electron and positron at rest, with respect to equation (25), that represents the various directions of motion of the energy within the photon structure, that was completely explored and developed in ([1], Section XXI), finally giving equation (16) of the previous paper, reproduced as equation (25) above.

Let us also note that for the positron, only the direction of minor vector **i** subordinated to major vector **J** of electrostatic space is reversed. We will afterwards show only the equation for the electron, always assuming that the equation for the positron is identical with only this minor reversal as a difference.

XIX. INTRODUCING THE ELECTRON NEUTRINIC ENERGY

Or better yet, by the following equation making use of the localized fields definitions established in a previous paper (**[5]**):

$$m_e c^2\,\vec{\mathbf{0}} = \left[\frac{\varepsilon_0 \mathbf{E}^2}{2} V\right]_Y \vec{\mathbf{J}}\,\vec{\mathbf{i}} + \left[2\left(\frac{\varepsilon_0\,\boldsymbol{\nu}^2}{4}\right)_X (\vec{\mathbf{I}}\,\vec{\mathbf{j}}, \vec{\mathbf{I}}\,\overleftarrow{\mathbf{j}})\cos^2(\omega t) + \left(\frac{\mathbf{B}^2}{2\mu_0}\right)_Z \overleftrightarrow{\mathbf{K}}\sin^2(\omega t)\right]V \tag{28}$$

$$\text{where } V = \frac{\alpha^5 {\lambda_C}^3}{2\pi^2},\quad E = \frac{\pi e}{\varepsilon_0 \alpha^3 {\lambda_C}^2},\quad B = \frac{\pi \mu_0 e c}{\alpha^3 {\lambda_C}^2} \text{ and } \boldsymbol{\nu} = \frac{\pi e}{\varepsilon_0 \alpha^3 {\lambda_C}^2}$$

Volume V, defined in ([5], equation 32h), simply is the volume within which the amount of energy of a photon or localized elementary particle would be contained if it was distributed with uniform density U after being spherically integrated from infinity (∞) to a distance from r = 0 corresponding to $\lambda\alpha/2\pi$ as can be extrapolated from Marmet's paper (**[13]**). In the present case, the Compton wavelength (λ_C) will of course be used since we are dealing with the rest mass energy of the electron.

which means that

$$m_0\,\vec{\mathbf{0}} = \frac{V_m}{c^2}\left\{\left[\frac{\varepsilon_0 \mathbf{E}^2}{2}\right]_Y \vec{\mathbf{J}}\,\vec{\mathbf{i}} + \left[2\left(\frac{\varepsilon_0\,\boldsymbol{\nu}^2}{4}\right)_X (\vec{\mathbf{I}}\,\vec{\mathbf{j}}, \vec{\mathbf{I}}\,\overleftarrow{\mathbf{j}})\cos^2(\omega t) + \left(\frac{\mathbf{B}^2}{2\mu_0}\right)_Z \overleftrightarrow{\mathbf{K}}\sin^2(\omega t)\right]\right\} \tag{29}$$

where $\boldsymbol{\nu}^2$ (Greek letter **nu** squared) represents a state of two quantities of kinetic energy (momentarily defined in equations (26) and (27) as $(|e'|)^2$) that could also be thought of as being "neutrinic energy" (a name the reason for which will be explained in a separate paper); that cyclically convert to magnetic state and back again, similarly to a photon's two half-photons of its electric state cyclically converting to magnetic state and back again.

Don't we discover by the same token why electrons have always proved indivisible? Like any photon of less than 1.022 MeV of energy, they simply are not energetic enough to allow their half-quantities (which in this model, let us be very aware, have no other possibility but to reside and move within normal space) succeed in decoupling!

XX. CHARGE BEING DEFINED AS A PRESSURE ON THE ORTHOGONAL PLANE

Electrostatic space existing by definition at right angles with respect to normal space, the charge of the electron behaves with respect to our "normal" space as if it was a pressure being applied backward away from normal space along axis Y-x, which is the axis along which the constantly unidirectional half of the electron's energy moves in electrostatic space, and in the same manner, we perceive the charge of the positron as if it was a pressure being applied toward normal space along the same axis.

Metaphorically speaking, the opposite charges of the electron and positron behave as fishes constantly pushing against the glass wall of their aquarium in opposite directions (a glass wall that we could see as a plane orthogonal to our normal space and that would separate it from both electrostatic and magnetostatic spaces), applying a constant pressure on the wall without succeeding in moving forward.

It is important to understand here that the two 0.511 MeV half-photons that existed before decoupling have not changed in nature or dynamic structure as they separated. They simply changed direction in the tri-spatial space geometry. We are still dealing with the same two half-photons, two quantized quantities of kinetic energy.

XXI. WHAT IS MASS

A. Electron Mass is Electrodynamic Inertia

Walter Kaufmann studied electrons at length at the beginning of the 20th century and observed that the measurable inertia of these elementary particles seemed to be constant at non-relativistic velocities, whichever direction if was measured from ([8]), which is entirely consistent with the idea proposed in this expanded geometry ([1]) that the energy making up the rest masses of elementary particles would reside outside normal space, in extra-spatial spaces existing perpendicularly to normal space, that is electrostatic space and magnetostatic space. This presence would then be perceived through the junction point where these spaces interconnect that would be located at the center of the particle, a presence that could then be perceived from any direction in normal space about this junction point and that would behave as a point-like event in normal space.

We can now see that what we perceive as the mass of particles would also be a relative impression just like their charge, and not an intrinsic characteristic, contrary to the accepted view.

Consequently, the invariant rest mass of electrons and positrons, which is estimated at 9.10938188E-31 kg, can be nothing else in this space geometry but the inertia of decoupled 0.511 MeV/c^2 half-photons whose energy is totally engaged within electrostatic and magnetostatic spaces as previously analyzed.

Such a conclusion, which seems obvious in this augmented space geometry, is in full agreement with Abraham's calculations ([7]) and Kaufmann's experiments ([8]) that showed that mechanical mass *per se* is null and that the mass of electrons was exclusively of electrodynamic origin ([9], p.247).

Presently, they clarified the equivalence of mass and inertia when resistance to change of state of motion was correlated with the direction of motion, and that quantities of unidirectional kinetic energy are sensitive only to longitudinal interaction, that is, totally unaffected by transverse interactions, which was verified with experiments where electrons moved at relativistic velocities.

B. Defining Electrodynamic Inertia

Consequently, the simplest definition of inertia would be that it is the resistance of unidirectional quantities of kinetic energy to being forced to slow down or accelerate.

This is what led Poincare to conclude that there exists no mass other than electrodynamic inertia, that mass increases with velocity and that it depended on the direction of motion, which means that a body animated by an important velocity will not oppose the same inertia to forces orthogonally tending to deflect its trajectory, and to those tending to decelerate its forward motion ([10], p.137).

C. Transverse Inertia vs Longitudinal Inertia

There is consequently ground to distinguish between **transverse mass**, or rather ***relativistic transverse inertia***, which can be measured as the resistance that a moving mass will offer to a force being applied perpendicularly to the direction of its motion, and **longitudinal mass**, or ***relativistic longitudinal inertia***, which corresponds to the sum total of the rest mass, the instantaneous relativistic mass increment, plus the quantity of unidirectional kinetic energy that maintains its velocity when measured in the direction of motion.

Let us note that these two measures of mass are relativistic, that is to say, that they depend directly on the velocity of the particle. The other two definitions of mass, the **invariant rest mass** of elementary particles and the **effective rest mass** of complex particles and larger bodies that we will examine in coming papers, depend in no way on the velocity or these particles or bodies in normal space.

Let us also note that the relativistic increase in mass of particles that is usually being referred to and that can be calculated with the gamma factor (γ) and whose theoretical curve was confirmed by the experimental values obtained by Bucherer and Neumann in 1914 ([4], p.172), specifically is the relativistic increase of **transverse mass** of particles, that is the **relativistic transverse inertia** (aka instanteneous relativistic mass) of particles, and whose expression is

$$m_t = \gamma m_o = \frac{m_o}{\sqrt{1-v^2/c^2}} \tag{30}$$

and not that of **longitudinal mass** that Kaufmann also studied and that includes the kinetic energy that sustains the corresponding instantaneous velocity as if it was part of the mass. Let us note by the way that it was Walter Kaufmann who was the first to demonstrate the variation of the electron mass with velocity in accordance with the relativistic equation ([12], p.238).

We will see in a coming paper how important these distinctions are to really understand why the actual angle of deflection of photons' trajectories by gravity is twice that "apparently" computable from Newton's mechanics.

Let us remember that the only difference between a 0.511 MeV photon and an electron (0.511 MeV/c^2) is the direction of the motion of the particle at the speed of light; in normal space for the photon, and in electrostatic space (that is, orthogonally to normal space) for the electron, and that it consequently can only be this difference in the direction of motion in the 3-spaces geometry that can cause a measurable "mass" to be associated to the particle in the case of the electron.

D. Conversion of half any added kinetic energy to relativistic mass

Analysis of Kaufmann's data leads to conclude that the relativistic progressive increase in transverse mass of electrons as they accelerate is caused by a process forcing very precisely half of the imparted unidirectional kinetic energy to continuously quantize orthogonally to the direction of motion of the electrons, thus joining the rest mass of the electrons, as unidirectional kinetic energy is being added.

This aspect of acceleration was thoroughly explored in a separate paper ([11]).

"B*eing quantized orthogonally*" meaning here "*being translated to orthogonal electromagnetic orientation with respect to the direction of motion in space, of the energy involved*", which causes half the unidirectional kinetic energy being added to transfer orthogonally to electrostatic and magnetostatic spaces to now acquire a property of transverse inertia that it henceforth shares with the pulsating electron rest mass energy on top of the inertia that it already had longitudinally.

This of course leads to conclude that any motion of massive elementary particles, such as electrons, quarks up or quarks down for example, would involve that half the unidirectional kinetic energy imparted would always quantize orthogonally to their direction of motion in space.

So this is why fields equation (29) for the electron at rest:

$$m_0\,\vec{\mathbf{0}} = \frac{E}{c^2}\,\vec{\mathbf{0}} = \frac{V_m}{c^2}\left\{\left[\frac{\varepsilon_0 \mathbf{E}^2}{2}\right]_Y \vec{\mathbf{J}}\,\vec{\mathbf{i}} + \left[2\left(\frac{\varepsilon_0\,\mathbf{V}^2}{4}\right)_X (\vec{\mathbf{I}}\,\vec{\mathbf{j}}, \vec{\mathbf{I}}\,\overleftarrow{\mathbf{j}})\cos^2(\omega t) + \left(\frac{\mathbf{B}^2}{2\mu_0}\right)_Z \overleftrightarrow{\mathbf{K}}\sin^2(\omega t)\right]\right\} \quad (31)$$

$$\text{where } V_{me} = \frac{\alpha^5\lambda_C{}^3}{2\pi^2},\quad E_e = \frac{\pi e}{\varepsilon_0\alpha^3\lambda_C{}^2},\quad B_e = \frac{\pi\mu_0 e c}{\alpha^3\lambda_C{}^2} \text{ and } \mathcal{V}_e = \frac{\pi e}{\varepsilon_0\alpha^3\lambda_C{}^2}$$

can be correlated and added within the corresponding spaces to the fields equation for the added kinetic energy

$$E_K\,\vec{\mathbf{I}}\,\vec{\mathbf{i}} = \left[\frac{hc}{2\lambda}\right]_X \vec{\mathbf{I}}\,\vec{\mathbf{i}} + \left[2\left(\frac{\varepsilon_0 \mathbf{E}_K{}^2}{4}\right)_Y (\vec{\mathbf{J}}\,\vec{\mathbf{j}}, \vec{\mathbf{J}}\,\overleftarrow{\mathbf{j}})\cos^2(\omega t) + \left(\frac{\mathbf{B}_K{}^2}{2\mu_0}\right)_Z \overleftrightarrow{\mathbf{K}}\sin^2(\omega t)\right] V_K \quad (32)$$

$$\text{where } V_K = \frac{\alpha^5\lambda^3}{2\pi^2} \text{ and } E_K = \frac{\pi e}{\varepsilon_0\alpha^3\lambda^2} \text{ and } B_K = \frac{\pi\mu_0 e c}{\alpha^3\lambda^2}$$

in the following manner:

Table I: Combined fields equations of the electron and its carrier-photon

	Directed Kinetic Energy In X-space (normal space)	Energy in Y- and Z- Spaces (magnetostatic and electrostatic) contributing to mass
Rest mass energy (m_0c^2)		$\left[\left(\frac{\varepsilon_0 \mathbf{E}_e{}^2}{2}\right)_Y \vec{\mathbf{J}}\,\vec{\mathbf{i}} + \left(\frac{\mathbf{B}_e{}^2}{2\mu_0}\right)_Z \overleftrightarrow{\mathbf{K}}\right] V_{me}$
K	$\left(hc/2\lambda\right)_X \vec{\mathbf{I}}\,\vec{\mathbf{i}}$	$V_K\left(\frac{\mathbf{B}_K{}^2}{2\mu_0}\right)_Z \overleftrightarrow{\mathbf{K}}$
Relativistic mass (Total electromagnetic mass)		$\frac{1}{c^2}\left[V_{me}\left\{\left(\frac{\varepsilon_0 \mathbf{E}_e{}^2}{2}\right)_Y \vec{\mathbf{J}}\,\vec{\mathbf{i}} + \left(\frac{\mathbf{B}_e{}^2}{2\mu_0}\right)_Z \overleftrightarrow{\mathbf{K}}\right\} + V_K\left(\frac{\mathbf{B}_K{}^2}{2\mu_0}\right)_Z \overleftrightarrow{\mathbf{K}}\right]$

XXII. CONCLUSION

Analysis of the mechanics of conversion of photons of energy 1.022 MeV or more to electron-positron pairs in the 3-spaces model reveals that electrons and positrons have exactly the same dynamic structure as photons, the only difference being one of localization of the unidirectional half of their energy, that is, within normal space for photons and within orthogonal electrostatic space for electrons and positrons, forcing their electromagnetic half to oscillate between the two remaining orthogonal spaces, magnetostatic space being common to both.

The fact that all of electron and positron energy resides in orthogonal electrostatic and magnetostatic spaces explains in this model why all of their rest energy can be measured as having transverse inertia (mass) .

By comparison, only half the energy of a photon of same energy can be measured as having transverse inertia, since only half of its energy resides in orthogonal electrostatic and magnetostatic spaces while the other half, being unidirectional in normal space, opposes no transverse inertia whatsoever to any force being applied transversally as discovered by Walter Kaufmann.

The charges of electron and positron are due in the 3-spaces model to the unidirectional half of their energy located in electrostatic space applying pressure towards normal space from inside electrostatic space for positrons, and applying pressure away from normal space from inside electrostatic space for electrons.

REFERENCES

[1]. André Michaud. The Expanded Maxwellian Space Geometry and the Photon Fundamental LC Equation. International Journal of Engineering Research and Development **e**-ISSN: 2278-067X, **p**-ISSN: 2278-800X, www.ijerd.com Volume 6, Issue 8 (April 2013), PP. 31-45. (http://ijerd.com/paper/vol6-issue8/G06083145.pdf).

[2]. André Michaud. The Corona Effect, The General Science Journal. 2009: (http://www.gsjournal.net/Science-Journals/Essays/View/2262).

[3]. Blackett, P.M.S & Occhialini, G. (1933) Some photographs of the tracks of penetrating radiation, Proceedings of the Royal Society, 139, 699-724.

[4]. Robert Resnick & David Halliday. Physics. John Wyley & Sons, New York, 1967.

[5]. André Michaud, Field Equations for Localized Individual Photons and Relativistic Field Equations for Localized Moving Massive Particles, International IFNA-ANS Journal, No. 2 (28), Vol. 13, 2007, p. 123-140, Kazan State University, Kazan, Russia. (http://www.gsjournal.net/Science-Journals/Essays/View/2257).

[6]. André Michaud. Expanded Maxwellian Geometry of Space, 4th edition, SRP Books, 2004. (Available in many eBook formats at https://www.smashwords.com/books/view/163704).

[7]. M.Abraham. Dynamik des Electrons, Nachrichten von der Gesellschaft der Wissenschaften zu Göttingen, Mathematisch-Physikalische Klasse, 1902, S. 20.

[8]. Walter Kaufmann. Uber die "Elektromagnetische Masse" der Elektronen, Kgl. Gesellschaft der Wissenschaften Nachrichten, Mathem.-Phys. Klasse, 1903, S. 91-103.

[9]. Henri Poincaré. La science et l'hypothèse, France, Flammarion 1902, 1995 Edition.

[10]. Henri Poincaré. La valeur de la science, France, Flammarion 1905, 1994 Edition.

[11]. André Michaud. From Classical to Relativistic Mechanics via Maxwell. International Journal of Engineering Research and Development, e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com. Volume 6, Issue 4 (March 2013), PP. 01-10 (http://ijerd.com/paper/vol6-issue4/A06040110.swf).

[12]. Yvette Cauchois. Atomes, Spectres, Matière. Éditions Albin Michel, Paris, 1952.

[13]. Paul Marmet. Fundamental Nature of Relativistic Mass and Magnetic Fields, International IFNA-ANS Journal, No. 3 (19), Vol. 9, 2003, Kazan University, Kazan, Russia. (Also available over the Internet http://www.newtonphysics.on.ca/magnetic/index.html).

[14]. Walter Greiner and Joachim Reinhardt. Quantum Electrodynamics. Springer-Verlag. Second Edition, 1994.

[15]. Isaac Newton. De la gravitation & Du mouvement des corps (Original Latin manuscripts titles: "De gravitatione & De Motu"**)**. Translated from Latin to French by Marie-Françoise Biarnais and François de Gandt, Gallimard, 1995.