THE PHOTON A TRAVELLER IN DISGUISE and THE ELECTRON THE COINCIDENCE OF BEING

12 March 2018 - Guido KINET - guido.kinet@telenet.be

Abstract *:* The word photon is one of the most confusing and misemployed words in physics. A small selection from the difference in word choice : the photon in spectroscopy as to explain how spectra are connected to the atoms and molecules has an another understanding than those in photon quantum optics experiments and again those have another understanding as from the photons used in high energy research and then there are the photons in the photoelectric effect, photons jumping around in atoms, the Compton scattering, Feynman diagrams, virtual photons, photons in two photon physics, Thomson scattering …and the photons that are usually associated with our ability to see …..

It is the intention to shed more "light" on the world of the photon and the part it plays in the scenery of the universe by putting it in its proper perspective, with some remarkable results.

Exploring the Casimir vacuum proper space and proper time give a new meaning to mass

The "fine structure constant" has always been a dimensionless quantity, one thought ... **but it is not**, and surprisingly enough, electromagnetic energy (photons) plays a part in this.

As for the electron *" .... JJ Thomson got the Nobel Prize for demonstrating the corpuscular nature of the electron, while his son GP Thomson got the same prize for demonstrating the non-corpuscular nature of the electron ... "*

… it is time for some audacious thoughts exercises.

EXPLORING THE INFINITE SMALL TO UNDERSTAND INFINITY

In "*Uncharted Territory**, a voyage** of discovery into the geometry and substance of our universe, the next challenge: an anatomy of a quantum of space*", a paper written in partnership, I brought forward that the connection between all the fundamental forces in nature is a hexagonal building block made of vibrating strings, the QUANTUM OF SPACE - $\mathbf{Q^s}$, which has led to defining the structure of empty space $\mho_m$ …

$$\mho_m = (l_p{}^z . Q^s)^n$$

…. a 3D structure composed of infinitely small interconnected vibrating points shaped as hexagons, a matrix structure, with exceptional properties.

As I was searching for an answer on the energy density in "empty space" and in a "vacuum", the Casimir vacuum was found to be the key to the secret of the molding of the elementary particles.

Exploring the reality with different dimensions opened the door to a unified field theory ajar … and an attempt was made.

At the end of the voyage a question did arises … "do we need other insights such as higher dimensions, strange mathematical twists … to uncover the true nature of the universe??"

To answer that question, it is crucial to continue the voyage of discovery into the geometry and substance of our universe.

Keywords : *Photon, electron, Casimir vacuum, fine structure constant, matrix, quantum of space, Planck length, Planck area, dimension, space, vacuum, mass, Lorentz transformation, entanglement, quark, gluon, proton, quantum leap, EM waves …. Planck catastrophe*

THE PHOTON A TRAVELLER IN DISGUISE

$$\Delta x \Delta p \geq \frac{h}{4\pi}$$

does not pertain to photons

I. THE CONFUSION OF TONGUES

The word photon is one of the most confusing and misemployed words in physics.

A small selection from the difference in word choice : the **photon** in spectroscopy as to explain how spectra are connected to the atoms and molecules has an another understanding than those in **photon** quantum optics experiments and again those have another understanding as from the **photons** used in high energy research and then there are the **photons** in the photoelectric effect, **photons** jumping around in atoms, the Compton scattering, Feynman diagrams, virtual **photons**, **photons** in two **photon** physics, Thomson scattering …and the **photons** that are usually associated with our ability to see …..

When speaking of **photons**, there is need to clearly distinguish between virtual **photons** and electromagnetic **photons**.
Exchange of **photons** between repelling or attracting electrons does not refer to physically existing electromagnetic photons, but to "virtual **photons**" a mathematical artefact to allow calculating force/energy interaction levels between charged particles.
The nature of real electromagnetic **photons** is one of only kinetic energy that is moving with the speed of light which can be emitted only in “quantized” form.
Light and other electromagnetic waves are emitted in discrete packets of energy, "quanta", which can only take on certain discrete values, multiples of the “Planck constant”.

We also have to be very aware that there is no such thing as a "**light photon**". It is only because there are specific biologically adapted organs (eyes and brains) that convert electromagnetic energy with a specific energy into a kind of pixelated reality that the label “light **photon**” emerged.

II. ENERGY CHUNKS IN QED

In modern quantum physics, the electromagnetic field is described by the theory of quantum electrodynamics (QED). In this theory, light is described by the fundamental excitations (or quanta) of the electromagnetic field, called **photons.** In QED, **photons**

are massless particles and thus, according to special relativity, they travel at the speed of light in vacuum.

At its origin the **photon**, is just a theoretical construct how to describe Planck's quantum theory where the energy is not radiated via continuous energy streams but in small chunks. Those energy chunks were called **photons**.

Being of a theoretical construct **photons** have zero mass and rest energy, they only exist as moving energy chunks**,** they are elementary entities lacking rest mass, they have no electric charge, they are stable, these chunks carry energy and momentum (notwithstanding that they are not real particles) characteristics which are dependent on the frequency and wavelength of the electromagnetic wave, they **can have interactions with other electromagnetic waves** and particles, they can be destroyed and created, when in empty space, they travel at the speed of light, and they are spin-1 entities which makes them bosons.

A **quantum** of light of wavelength λ is the minimum amount of **energy** which can be stored in an electromagnetic wave at that wavelength, which is Planck's constant h times the frequency

III. PAVING THE WAY

" … Einstein himself believed that theory of general relativity could not properly function without a medium …"

Planck length is the length scale at which the structure of space becomes dominated by quantum effects, and it is impossible to determine the difference between two locations less than one Planck length apart. In string theory, the Planck length is also in the order of magnitude of the oscillating strings that form elementary particles, and shorter length do not make physical sense … but there is a problem !!!!

The Planck length being the smallest possible length (l_p = 1,616 199(97) × 10^{-35} m), ought to make the Planck area (l_p^2) the smallest possible…. but the diagonal of the surface of the Planck area is longer than one Planck length and smaller than two Planck lengths. Since the Planck length is the smallest meaningful length, fractions of a Planck length don't have meaning, therefore the only logical option is that when the diagonal should be (out of necessity) exactly equal to the Planck length, is to conclude that the Planck area, is a circle.

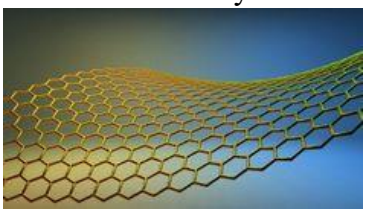
But again there is something strange. As the Planck length is the smallest meaningful length, fractions of a Planck length don't have meaning. The **circumference** of our circle is not a multiple of that Planck length what makes that circle an impossibility, and the question arises if there is a minimum 'true size' to that circle.

The solution lies in answering the question "what mathematical figure has a circumference of three times the diagonal of our circle?" (instead of 3,14 times), the answer is a **HEXAGON**.

The smallest Planck area is NOT a square or a circles but is in fact a two dimensional hexagon, a quantum of space.

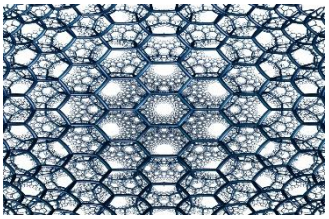
This has repercussions, because this also means that (single) closed strings with a diagonal smaller than the Planck length cannot exist, which makes the assumption that 6 out of the 10 spacetime dimensions in string theory wrapped up to a size of 10^{-35} m an impossibility. Furthermore in physics the definition of a closed string is a string that has no end-points, and therefore is topologically equivalent to a circle, but as proven a single string is unable to curl up and if that "closed string" refers to a single string with the assumption that one of the vibrational modes of a closed string can be identified as the graviton, there is again a problem.

The first dimension in the quantum world are Planck length strings. Several strings in each other's vicinity will always have a tendency to stick together, and that can only be



in the shape of a hexagon, it is their ultimate fate, there is no other option possible. **The second dimension** down in the quantum world is made up of hexagons with Planck length dimensions, matted together and molded into **a two dimensional fabric**, a **flexible field**.

"n" layers of this two dimensional field, will transform into a 3D canvas or matrix, the quantum dimension from which emerge all the elementary particles. The third dimension of the matrix is not the height to indicate the third dimension in space, but rather the stacking of n-layers of hexagons separated by a measure of one Planck length. Arguing that the Planck length is in fact the smallest possible length, implies that **it is**



impossible at that level **to compress** the quantum dimension still **further**, so it is fair to say that the measure of the Planck length is a *"**force**"* sustaining *the* 3D *canvas/matrix*, **it is in fact a STRONG FORCE**. Extending throughout the whole of space this minimum measure prevents space to implode, **it acts as force field**. One can argue that our universe is build out of infinitely interconnected tiny dots, almost like a viscous liquid.

(Ref 1 pages 3 through 7)

IV. THE CODE ($\mho_m$)

The assumption that space exists in individual units rather than an area only stuffed with electromagnetic waves makes it quantifiable.

The Planck length determined the nature of the *smallest possible area*. By dimensioning this data, it was possible to describe the aether based on the shape of a *hexagon*, reason why it is considered as the individual basic unit that makes empty space quantifiable.

Keeping the Planck length as a standard, space became a structured three-dimensional entity.

Therefore, **empty space, the most basic 3D environment,** can be summarized in one equation:

$\mho_m = (l_{p(z)} . \{l_{p(x)} . l_{p(y)}\})^n$ (provisional notation)

- ✓ ($\mho_m$) the **U**niversal **m**atrix",
- ✓ ($l_{p(z)}$) By taking the "z" coordinate (divided into units of Planck length), without any restriction of length, is emphasizing the extent of the cosmos,
- ✓ $\{l_{p(x)} . l_{p(y)}\}$ the impossibility of a Planck surface, a new notation for a hexagon with Planck length – Q_s
- ✓ The quantum of space (Q_s) has an open surface area $(3 \sqrt{3} \times l_p^2) / 2 = 2{,}598\ l_p^2$
- ✓ a circumference of: $6 \times l_p = 9{,}697 \times 10^{-35}$ m,
- ✓ …. but NO-volume

Linking "n" number of space quanta in "n" horizontal planes (in the four quadrants) separated by a Planck length to that "z" coordinate is the definition of the Universal Matrix ($\mho_m$), a flexible field composed of "n" hexagons (Q_s) stacked in a 3D grid, where each layer of that flexible field is separated by one Planck length … EMPTY SPACE.

$$\mho_m = (l_{p(z)} . Q_s)^n$$

THE MATRIX IS NOT TO BE REGARDED AS A CONTINUOUS INFINITELY INDIVISIBLE QUANTITY, BUT AS A DISCRETE QUANTITY COMPOSED OF AN INTEGRAL NUMBER OF FINITE EQUAL PARTS, THE QUANTUM OF SPACE, Q_s.

A 3D structure composed of infinitely small interconnected vibrating points shaped as hexagons. The $\mho_m$ is in a collective state of excitation with vibrations in its matrix.

Its vibrations, ON a string of Planck length, propagate at:

$v = \sqrt{\tau}/\mu$

τ = tension = energy per unit length = $E/l = mc^2 / l = \mu c^2$

μ = mass per unit length = m/l

Consequently, we arrive at:

$v = \sqrt{\mu c^2} / \mu = \sqrt{c^2} = c$ = speed of light

Vibrations on a quantum of space (Q^s) will, therefore, travel at the speed of light.

Note that Planck time = time required for light to travel one Planck length, which means that vibrations on a string that travel at one Planck length per Planck time, are only possible when speaking of waves with a wave length in the range of the **photon**.

It follows that $C = l_{pl} / t_{pl}$

The classical behavior of the electromagnetic field is described by Maxwell's equations, which predict that the speed *c* with which electromagnetic waves such as light, **photons** in other words, propagate through ***the vacuum*** is related to the electric constant ε_0 and the magnetic constant μ_0 by the equation:

$C = 1 / \sqrt{\varepsilon_0 \mu_0}$

V. VACUUM

Space or vacuum is not exactly empty. According to quantum field theory, quantum fields permeate every point in space-time. When the expectation value of the field is zero, we call that place “the matrix”. Think of that matrix as an ocean with **waves** of all the different frequencies and positions possible. Consider this matrix as a conservative "static" electric **field** (*any field that has no means of dissipating energy is conservative)* which is nothing but an immense intense space in terms of power where work is done or needed to be done upon presence of an electrical charged particle depending on the nature of the charged particle ...

So is it that a "pure" static electric or magnetic field, can be converted to an EM field, with both E and M components present, by simply moving a particle with regard to the frame in which only the “pure” electric field appears. That is, a pure static electric field will show the familiar magnetic field associated with a current, in any frame of reference where a charge moves. Likewise, any new motion of a charge in a region that seemed previously to contain only a magnetic field, will show that the space now contains an electric field as well, in that case then $U = 1/2\ (hf/2)^2 + 1/2\ B^2$ (exchanging velocity by frequency) computes for the **energy density in vacuum.**

VI. ENERGY DENSITY IN "EMPTY SPACE "

Relative permittivity (the ability of a substance to store electrical energy in an electric field) of the vacuum

$\varepsilon = \varepsilon_0 \varepsilon_r$ where $\varepsilon_r = 1$ in vacuum which in itself means that there is no propagation of electric fields

$\varepsilon_0 = 1$ in Gaussian units

Permeability constant: a measure of the amount of resistance encountered when forming a magnetic field in a classical vacuum

$\mu_0 = 1$ in vacuum meaning there is no diamagnetic nor paramagnetic permeability

The equation of energy density in a vacuum is:

$$U = \varepsilon_0/2 \cdot E^2 + 1/2\, \mu_0 \cdot B^2 \quad (1)$$

Given the above data:

$$U = 1/2 \cdot E^2 + 1/2 \cdot B^2 \quad (2)$$

E = electrical field that stores background energy that exists in space = vacuum energy = the zero-point energy of the string:

$$E = 1/2\ hv \quad (3)$$

B = magnetic field

Now we can say that:

$$U = 1/2\ (1/2\ hv)^2 + 1/2\ B^2 \quad (4)$$

…. as long as the matrix represents a static electric field, in other words, if no particles pass through, there will be no magnetic field, we can equal the second part of the equation to zero which leaves us with the electrical density of **EMPTY SPACE**:

$$U = 1/2\ (hv/2)^2 \quad (5)$$

A system in equilibrium $\Rightarrow \Sigma F = 0$

… so it is here that the electrical conductivity (σ) of **empty** space is zero, there is no conductivity, this is not quite the same as saying that in the **vacuum** of space there is no conductivity.

Empty space is an isotropic medium where the permittivity, ε, and permeability, μ, of the medium are uniform in all directions.

VII. CASIMIR VACUUM AND THE PHOTON

A vacuum is full of fluctuating electromagnetic waves that can never be completely eliminated. These waves imply that vacuum space contains a certain amount of energy that is always there.

The typical example of the Casimir effect is of two uncharged conductive plates in empty space, placed a few nanometers apart. In a classical description, the lack of an external field means that there is no field between the plates, and no force would be measured between them.

When this field between the plates, is instead looked upon using the quantum electrodynamic vacuum, it is seen that these plates are making geometrical restrictions on the waves in it, so relative to that, what is between the plates is a local drop in the energy density compared to the vacuum.

Energy density between the plates depends on the way plates interact. When they are pulled apart a little, there is not only the increase of the volume between them but also the increase of energy density in that volume, and so when plates are pulled apart just a little it is actually like creating energy, and by pulling the plates apart work must have be done and that means unconditional that a force was applied ….

When we take a look at the matrix ($\mho_m$) then the similarity arises with the uncharged conductive plates and the "n" layers of the flexible field ($\mathbf{l_{p(z)}.Q_s}$) of that matrix that are constantly vibrating and pulling the fabric back and forth. The excitation of the field changes the expectation value of that field and causes a disturbance that gives rise to an electromagnetic **wave packet**, whereby a particle in essence is the translation of vibrating/oscillating **space quanta** into each of the elementary particles, each with their own **unique** vibrational signature.

(Ref 2 – pages 1 through 6)

The PHOTON, a quantum of energy, is a transversely vibrational disturbance or perturbation in the electromagnetic field, traveling longitudinally THROUGH the matrix which itself is composed out of quanta of space.

Even when that disturbance proceeds through the electric field of the matrix, a small magnetic field is produced which in turn generates an electrical field, an electromagnetic wave, giving rise to that chunk of energy, (a **photon**) that in turn generates a magnetic field …. an moving electrical field, in that way sustaining its own being.

There is a nice analogy, compare the electromagnetic wave with the lateral movement of water, where waves just move up and down but otherwise stay in the same place moving their energy through the water.

Photons do not obey the Pauli exclusion principle, they are transverse waves moving the energy of the electromagnetic wave through the matrix.

Photons travel in straight lines and do not vibrate about their mean position while traveling, it is the value of the electromagnetic field at one given point in the matrix that oscillates. Every electromagnetic wave (in vacuum) travels at the same velocity, but when frequencies differ **photons** will have different energy levels.

Photons follow the direction in which they have been emitted. This does not mean that photons do not stray from their path, but any deviation from their original path always happens in small steps in the order of a Planck length or a multiple thereof, (up, down, left, right).

From the perspective of the photon it always travels in a straight line, whereas for an observer there is curvature when light passes around a massive object (light deflection).

The higher the frequency, the shorter the wavelength. Because all electromagnetic waves move through the vacuum at the same speed, the number of wave crests passing by a given point in one second depends on the wavelength. That number, or frequency, will be larger for a short-wavelength wave than for a long-wavelength wave, and therefore indicates the difference in the amount of energy they possess. This has an effect on the way they manifest. Low frequency electromagnetic radiation like radio waves, act like waves, while for high-frequency radiation like gamma rays, more frequently "seem" to be more particle like.

*EVERY **PHOTON** IS THE OUTCOME OF AN ELECTROMAGNETIC WAVE, meaning that all frequencies and therefore all energy of the electromagnetic radiation is translated into **photons** traveling (in vacuum) at the speed of light.*

This also means that every particle moving through the matrix is submerged in an environment saturated with *photons*, and these *photons* interact with matter due to their electric field exerting a force on the electrically charged cloud surrounding that matter.

VIII. CASIMIR VACUUM AND THE MASS RELATION

If we associate electromagnetic wave behavior with an elementary particle, it can easily be assumed that this oscillating electromagnetic wave (or electromagnetic waves) that gives shape to the elementary particle, can be considered as a time apparatus, a clock with a specific frequency (f_x), and by that it is also possible to assign a wavelength to that elementary particle (λ_0).

If the frequency (f_x) than generates "proper time", the elementary particle with a wavelength (λ_0) generates "proper space" for itself …. space and time into elementary particles !!!!

Mass is therefore the physical expression of the right frequency related to a flexible coupling towards the "n" layers of the flexible field of the matrix that constantly vibrates, the matrix *in its parts* being a massless scalar field that extends through the entire universe.

IX. THE PHOTON AT IT'S LIMITS - THE PLANCK CATASTROPHE

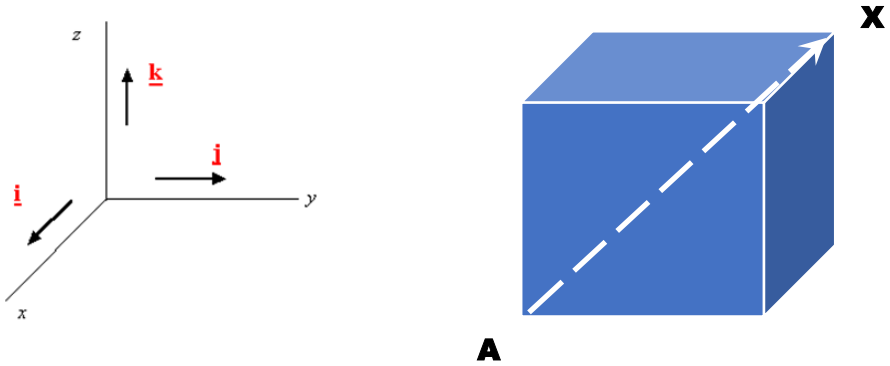
In 1935 came the quest for clarification concerning the entanglement theme and the baffling conclusion of information processing faster than the speed of light.

" …. *Einstein, Boris Podolsky, and Nathan Rosen published a claim that quantum mechanics predicts that more information about a pair of* ***ENTANGLED PARTICLES*** *could be observed than Heisenberg's principle allowed, which would only be possible if information were travelling instantly between the two particles. This produces a paradox which came to be known as the "EPR paradox" after the three authors. It arises if any effect felt in one location is not the result of a cause that occurred in its past, relative to its location. This action at a distance would violate the theory of relativity, by allowing information between the two locations to travel faster than the speed of light …"*

Excerpt from a portion of the discussion of Bell's test experiment published in Wikipedia under https://creativecommons.org/licenses/by-sa/3.0/

An orthogonal scalar time coordinate system, **tx + ty + tz** will label a position where "T" is the scalar measurement of time and "t" is a scalar measure of time in a sense that the time co-ordinate "T" is also a scalar quantity just like the spatial co-ordinates are.

Let’s imagine these three spatial time coordinates (tx, ty and tz), and AX indicating a displacement in time (T). After closing that configuration, a “volume” is obtained with AX as body diagonal.

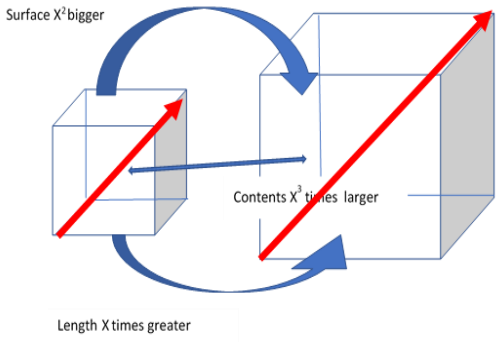


“A Three-Dimensional Time Structure” or **SPACE VOLUME**

The body diagonal AX stands for "T", scalar time (measurement). The volume in which “T” is the body diagonal replaces the concept of "space-time" by the more accurate denomination "SPACE VOLUME" which has no concrete shape because depending on the force or momentum exerted on an object, this new concept has a different content.

Objects create no specific space for themselves, they will only use a certain SPACE VOLUME to go from point A to point X.

The greater a force exerted on an object, the faster it moves, the less scalar time (T) to bridge (see red body diagonals below), the smaller the SPACE VOLUME used.

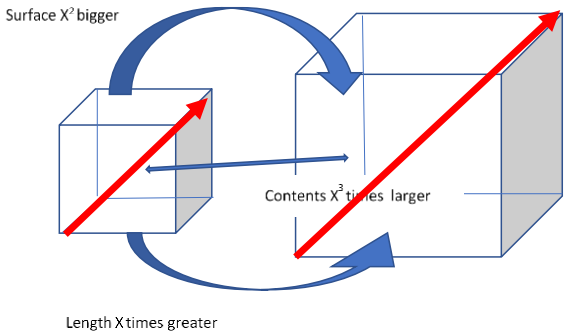


Due to the complementary nature of time and length it should be clear that when a certain distance has been traveled at a certain speed, the numeric value of that distance traveled (length) or the progress of time will not change when that same distance is traveled at a higher speed, it is the arithmetical value of the unit of measurement that changes.

"…. it was important to be able to estimate how much effort it would take to go from point A to point B and back .... and each time distance (= spatial separation between the receiver and the incoming data) was further subdivided into smaller chunks which gave a more exact idea of the distance to bridge. The more " chunks " the more accurate the measurement, and ultimately these chunks were the forerunner of what became finally known as .... TIME "

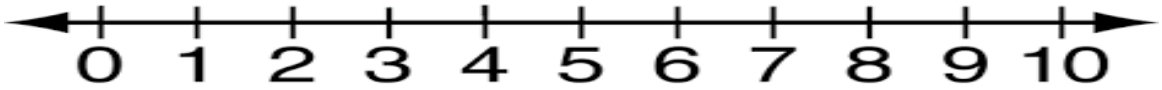
Reference: ***Why TIME is an evolutionary given and not something that sprouts out of the Big Bang***
https://zenodo.org/record/57399

Some explanation ……

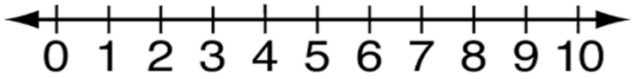


The scalar time "T" (visualized in **B)** suggested by the body diagonal on the left in the drawing is half the length of scalar time "T" on the right, (visualized in **A) due** to a force twice as large exerted on a similar object.

A



B



A and B represent the same distance or scalar time, and yet there is a distinct difference.

There is **uniform scaling of the space volume as the scalar "T" depicts simultaneously the time and length dimension**, **both pointing in the same direction** (see the drawing above).

Every time the progress of time and/or the speed and distance traveled changes a new space volume opens up (scaled to its new proportions) and gives the body diagonal the possibility to point in another direction while maintaining its scalar identity.

Consequently, when a **photon** is moving at the speed of light, it is obvious that ***the body diagonal of its SPACE VOLUME will be reduced to the size of one Planck length***, but as said before, there is no smaller length than the Planck length, meaning that the scalar measures tx, ty and tz of that space volume must measure one Planck length … and after a bit of number crunching the problem with the Planck square(s) appears again … the indivisibility of the smallest length.

The only option that remains open is to conclude that with the speed of light we get back to the real foundations of space, where that space volume overflows into the matrix…. *back to the beginning and anew we stumble on a real limit where it is impossible to travel faster than the speed of light, ... an answer on what entanglement is all about?*

Before reading any further the attentive reader will scratch his head with this new angle of approach, because now it must be clear that the speed of light (or **photons** in general in vacuum) is limited by the structure of the universe itself, in other words, if the Planck length had a smaller value than is now generally accepted, needless to say that the current value of the speed of light (or **photons** in general in vacuum) would be higher.

(Ref 3 – pages 14 through 19)

X. THE PHOTON AND THE LORENTZ TRANSFORMATIONS

The theory of special relativity started off with the experiment of Michelson and Morley which led to the Lorentz transformations (length contraction and time dilation) in order to **sustain the outcome of their experiment that the speed of light is independent of the motion of the source**.

However, when it is alleged that the speed of light is the ULTIMATE speed, we stumble on the same problem as with the Planck length, the inability to take the hurdle of the smallest length.

There is simply nothing that can move faster than the speed of light, even when (for arguments sake) another **photon** is projected from an already travelling photon, the speed of light will not be infringed.

Indeed, both **photons** will collide on the foundations of space, **the matrix** …., a limit, the Planck length, reason why it is impossible to travel faster than the speed of light.

The absolute minimum length, (the Planck length) and the most extreme speed limit, (the speed of light) congregate at the very foundation of space ….. the matrix.

It is of the utmost importance to realize that there is **ONLY** uniform scaling of the space volume and the body diagonal representing the distance traveled (length) and the progress of time, moving **objects** themselves **undergo no length contraction and are not subject to time dilation, they retain their original characteristics,** reason why **there is no need for length contraction or time dilation**.

XI. PHOTON ENTANGLEMENT UNRAVELED

Entanglement is a term used to describe the way particles of energy/matter can become correlated to predictably interact with each other regardless of how far apart they are.

Important remark: entanglement is inherently connected to the speed of light or speeds very close to the speed of light.

For entangled pairs of **photons**, there is no such thing as an arbitrarily large distance. **With the speed of light,** and a separation of 300.000 km, **photons** are separated only by a Planck length, and therefore the SPACE VOLUME travelled is at its smallest, reason why "communication" is almost instant. Ultimately this means that in our "slow" world **photons** span every second a distance of +/- 300,000 km, in the "ultra-fast" world of **photons**, only a Planck length of distance will be bridged.

In one year in our slow world, light travels a distance of 9.460.800.000.000 km but the **photon** in its ultra-fast world covers a distance of only 31.536.000 Planck lengths, and those traveled at the speed of light means that information is less than a blink of an eye away even at that distance, a mere (31.536.000 Planck lengths / speed of light) = 1,7 x 10^-36 s.

XII. THE PHOTON - THE DOUBLE SLIT EXPERIMENT - A DIFFERENT APPROACH

The universe, THE MATRIX, is flooded with (real) **electromagnetic *photons*** (versus virtual **photons**), **chunks of (kinetic) energy**, moving with the speed of light which are only emitted in a “quantized” form, in other words light and other electromagnetic waves are emitted in discrete packets of energy, "quanta", which can only take on certain discrete values, multiples of the “Planck constant”, ….. and then there is the double slit experiment.

The outcome of the double slit experiment was at least surprisingly, it showed that when light is shone at a screen with one slit open a **photon** can pass that slit as a whole similar to a solid particle. When presented a screen with two slits open the **photon** passes through both slits behaving as a wave.

Quantum physics postulates that the reason for this is that a **photon** lacks definite physical properties and is defined only by the probabilities of it being in different states. You could say it exists in a suspended state, a sort of super-animation until it is actually observed, at which point, it takes on the form of either a particle or wave, while still having the properties of both

But there is another option that has never been suggested …. polarization by scattering of electromagnetic waves !!!!

" .... Polarization occurs when light is scattered while traveling through a medium. When light strikes the atoms of a material, it will often set the electrons of those atoms into vibration. The vibrating electrons then produce their own electromagnetic waves (accompanied with chunks of energy) which are radiated outward in all directions ... this scattered light is partially polarized.."

This is exactly what happens when **photons** pass through the two slits of the screen, they are literally passing "through" a medium striking (activating !) the material of the screen at the edges of the slits, setting the electrons of the atoms into vibration, which in turn produce their own electromagnetic waves, radiating outwards in all directions.
These newly generated waves strike free atoms in the surrounding atmosphere, oxygen, nitrogen, helium, argon, … forcing their electrons into vibrations at the same original frequency. These vibrating electrons produce another electromagnetic wave that is once more radiated outward in all directions. This absorption and re-emission of light waves causes the light (**photons**) to be scattered throughout the space between the slits and the screen, waves will interact and when the top of one wave meets the bottom of another wave, nodes will be created which will translate themselves on the screen ahead as dots and mingle with the dots made by the **photons** who passed the slits without touching. This of course does not mean that all the waves that interact will have their mark on the screen, only those who direct themselves to the screen.
With one open slit, the scattering of the EM waves will determine the width of the single band on the screen which does not rule out that at random dots will appear on the screen spread over the entire area but not as an interference pattern.

XIII. QUARKS AND THE GLUON ENIGMA

Quarks combine to form composite particles (hadrons), such as protons and neutrons, components of atomic nuclei. There was and still is much debate about their nature and properties. The design of the matrix and its effects give us a glimpse of the world of these smallest of building blocks.

If the electromagnetic wave or **photon** is a transversely vibrational disturbance or perturbation in the electromagnetic field, traveling longitudinally THROUGH the electromagnetic field, QUARKS, are disturbances or perturbations in the electromagnetic field consisting of sets of component sinusoidal waves electromagnetic

waves of different wavenumbers, with phases and amplitudes such that they interfere constructively over a small region of the matrix, giving shape to the different manifestations of those smallest of building blocks. **In order to maintain their individual identity, it is paramount they bond with each other in order to achieve stability,** (for instance, two up quarks (+ 2/3 e) and one down quark (- 1/3 e) make a + proton), **and they do that by attaching themselves to each other over different layers of the flexible field of the matrix, each set of layers separated by a Planck length. So being "embedded" in the matrix, they are restrained by that Planck length, making it impossible to disconnect the bond between them (Asymptotic Freedom). The STRONG FORCE acting as a gluon.**

" ... The third dimension of the matrix is not the height to indicate the third dimension in space, but rather the stacking of n-layers of hexagons separated by a measure of one Planck length. ***Arguing that the Planck length is in fact the smallest possible length, implies that it is impossible at that level to compress the quantum dimension still further****, so it is fair to say that the measure of the Planck length is a "force" sustaining the 3D canvas/matrix, it is in fact a STRONG FORCE ... "*

When talking about the impossibility of compression of the quantum dimension it speaks for itself that the infinite stacking of n-layers of the flexible field separated by a Planck length, also makes it impossible for the matrix to fall apart.

IT IS THEREFORE IMPORTANT TO REALIZE THAT
"FORCES CAN BE PARTICLES TOO"

THE ELECTRON AND THE COINCIDENCE OF BEING

The ratio between the mass of a proton
and that of an electron is about 1836

XIV. ELECTRONS AND PROTONS

" .... JJ Thomson got the Nobel Prize for demonstrating the corpuscular nature of the electron, while his son GP Thomson got the same prize for demonstrating the non-corpuscular nature of the electron ... "

Scientists in the nineteenth century discussed problems regarding modelling the electron as a particle with spatial extension. On the one hand there were proponents who advocated the idea that an electron most probably was a kind of an extremely tiny ball of mass with the electric charge dispersed in the substance of that mass, meanwhile, there was also a tendency that assumed that the electron could be disc-shaped rather than a spherical particle. To overcome this discrepancy, physicists came to an **agreement** that modelling the electron could be resolved with the assumption that the electron has no physical spatial extension and no internal components or substructure. It was declared to be an elementary particle with electric charge, mass, electromagnetic behavior, spin …

The Casimir vacuum however sheds more light on the origin of the elementary particles of which the electron also makes part of :

*" ... When we take a look at the matrix ($\mho_m$) then the similarity arises with the uncharged conductive plates and the "n" layers of the flexible field ($\boldsymbol{l_p^z.Q^s}$) of that matrix that are constantly vibrating and pulling the fabric back and forth. The excitation of the field changes the expectation value of that field and causes a disturbance that gives rise to a **wave packet**, whereby a particle in essence is the translation of vibrating/oscillating **space quanta into each of the elementary particles**, each with their own **unique** vibrational signature.*

One of the most remarkable features of the electron is that despite the mass ratio electron/proton equal to 1/1836, the electric charge of both ((the electron (-) and the proton (+)) is opposite and identical to 1.602 x 10^-19 C, being the elementary electric charge. Any electron irrespective of any condition cannot have charge more than the above value . This is because that is the inbuilt characteristics of the electron.
The proton on the other hand **is a composite particle** consisting of two up quarks each having an electric charge +2/3 e (electron charge) and one down quark equaling -1/3 e (electron charge) giving it a positive charge.

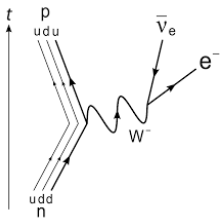
The starting point in the relationship between the electron and the proton, should be that protons are the result of the nature of the electric charge of the electron. Being an elementary particle and the quantum of electric charge, it is the electron that determines the structure of the proton and not the other way around …. the electron is in a sense the first "architect " of the tangible world as we know it.

Even the neutron obeys the rules of the architect.

XV. THE WEAK FORCE, QUARKS AND FLAVOR

In **the Casimir vacuum** the excitation of the field causes a disturbance in the matrix whereby a particle emerges and is an integral part of the matrix, but there are also constantly virtual particle pairs popping into existence. They come into life for only a very short time, then annihilate and vanish. As is common for quantum objects, their energy is related to a wavelength. The higher their energy becomes, the smaller the wavelength. The particle energy can actually become arbitrarily large. In fact, it can theoretically be infinitely large.

In Feynman diagrams the virtual line, in this case **a W^- boson**, (the W boson changes the makeup of particles. By emitting an electrically charged W boson, the weak force changes the flavor of a quark, which causes a proton to change into a neutron, or vice versa), does not represent a "particle" that can be measured, it **is a virtual particle**. A virtual particle is not a particle at all. It refers to a disturbance in a field that is not a particle, in contrast to a real particle which is a regular ripple in a field, that can travel smoothly and effortlessly through the matrix. A virtual particle, is a disturbance in a field that will never be found on its own, it is something that is triggered by the presence of other particles, often of other fields.



The process in which a neutron changes into a proton and vice versa is called beta decay. Beta decay occurs when, in a nucleus with too many protons or too many neutrons, one of the protons or neutrons is transformed into the other. Beta decay can go in one of two ways. In beta minus decay (β^-decay) a neutron decays into a proton,. In beta plus decay (β^+decay) a proton decays into a neutron.

As **a W boson is** almost a **100 times as massive as the proton** (E=mc^2), **in terms of "energy"**. That electric disturbance has enough energy to change the "flavor" of a "down" quark into that of an "up" quark, or change the "flavor" of its 3-dimensional EM wave packet, transforming a neutron into a proton with emission of an electron and a antineutrino in β^-decay or a positron and a neutrino when a proton decays into a neutron in β^+decay … **the weak force at work**, which brings us seamlessly to the next issue.

XVI. SOME AUDACIOUS THINK EXERCISES

THE JANUS ELECTRON - BEGINNINGS AND TRANSITIONS
W-ELECTRONS (e^-_W) AND P-ELECTRONS (e^-_P)

According to quantum theory, electrons orbit the nucleus of an atom in a series of orbital shells that correspond to the energy level of the **electron**. No two **electrons** of exactly the same properties (*every **electron** is identical to every other **electron**, they all have the same mass, the same electric charge, and the same spin*) can inhabit the same space at the same time (*the Pauli exclusion principle*) thus, atomic orbitals are characterized as "probability clouds".

" .... All particles/waves can actually be described as wave-functions which exhibit both wave-like and particle-like behavior (!). Naïve notions of light being a wave and electrons being a particle are limited interpretations of the underlying reality…. "

As mentioned before the way elementary particles come about makes them indistinguishable between themselves, meaning that every up quark is indistinguishable from another up quark, every down quark is the same ***as is the case for an electron …***

Since Louis de Broglie proposed the wave interpretation of a particle of momentum *p*, as having wavelength $\lambda = h/p$ it explains the discrete energy levels in atoms in terms of standing waves, with electrons at specific energy levels (shells & subshells) consisting of a standing wave with "n" cycles forming an electrical cloud around the nucleus, the ***W-electron*** confined to dimensions on the order of the size of an atom**,** the **W**ave like electron (e^-_W).
It is never to be found as a free **electron**, it only exists in the presence of an atomic nucleus.
The twin **electron** on the other hand has a different *occurrence*, it is the **electron** that is to be found in the valence (conduction) band, hitchhiking on the electrical cloud around the nucleus, a **P-electron**, the **P**article like **electron** (e^-_P).
It is the electron that hops in and out the valence (conduction) band(s) in an attempt to establish a bond between atoms.
It is also the **electron** that brings about the equilibrium of the electrical cloud around the nucleus (ionization being the exception).
This **electron** which when not attached to the outer shell of an atom is a free **electron** that can move freely when external energy is applied.

We have to forget the image of the number of particle like **electrons** that match the amount of protons "within" the so-called probability cloud around the nucleus ... there are indeed **electrons** present in the electromagnetic field but not all with the same appearance.

The nucleus being an electrical charged particle moving through the matrix is served by W- and **P-electrons**, it is the natural way it gains its "neutral" status.

The quantum number "*n"* labels the energy level "E_n*"* around the nucleus .

The lowest energy level *n*=1, so "*n"* is related to the number of wavelengths that fit into the **W-electrons** orbit. All orbits with the same *n* form a (spherical) shell. Since the size of a shell increases with *n*, outer shells can hold more **W- electrons** in shells and subshells. Together they form the cloud.

It is the energy from the **W-electrons**, which constitutes the so called "cloud", around the nucleus. At large (!) distance from the nucleus this electromagnetic field is weak, however closer to the nucleus, the field becomes stronger. Because the cloud wants to reduce its kinetic energy by shrinking closer to the core, its potential energy rises more than its kinetic energy goes down, which is why it regulates itself at an average size.

This electromagnetic field (the cloud) around the nucleus actually extend all the way down to the nucleus itself and the protons/neutrons are constantly interacting, electromagnetically. In quantum field theory we would say that there is constant **photon** exchange. Thus you might say that the otherwise "empty" space is "filled" with these quanta carrying forces.

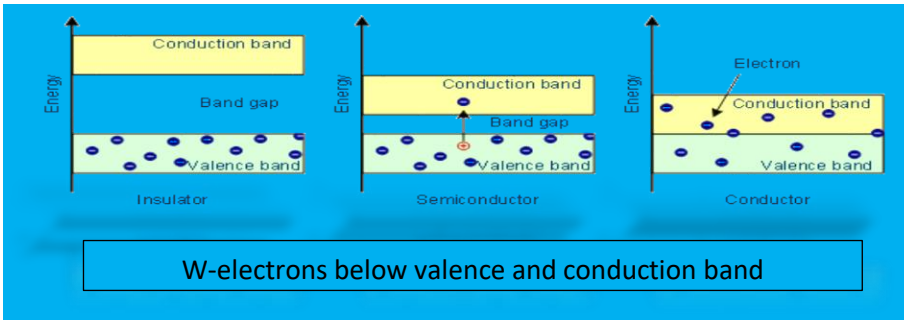
*((every **photon** is the outcome of an electromagnetic wave, meaning that all frequencies and therefore all energy, of the electromagnetic radiation are/is translated into **photons** traveling at the speed of light (in vacuum), this also means that every particle moving through the matrix is submerged in an environment saturated with **photons** ...))*

The equilibrium of the electromagnetic field around the nucleus will ultimately depend on the amount of **P-electrons** present in the valence and/or conduction band and the total value of the electric charges of the **W-electrons** around the nucleus.
Therefore when atoms combine, electromagnetic waves overlap, **P-electrons** will or will not be exchanged … rejected, and (eventually) a new kind of pattern will be created with a stable new electromagnetic "inner" cloud and a new **electron** configuration at the outer rim of that electromagnetic cloud, a new "bond" that will balance the electrical charge of the nuclei. The possible imbalance is smoothed out by the leakage (or absorption) of **photons** with appropriate electrical values.

W-electrons are electromagnetic waves and have the same properties as the **P-electrons**, except for their appearance.

The **P-electrons** present in the valence and outer conduction bands of the atom contribute to the balance of the electrical charge of the nucleus and allow possible bonding ... they dictate the state of matter, being a conductor, semiconductor or

insulator….. being a negative or positive charged atom, an ion …. the number of **P-electrons** in the outer energy level of the atom determines many of the chemical properties of the atom ….



When atoms bond, the valence and conduction band are most important. The difference between conductors, insulators and semiconductors is the available energy for **P-electrons** in the materials.

- ***CONDUCTOR***

Conduction Band : Full of **P-electrons**

Valence Band : the valence band is either not fully occupied with **P-electrons**, or the filled valence band overlaps with the empty conduction band. In general, both states occur at the same time, the **P-electrons** can therefore move inside the partially filled valence band or inside the two overlapping bands.

Band Gap : No band gap

- ***INSULATOR***

Conduction Band : Remains empty

Valence Band : the valence band is fully occupied with electrons due to the covalent bonds. The **P-electrons** cannot move because they're "locked up" between the atoms. To achieve a conductivity, **P-electrons** from the valence band have to move into the conduction band. This is prevented by the

band gap, which lies in-between the valence band and conduction band.

Band Gap : Large band gap

- ***SEMI CONDUCTOR***

In semiconductors, there is a band gap, but compared to insulators it is so small that even at room temperature **P-electrons** from the valence band can be lifted into the conduction band.

The **P-electrons** can move freely and act as charge carriers. For each **P-electron** that jumps to the conduction band there is a hole left in the valence band, that can be filled by other **P-electrons** in that valence band.

THE QUANTUM LEAP

*" ... It is the laws of quantum mechanics that describe the process by which **electrons** can move from one allowed orbit to another and as with many processes in the quantum world, this process is impossible to visualize. An **electron** disappears from the orbit in which it is located and reappears in its new location without ever appearing any place in between, a quantum leap or quantum jump ..."*

The term "quantum leap" however is highly misleading.

An **electron** is a quantum object, it will act both as a wave and as a particle at the same time. When bound as part of an atom, an **electron** mostly acts like a wave, it spreads out into cloud-like wave shapes called "orbitals" overlapping in space.

When an **W-electron** transitions from one energy level to another energy level, it does not really go anywhere, it just changes shape. The orbital shapes with higher frequency contain more energy. In other words, when an **W-electron** transitions to a lower atomic energy level, its wave shape changes to have fewer cycles in it.

A **W-electron** that transitions from one energy level to another does not make any kind of leap from one location in space to another location in space, it makes a smooth transition, readily sliding along the energy scale from one **stable state** to the next "**the jump or quantum leap**".

*" ... The orbitals of a particular atom are not the only allowed states that an **electron** can take on in the atom. They are the only **stable states** of the atom, meaning that when an **electron** settles down to a particular state in an atom, it must be in one of the orbital states ..."*

A **W-electron** that "**jumps**" **from a higher to a lower energy level** loses energy emitted by that **W-electron** in a beam of electromagnetic radiation, which is "partially" visible as a light **photon**, this to match the energy level of that lower energy level. *(A lower level means that the **W-electron** moves closer to the core of the atom)*

Different orbits have different energies and whenever an **W-electron** migrates from one energy level to another, a so called "**quantum leap/jump**" a smoothly transition from the one energy level to the other energy level over a period of time along the energy scale from one stable state to the next, the energy value of that **W-electron** that makes the "**jump"** will be different after that transition, it can seem to be nearly instantaneous but fundamentally it is not.

A **W-electron**, negatively charged, is attracted to the nucleus of an atom and keeps circling around the core due to the attractive electric power of the protons because of its positive charge. The amount of energy that must be given to the **W-electron** to pull it away from this attraction force is called the binding energy.

If energy is added to a **W-electron** it can use that energy to make a "**quantum leap**" **from a lower to a higher energy level**, in other words (the wave **electron**) enlarging its orbit to fall almost immediately back to its former energy level by getting rid of a **photon** of just the right frequency to match the energy level of that lower level.

On top of that it also requires extra energy to surpass the resistance of the binding energy from the energy level it is trying to escape from. When more than one **electron** is present in orbit around a nucleus one most consider the electrostatic repulsion which arises between the **W-electrons**. Because of this additional repulsion, the energy one needs to give a certain **W-electron** to move away from the nucleus is less than would be needed otherwise.

On the other hand, to **jump** from a higher energy level to a lower energy level it is needed to level down the energy content of the **W-electron** to fit the required lower energy level, but in this case it does not need that extra energy to make the **jump** to that lower level because it is pulled in by the attraction of the core, extra potential energy is added to that **W-electron** due to the action of being pulled in.

A NUMBER EQUAL TO THE FINE STRUCTURE CONSTANT BUT NOT DIMENSIONLESS

$\alpha = e^2 / \hbar c = 1/137 = 0{,}0072992 \ldots$ a **dimensionless quantity**, a fundamental physical constant characterizing the strength of the electromagnetic interaction between elementary charged particles.

- e is the elementary charge
- $\hbar = h/2\pi$ is the reduced Planck constant,
- c is the speed of light in vacuum,

In a paper submitted to Physical Review Letters, a team led by John Webb and Julian King from the University of New South Wales in Australia present evidence that the fine-structure constant may not actually be constant after all. What they found shocked them, α is not changing with time, it is varying through space … I did my own digging.

The result of dividing the speed of light by 137 is 2188 Km/s (which is also the unit of velocity in the atomic system of units)

299.792,458 Km/s / 137 = 2188,262773722628… Km/s and dividing that number by C, we obtain : 2188,262773722628 Km/s **/ 299.792,458** Km/s **= 0,0072992c**

THE ACTUAL VALUE OF THE FINE STRUCTURE CONSTANT,

BUT NOW NO LONGER DIMENSIONLESS

a quantity with dimension (10^6 m/s) **length/time**.

In all studies or scientific papers whether or not concerning atomic units and/or the fine structure constant, to my knowledge, this connection was never made or expressed in this way, neither have I encountered it elsewhere … **to be continued**.

DO NOT BE AFRAID TO MOVE FORWARD SLOWLY,
JUST BE AFRAID TO STAND STILL

guido.kinet@telenet.be

+32 498 35 79 60

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