

On the 3-Spaces Expanded Maxwellian space Geometry

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[Expanded Maxwellian Geometry of Space](#)

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Abstract :

Description of a new space geometry that allows explaining the existence of all stable physically scatterable particles, relativistic velocities and gravity solely from Maxwell's electromagnetic theory and that consequently opens up a new and very promising avenue of research.

This expanded geometry is the first to allow a seamless series of clearly defined interaction sequences providing an uninterrupted path of causality from:

- 1) the unquantized quantities of unidirectional kinetic energy induced in particles by natural acceleration through Coulomb or gravitational interaction,
- 2) to the quantization in the form of free-moving electromagnetic photons of any quantity of this energy in excess of the precise amount required by the local stable or metastable electromagnetic equilibrium
- 3) to the creation of electron-positron pairs from the destabilization of photons of energy 1.022 MeV or more,
- 4) to the creation of protons and neutrons from the interaction of electrons and positrons forced into groups of three including both types in sufficiently small volumes of space with insufficient energy to escape mutual capture,
- 5) to the final shedding in the form of neutrino energy of momentary metastable excess rest mass (different from velocity induced extra momentary relativistic mass) as overexcited massive elementary particles are forced by local electromagnetic equilibrium into lowering their mass to their lower and stable true rest mass.

First described in a popularization work ([8]) in 1999, a summary overview of this new space geometry was formally presented at **CONGRESS-2000, "Fundamental Problems of Natural Sciences"** ([9]), St. Petersburg State University, St. Petersburg, Russia on July 5 of 2000.

The complete model based on this expanded geometry with appropriate mathematical support was then the object of a book ([6]) made available in 2004. The fundamental

geometry of the model is now presented as a separate paper quoted from this book. Many aspects of the model were then progressively made available over the Internet in separate papers.

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Maxwellian Space Geometry

1 The Neglected Maxwellian Space Geometry

Maxwell's theory has traditionally been considered strictly from the mathematical viewpoint offered by his famous equations and understood within the restrictive perspective of plane wave treatment, which resulted in the space geometry that mandatorily must underlie it to remain obscured.

Maxwell Equations		
	Integral Form	Differential Form
1	$\oint \mathbf{E} \cdot d\mathbf{S} = \frac{q}{\epsilon_0} = \Phi_E$	$\nabla \cdot \mathbf{E} = \rho/\epsilon_0$
2	$\oint \mathbf{E} \cdot d\mathbf{l} = - d(\int \mathbf{B} \cdot \hat{n} d\mathbf{S})/dt = - d\Phi_B/dt$	$\nabla \times \mathbf{E} = - \partial \mathbf{B} / \partial t$
3	$\oint \mathbf{B} \cdot d\mathbf{S} = 0$	$\nabla \cdot \mathbf{B} = 0$
4	$\oint \mathbf{B} \cdot d\mathbf{l} = \mu_o (i + \epsilon_o d(\Phi_E)/dt)$	$\nabla \times \mathbf{B} = \mu_o \left(\mathbf{J} + \frac{\epsilon_o \partial \mathbf{E}}{\partial t} \right)$

This geometry is the traditional Euclidian 3 dimensional flat space geometry to which the time dimension is added to justify motion.

A fundamental aspect of his theory is his conclusion regarding the state of orthogonality between the electric and magnetic fields of free moving electromagnetic energy, both normal to the phase velocity vector (which identifies the direction of motion of any point considered on the wave front). Experimental reality reveals that this also applies to charges moving in straight line.

Indeed, any elementary textbook on electricity and electromagnetism explains how the vectorial cross product¹ of an electric force and a magnetic force being applied to a charged particle can generate a velocity vector in straight line forcing that particle to move in a direction perpendicular to both forces, which is represented in classical electrodynamics from the Lorentz equation, by this well known relation

$$\mathbf{v} = \frac{\mathbf{E}}{\mathbf{B}}$$

or rather, in the present context, under the form of a vectorial cross product

$$\mathbf{E}\hat{\mathbf{j}} \times \left(\frac{-1}{\mathbf{B}} \right) \hat{\mathbf{k}} = \mathbf{E} \left(\frac{-1}{\mathbf{B}} \right) \cos \theta \hat{\mathbf{i}},$$

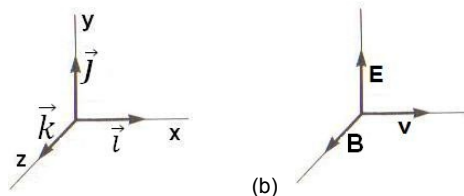
and since θ must be equal to 90° by definition in the present case:

$$\mathbf{E}\hat{\mathbf{j}} \times \left(\frac{-1}{\mathbf{B}} \right) \hat{\mathbf{k}} = v\hat{\mathbf{i}}$$

It must be clearly understood also that despite the precision of the calculations that Maxwell's theory allows at the general level, it is deemed unable to directly describe photons as discrete localized electromagnetic particles since it is founded on the notion that electromagnetic energy is a continuous wave phenomenon.

Maxwell's theory, as a matter of fact, was designed to account for electromagnetic energy behavior at the macroscopic level without the need to take quantization into account (which had not been clarified in Maxwell's time), that is, by treating it as general energy density per unit volume or general energy flow per unit surface rather than by adding the energy of localized moving electromagnetic particles enclosed in a unit volume or flowing through a unit surface, that could account just as well for observed phenomena at the macroscopic level.

¹ The following orthogonal basis will be used in this paper: **a)** 3-D rectangular coordinate system, and corresponding rectangular vectorial base and **b)** the corresponding rectangular electromagnetic fields vs velocity vector base



2 The need for a new space geometry

This leads to attempting to clarify why an acceptable description of electromagnetic photons such as deBroglie's ([1]) as permanently localized moving particles cannot be reconciled with the verified aspects of Maxwell's theory.

According to his theory, the electric and magnetic aspects of a wave must of necessity always be in phase at the wavefront, that is, at maximum at the same moment for the wave to exist at all and propagate. When both aspects are 90° out of phase, we obtain a standing wave. But as an intriguing dead end, when both aspects are set 180° out of phase, we end up with the exact equivalent of both aspects being in phase!

Also, it is the conjunction of both fields, in phase and at right angle with each other at all points of the wave front that is deemed to maintain the intensity of the energy of the wave at every points of the wavefront, despite the inherent spherical spread involved from the mandatorily point-like origin of such a wave. This issue is of course familiar to all in the physics community but is accepted as being a yet unexplained and unavoidable axiom.

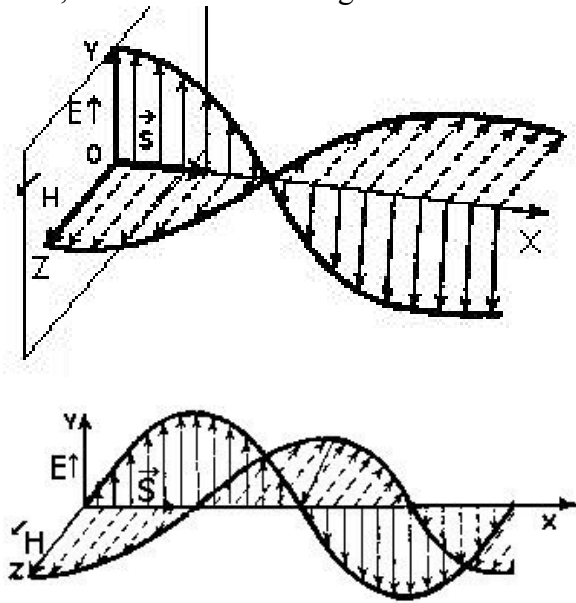
Mathematically speaking, when any local point of the curved spherical wavefront surface is considered, this surface can be locally approximated to a plane surface at the infinitesimal level and this is the origin of the "plane wave" equations set.

But space being three-dimensional, treatment by plane wave analogy can of course be only a mathematical approximation, an approximation that easily obscures the fact that physically, if such an electromagnetic wave really existed as such, it could only be in spherical expansion in vacuum from its point of origin, assuming unbounded isotropic expansion in deep space. So Maxwell's equations then describe the electromagnetic interaction only once the wave already is in full swing and has begun to propagate.

But if electromagnetic waves such as Maxwell imagined really existed, the geometry of their propagation would of necessity be much more similar to the spherical expansion of sound waves in the air than to the propagation of waves on a plane liquid surface, and it then becomes very difficult to logically accept the idea that the initial intensity at the point source of the wave could be arbitrarily multiplied in such a way that it could be measured as equal to the energy of the source at any point of the spherical wavefront at any arbitrary distance from the source as plane wave treatment seems to indicate.

3 Applying EM Properties to Maxwell's Wave Point-like Source

Consequently, always dealing with the state of orthogonality of both fields with respect to each other and to the normal in space at any point of the wavefront always leaves in the background the fact that the spherically expanding electromagnetic wave imagined by Maxwell can only be a single event originating from a single source.



Now if such an electromagnetic event is single event, could it be imagined that after appearing at its point like origin, it could remain locally point-like as it starts moving, like a local harmonically oscillating standing wave, instead of spherically expanding?

The idea naturally comes to mind then that the state of fundamental orthogonality of both fields could possibly be served just as well if it was defined with respect to the very point of origin of the wave instead of with respect to any given points of the spherical surface of the wavefront.

But an apparently insurmountable problem of this approach is the assumed infinite energy associated to all such a punctual electromagnetic event in classical electrodynamics.

Another problematic issue also comes up with the idea of mathematizing EM energy at its point like source. It is the fact that both fields can be orthogonal to no particular direction in space at the very moment of punctual coming into being, which lead directly to the conclusion that at such a point source, both fields of the EM punctual event can be orthogonal to nothing but 3-D space itself, despite the strangeness of the idea.

Let us consider however that such an idea is no stranger than this one, recognized for over a century, that sets time itself as being orthogonal to tri-dimensional space in Minkowski's space geometry, foundation of Einstein's General Relativity Theory, and it is precisely the avenue that we are going to explore here.

4 Expanding the Space Geometry

Obviously, the intersection of a magnetic field and an electric field at right angle with each other at the point of origin of the EM event, that is, with respect to 3-dimensional space itself at this point of origin, is far from easy to visualize. But as we will see, there are tricks that can be used to circumvent the problem.

For example, as a first stage in an expansion process of space geometry, let us represent the magnetic field by a plane that would correspond to the horizontal major Z-axis of a superset major coordinate system, and the electric field by a plane corresponding to the vertical major Y-axis. Normal space will then be represented by the horizontal major X-axis normal to the Z-axis and to the Y-axis of this superset coordinate system. We must now do a very special mental exercise with the concept of normal space in relation with this major X-axis.

We must now imagine the 3 familiar dimensions of normal space (represented by minor orthogonal axis x, y and z) as if they were the ribs of an open three-ribs metaphorical umbrella. If we mentally fold the umbrella, we can then visualize the folded umbrella as if it was this linear major X-axis of the expanded coordinates superset.

Having now this representation of both planes intersecting only along the X-axis, if we visualize these two planes moving at the speed of light along the X-axis, we have a representation of an electromagnetic event in phase moving at the speed of light along this X-axis representing 3-D space, in conformity with Maxwell's theory.

Let's emphasize again here that the Z and Y axes of this representation of Maxwell's geometry are not the z and y axes of our 3-D normal space, but rather supplementary extra-spatial dimensions. Each occurrence of a Maxwellian electromagnetic wave interaction could thus be represented by such an intersection of this Z-Y plane moving along the major X axis at the speed of light.

To visualize now the spherical expansion of the wavefront, we only need to mentally open the X-axis "umbrella" while visualizing the Z-Y plane moving at the speed of light along its length,

which allows clearly visualizing the spherically expanding wavefront in our 3-D space as the X-axis umbrella progressively opens.

But this already expanded space geometry, no doubt surprising to many by its extension, is still insufficient to describe localized photons in motion, as we will soon see.

What we just built is only a space geometry that allows describing how a classical Maxwell EM wave could spherically expand after having come into being at the major XYZ axis superspace point-like origin. In reality, we are just one step further from plane wave treatment in 3-D space.

5 What is Known about Photons and other Localized EM particles

But before expanding our space geometry further to finally harmonize localized photon motion with Maxwell's theory, we need to put in perspective a few major discoveries made after Maxwell gave us his theory more than 160 years ago. This information is required if we are to elaborate our solution while taking into account all of what is now known about photons and other localized electromagnetic particles.

First, Wien's experimental observations regarding the black body and Planck's interpretation of his results, showed us more than 110 years ago that electromagnetic energy is not continuous at the microscopic level as Maxwell had assumed, but discontinuous, and that what he interpreted as being waves, turns out to be in reality a perception at the macro level of a crowd phenomenon due by the existence of innumerable discrete electromagnetic events at the micro level, an idea that was strongly accredited by Einstein's photoelectric proof in 1905, and which were eventually named "photons", a proof that earned him a Nobel Prize.

Compton and Raman added further credit to Planck's interpretation, as they experimented with other types of collisions between photons and electrons. Their findings conclusively confirmed the discrete and localized nature of photons at the micro level. So, we know for certain now that Maxwell's "waves" do not exist as such at the microscopic level.

What can be experimentally observed regarding free moving energy at the micro level always turns out to be discrete amounts of energy escaping from atoms each time either an electron or a quark releases a quantum of energy (a photon) as it goes to a lower energy state after having been momentarily excited to a higher energy state, and conversely, discrete amounts of kinetic energy being gained by electrons being hit by photons, amounts that can always be related to one discrete amount having previously been released by one or other of the photon emitting de-exciting processes previously mentioned.

No experiment however ever contradicted a critically important aspect of Maxwell's theory which is the state of orthogonality of the electric and magnetic fields of free moving energy with respect to its direction of straight line motion, which consequently also applies to localized photons.

It is now an established fact that photons always are emitted and captured as discrete and localized electromagnetic photons that very precisely obey at all times this triply orthogonal law.

6 Localized existence of photons between emission and capture

At this point, an important philosophical question determines the manner in which these experimentally observed data, recognized by all, will be interpreted. In this regard, two diametrically opposed philosophies are being confronted since the end of the 1920's, more precisely since the 1927 Solvay Congress.

This historical debate, that very actively raged during the first half of the 20th century between causalists Einstein, Planck, Schrödinger, deBroglie, et al., and the promoters of the Copenhagen school of thought, that is, Bohr, Heisenberg, et al., has still not been resolved, as clearly emphasized as recently as 1994 by Franco Selleri ([2]).

6.1 Causality vs Non-causality Debate

To summarize the debate in a few words, causalists were convinced that the fundamental objective reality that underlies the theories that we elaborate is not chaotic and obeys logical laws that can be identified and understood, while the promoters of the Copenhagen school were convinced that there exists no fundamental reality beyond what Quantum Mechanics can describe, and that even if there was one, it would forever remain beyond our comprehension!

6.2 No Localized Trajectories for Non-causalists

This Copenhagen school interpretation of Quantum Mechanics, considered akin to giving up any further research towards better understanding of physical reality by the causalists, made it illogical in the view of the Copenhagen school supporters that a photon could remain localized after emission and follow a precise trajectory until it is captured, even if they are in perfect agreement that it comes into being as a discrete and localized quantum and will be captured in the same state.

Consequently, this philosophy generated no hypothesis regarding the precise electromagnetic behaviour of a photon's energy during its travel between its source and its point of capture other than that it would diffuse after emission into a packet of wavelets whose number and theoretical extension reaches infinity, to instantaneously regroup at the moment of capture and recover all the characteristics that the photon had as it was emitted.

This conclusion being final with this philosophy since each individual wavelet in the packet can be dealt with the classical plane wave treatment, no further hypothesis can be expected from them on the behaviour of localized electromagnetic energy in motion.

A final confirmation that no further research was to be undertaken to better understand fundamental reality was directly stated by no lesser scientist than Richard Feynman's opinion when he declares in his major 1949 paper where he defined virtual photons to account for the Coulomb interaction between charged particles, and I quote:

"In many problems, for example, the close collisions of particles, we are not interested in the precise temporal sequence of events. It is of no interest to be able to say how the situation would look at each instant of time during a collision and how it progresses from instant to instant." ([3], p.771)

6.3 Precise least Action Trajectories for Causalists

For deBroglie, Einstein and other causalists, who also perfectly agree that Quantum Mechanics is the most useful mathematical tool to calculate energy levels and explore atomic structures, the foundation of physical reality can be made up of nothing but the complete set of discrete electromagnetic events (photons and other electromagnetic particles) in constant interaction and the complete set of least action trajectories that the electromagnetic interactions that animates them forces them to constantly follow in a very precise manner.

For them, the imprecision of QM regarding any possible least action trajectories of particles is only a failing of the method and not a characteristic of the underlying physical reality.

It obviously is forever impossible to learn the location of every electron in the universe, for example, but it is perfectly within our reach to understand every which way an electron can

occupy the various possible orbitals in any atom. This makes it then possible for us to know how every electron in the Universe will behave in any specific situation where it is part of any atom in the Universe by the frequency of photons that are emitted or absorbed when these electrons temporarily jump between orbitals.

De Broglie perfectly defined causality as simply recognizing that nothing can happen in nature without a cause: *"The search for causality is an instinctive tendency of the human mind. It consists in admitting that the events that successively manifest themselves to us do not follow one another by chance, but derive from one another, being connected by such links that each of them is the necessary consequence of those which preceded it."* ([4], p. V).

"It is obviously certain that the emission of a particle by the source is the cause of its arrival on the detector. Now, the causal link between the two phenomena can be established only through the existence of a trajectory and to deny this existence, is tantamount to sacrificing causality. It is condemning ourselves not to comprehend." ([4], p. 13).

7 The Local Electromagnetic Oscillation of deBroglie's Photon

In the 1930's, Louis deBroglie, whose 1924 thesis inspired Schrödinger's wave equation and earned him a Nobel prize, formulated from these considerations a hypothesis on how a permanently localized photon following a least action trajectory could satisfy at the same time Bose-Einstein's statistic and Planck's Law, perfectly explain the photoelectric effect while obeying Maxwell's equations and totally conforms to the properties of Dirac's theory of complementary corpuscles symmetry. His theory highlighted the fact that the only possibility answering all of these criteria was that a photon be made up not of one corpuscle, but of two corpuscles, or half-photons, that would be complementary like the electron is complementary to the positron ([4], p.277).

From his hypothesis: *"Such a complementary couple of particles is likely to annihilate at the contact of matter by relinquishing all of its energy, which perfectly accounts for the characteristics of the photoelectric effect."*

Furthermore, *"The photon being made up of two elementary particles of spin $h/4\pi$, it must obey the Bose-Einstein statistic as the precision of Planck's law for the black body requires."*

Finally, he concludes that *"...this model of the photon allows the definition of an electromagnetic field linked to the probability of annihilation of the photon, a field that obeys Maxwell's equations and has all of the characteristics of electromagnetic light waves."*

DeBroglie's hypothesis on the permanently localized photon is completely explored in a separate paper ([1]).

8 Internal Electromagnetic Symmetry

These conclusions involve that localized photons have to be stable dynamic structures that can logically only alternate between a double-particles electric state with both particles separating in space (an electric dipole) and a single magnetic particle state that could be dipolar in only one manner, which can consist only in a spherical magnetic expansion phase as both electric state particles move towards each other, followed by a spherical magnetic regression phase as both electric state particles move away from each other, both magnetic phases being normal to the electric phase at all times. This means that the magnetic aspect of the photon will be spherical at all times and can be dipolar only along the time dimension since both expansion and regression cannot possibly occur simultaneously.

Such a dynamic structure still preserves fundamental symmetry since the space-wise electric dipole is then counterbalanced by a related time-wise magnetic dipole, with both dipoles remaining orthogonal to the direction of motion of the photon in space in agreement with Maxwell's theory.

9 Internal Coulomb Interaction between Half-Photons

Let us note that he considered both half-photons as electrically neutral, that is not being made up of oppositely signed charges. But given that Quantum Electrodynamics itself implicitly recognizes the presence of Coulomb interaction between a decoupling photon and a heavy nucleus with which it interacts by representing this interaction with a virtual photon, thus implicitly recognizing the presence of charges in photons to be interacted with, we will also assume that the possibly electrically neutral sub-components of the photon would also be subject to Coulomb-like interaction. The interaction between both half-photons inside a photon could then be represented by a Feynman diagram.

10 Photons, electrons, positrons, made up of kinetic energy

Consequently, simple logic leads to the conclusion that when a photon of sufficient energy (1.022 MeV or more²) grazes sufficiently close another corpuscle, the destabilizing effect of such Coulomb interaction between the half-photons and the charged particles making up the corpuscle being grazed, could be the direct cause of the destabilization that initiates the decoupling process resulting in the separation of the half-photons pair, which can thereafter be observed behaving as an electron and a positron henceforth traveling separately.

On the other hand, we also know that all photons are created by the process of "bremmsstrahlung", that is, by the quantification of quantities of kinetic energy, unidirectional by definition, that electrons accumulate as they accelerate between the electrodes of a Coolidge tube for example, photons that are ultimately liberated as the electrons suddenly come to a relative stop as they are captured by the anode (or anti-cathode), or as electron beams are magnetically wiggled in particle accelerators, submitting the electrons in the beam to repeated transverse slowing-downs as the beam is forced to oscillate from side to side, producing the so-called synchrotron radiation, typically in the X-ray range, or also in storage rings, when an electron beam is repeatedly magnetically pulsed to maintain a best fit approximately circular trajectory.

The fundamental question can now be summarized as follows:

How can a quantity of kinetic energy causing a massive particle (an electron for example) to move unidirectionally in space to start with, dynamically "fold" onto itself according to the threefold orthogonal relation revealed by Maxwell's theory, to become a stable quantum of energy (a photon) escaping at the speed of light, while being animated by this local multidirectional pulsating motion suggested by deBroglie's conclusion, which would consist in a space-wise electric dipole cyclically morphing into a time-wise magnetic dipole, and that could also explain all electromagnetic properties of photons, and

² This well verified process of conversion of photons (bosons) of energy 1.022 MeV or more into pairs of electron and positron (leptons) as such photons graze massive nuclei is the material proof that electrons and positrons are electromagnetic in nature just like photons and are made up of the same energy. The materialization of electron-positron pairs from gamma photons was verified for the first time by Anderson from cosmic radiation in a bubble chamber in the early 1930's and has been constantly verified ever since in high energy accelerators.

by extension, those of all other elementary electromagnetic particles, since such photons of sufficient energy can be destabilized to convert into massive electrons and positrons?

In other words, in the case of a photon we would be dealing with a complex locally standing wave in motion, made up of kinetic energy, with two components in space-wise resonance cyclically morphing into one component in time-wise spherical resonance. Let us emphasize here that we are talking about the cyclic motion of the actual energy locally involved described by the fields of Maxwell's equations and not of the fields themselves, which are mathematical concepts.

It must be obvious by now that all photons have to be made up of the same material, that is *quantized amounts of kinetic energy*, which would by nature be undifferentiated, and we will see further on that all massive elementary electromagnetic particles also have to be made up of the same substance.

It is this particular characteristic that allows demonstrating in a separate paper ([5]) the time-wise magnetic bipolarity of elementary particles by similarity with that of a very special type of permanent magnets, and to clarify by the same token the magnetic monopoles issue.

Expanded Maxwellian Space Geometry

11 deBroglie's Hypothesis of neutral Half-Photons

DeBroglie associated no signs to the two electric state particles of his localized photon hypothesis after having analyzed this possibility³.

But paradoxically, it has been understood and extensively experimentally confirmed since the 1930's that any photon of energy 1.022+ MeV, which has no mass and is electrically neutral, can be destabilized to convert into an electron-positron pair (massive and charged in opposition) when grazing a heavy particle such as an atom nucleus.

Could the sign of charges then be an extrinsic property of charges, possibly a vectorial property acquired at the moment of separation of the pair? This would leave the door wide open to the possibility that the half-photons could be associated to unsigned charges, that is, fundamentally neutral charges!

12 The Sign as an Extrinsic Property of Charge

The unraveling of the origin of constants ϵ_0 and μ_0 proposed in ([6], **Chapter 11**), soon to be proposed in a separate paper, shows that the possibility of the existence of such neutral pairs of charges within photons is definitely worthy of consideration, which would effectively reduce the "sign" of a charge to a property acquired at the moment of decoupling by the then fundamentally neutral charges of the decoupling photon, which resolves in this model into a simple case of motion (or pressure) in opposite directions in electrostatic space (see further on).

13 Discrete Particles as only Support of Electromagnetic Properties

If we refer to the conclusion already discussed to the effect that if electromagnetic "waves" are only a perception at the macroscopic level of the motion of crowds of innumerable localized photons at the microscopic level, then photons cease having to be considered as singularities in a suddenly non-existent underlying wave phenomenon, to individually become full-fledged

³ This was confirmed to me at the **Fondation Louis deBroglie** upon a specific question on my part regarding this point, through a copy of a Note to Dominique Morenas from Georges Lochak, director of the Foundation and lifelong colleague and friend of deBroglie.

electromagnetic entities on their own, which would make the whole set of these photons and their interactions, the only possible foundation for the complete Maxwellian electromagnetic structure!

However, if reconciling deBroglie's dual-particle photon hypothesis with Maxwell's theory without resorting to the idea of an underlying electromagnetic field seems a hopeless endeavor in the restricted frame the 3D+time classical space geometry, it may well be that a more extensive space geometry would naturally allow it!

14 EM Oscillation Energy Driven Rather than Fields Driven

Keeping in mind that a photon fundamentally is a discrete quantity of kinetic energy, half of which remaining unidirectional in deBroglie's photon while the other half quantizes orthogonally in electromagnetic oscillation, it seems logical that the energy of this second half of the photon's energy would not suffer any change in nature even when quantized orthogonally to the direction of motion as it is propelled by the first unidirectional half at the speed of light in vacuum, despite our perception that it must alternately possess distinct and apparently irreconcilable magnetic and electric properties, that would be reciprocally induced by motion of the other aspect, and that this impression could be due to a cause yet more fundamental than mutual fields interaction.

For example, if kinetic energy was a material incompressible in volume on top of its fundamental property of always remaining in motion, the local oscillation between both electric and magnetic states of any given quantity of this energy could be forced uniquely by the property of this energy to always remain in motion.

So, instead of a relation of mutual orthogonal induction between two fundamentally different electric and magnetic fields as Maxwell's theory assumes, this relation could be one of cyclic orthogonal translation of a the fixed amount of energy making up the photon.

That is an energy that would always conserve the characteristics it originally possessed even before it was quantized to become a photon, but that would, by alternating between two dynamic states, both of which orthogonal to each other and to the direction of motion in space, in accordance with Maxwell's theory, would give the impression to have all of the electrical set of characteristics, and then, all of the magnetic set of characteristics; but whose high frequency of the cyclic translation between both states would create the illusion of the simultaneous and permanent presence of both states.

Considering that magnetic interaction obeys the inverse cube law of attraction and repulsion ([5]) and that electrostatic interaction obeys the inverse square law of attraction and repulsion, make it appear illogical that quantized quantities of kinetic energy could possess both magnetic and electric properties at the same moment.

It is precisely this conclusion that mandates that half of the isolated quantum of kinetic energy making up a photon would have no choice but to locally alternate between magnetic and electric behavior while remaining unchanged in nature, metaphorically speaking like a caged tiger endlessly pacing to and fro. This however does not negate the usefulness of fields as we will see further on. Fields would simply take second seat to the more fundamental forced motion of the kinetic energy proper now operating as a prime mover, being perceived as "electric energy" as it transits in an electrostatic space and "magnetic energy" as it transits in a magnetostatic space.

It seems entirely conceivable that such a high frequency cyclic translation process of a discrete quantity of incompressible energy between two dynamic states, at the frequency of the photon, could explain all observed phenomena while underlying the traditional perception of electric and magnetic fields that would mutually induce each other in phase. We will see further on the

benefits of taking into consideration this forced motion of kinetic energy as acting at a level more fundamental than fields.

Maxwell's four original equations would remain totally valid in this new perspective, since his second equation does not even mandate that both fields be in phase, since it directly accepts the opposite relation, which is that of a reciprocal interaction of both fields when out of phase by 180° as is being considered here.

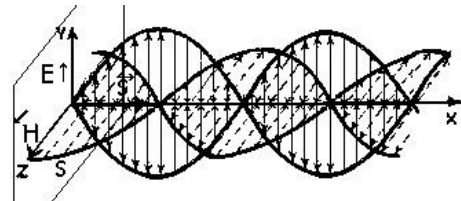
15 Expanding beyond 3-D Space Geometry

It is at this point that we are going to give its final extension to the already expanded second stage XYZ space geometry that we tentatively considered in **Section 4**, to end up with a new space geometry that will allow quantized kinetic energy to cyclically alternate between these two incompatible states without changing in nature.

So, instead of considering two Y and Z extra-spatial planes respectively for the electric and magnetic aspects, we will now expand these planes to extra 3-D spaces of their own, to have come into being an entirely new local space geometry, which will ultimately allow reconciling deBroglie's permanently localized dual-particles photon with Maxwell's theory.

If we imagine the observed electric behavior as being caused by the incompressible energy of the photon being momentarily present in a 3D-space that allows such behavior, and the magnetic behavior being caused by the same energy being momentarily present in alternance in a different 3D-space that allows such behavior, each space being governed by the same laws of motion as normal 3D-space, the same capacitance and inductance, and each space allowing quantized energy not to change in fundamental nature, it will become possible to visualize completely the localized photon dynamic standing motion much more clearly.

In order to easily refer to these new spaces, let us name **electrostatic space** the Y-space into which quantized kinetic energy displays electric behavior, and **magnetostatic space** the Z-space into which it displays magnetic behavior.



In this space geometry, a junction point (or passage point) between these two spaces (three, counting normal space that would be orthogonal to the other two) would be located at the geometric center of each photon, and it is this junction point that would be moving at the speed of light in normal 3D-space, along the major X axis of this expanded geometry.

The photon itself now appears as a discrete amount of quantized energy, half of which unidirectional and residing in normal space, propelling the other half that would be pulsating non-stop through this junction by orthogonal translation between electrostatic space and magnetostatic space at the frequency determined by the photon's energy.

16 Applying Plane Wave Treatment to the Localized Photon

It is particularly interesting to note that such a dynamic cyclic energy structure would be totally conform to the conventional definition of a plane wave, given that at any instant the fields would be uniform over a plane intersecting that junction point, perpendicularly to the direction of propagation of the photon.

The energy of the photon would of course behave on that moving plane as if it were stationary, as it actually is in the reference frame of the junction point, but a stationary wave that locally adopts

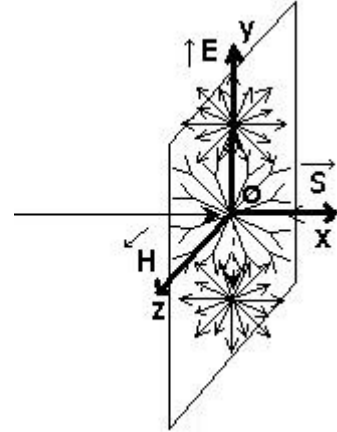
the beautiful symmetry that is so enticing in the QFT vacuum fluctuations concept, with the advantage that this plane, just like the junction point, can regardless continue moving at the speed of light in normal 3-D space.

Also, we can observe that the product of the projections on the transverse plane of the electric and magnetic pulsating energy is constant and consequently does not fluctuate over time as is the case with classical in-phase plane waves.

In this model, the magnitude of the Poynting vector will thus be constant all through the electromagnetic cycle of any localized photon at the following value

$$\mathbf{S} = \frac{\mathbf{E}\mathbf{B}}{2\mu_0}$$

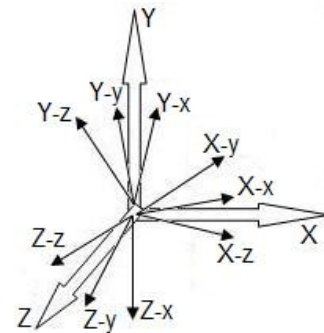
instead of fluctuating over time as in classical electromagnetism to average out at this same value, since one more characteristic of plane wave treatment applied to the moving photon is that the value of S obtained corresponds by structure very precisely to the average value calculated in classical electromagnetism, and which gives directly the measurable *intensity* of the "wave" ([7], p.987). See paper ([1]) for analysis of the discrete LC oscillation equation that explains the stability of the Poynting vector in this model.



Let us note here that this measurable *intensity* is directly reconcilable with the conclusion of this model according to which only half of the energy of a photon pulsates to and fro between electrostatic and magnetostatic spaces while the other half is not pulsating but moves unidirectionally and simply serves to propel the pulsating half at the speed of light in vacuum, as we will see in a coming paper.

17 Identifying the required 9 spatial dimensions

For coherence, we will identify normal, electrostatic and magnetostatic spaces, X-space, Y-space and Z-space respectively. Within normal space, let us rename the three minor spatial dimensions: X-x, X-y and X-z. Likewise, for electrostatic and magnetostatic spaces Y-x, Y-y, Y-z and X-x, X-y, X-z. Let's assume furthermore that the minor x-axes of all three spaces are mutually parallel in a direction corresponding to the conventional direction of motion of energy in normal space in plane wave treatment⁴.



In this space geometry, electrostatic properties such as Coulombian inverse square interaction with distance belongs to electrostatic space, while magnetostatic inverse cube interaction belongs to magnetostatic space.

Free fall acceleration induced kinetic energy will appear massive to an observer located in normal space when it occurs in either one of the other two spaces, but would locally be perceived as non massive. For example, as perceived from normal space, magnetostatic space would be the realm of massive states; electrostatic space would harbor massive/2 states, while normal space

⁴ Referring to the accompanying dimensions drawing, remember the 3-ribs umbrella metaphor representing the opening from 0° to 90° of the inner dimensions of each space to allow easier visualization.

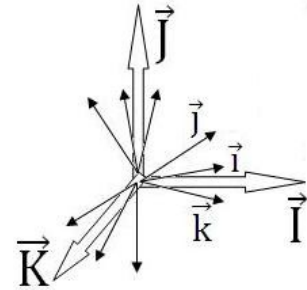
would be, as far as we observers located in this space are concerned, the realm of free fall acceleration induced unidirectional quantities of kinetic energy between bodies.

If we represent the orthogonal base of normal space with a 3-ribs umbrella with the x, y and z ribs folding and unfolding, and visualize the orthogonal basis of these new spaces as closed umbrellas intersecting each other and normal space at right angles at their tips, we only need to mentally open any one of them to examine what is occurring in it at any given moment.

18 Defining a Major Unit Vectors Superset $\hat{\mathbf{I}}, \hat{\mathbf{J}}$ and $\hat{\mathbf{K}}$

The traditional $\hat{\mathbf{i}}, \hat{\mathbf{j}}$ and $\hat{\mathbf{k}}$ unit vectors set previously mentioned was of course defined to describe normal space since electromagnetic phenomena have up to now been perceived as occurring entirely within normal 3-D space.

So, each of the two new spaces must also possess its own set of minor unit vectors subordinated to its major unit vector, all 12 resulting unit vectors (9 minor and 3 major) being of course drawn from the same origin O.



So let's define a new superset of major unit vectors that will identify the three orthogonal spaces as $\hat{\mathbf{I}}, \hat{\mathbf{J}}$ and $\hat{\mathbf{K}}$, or to make notation easier, \mathbf{I}, \mathbf{J} and \mathbf{K} ($\mathbf{Ibar}, \mathbf{Jbar}$ and \mathbf{Kbar})

Each one of the three orthogonal minor unit vectors subsets (shown in the drawing as being half folded - remember the umbrella analogy), that is $\mathbf{I-i}, \mathbf{I-j}, \mathbf{I-k}$, for normal space $\mathbf{J-i}, \mathbf{J-j}, \mathbf{J-k}$ for electrostatic space and $\mathbf{K-i}, \mathbf{K-j}, \mathbf{K-k}$ for magnetostatic space allows defining the vectorial magnitude of energy in any one of the three orthogonal coexisting spaces.

This is how the vectorial relation drawn from Lorentz mentioned in **Section 1** becomes in this expanded space geometry

$$E\mathbf{J} \times \left(\frac{-1}{B} \right) \mathbf{K} = v\mathbf{I}$$

These three orthogonal spaces allow visualizing a system of major polar orthogonal axes, each axis of which corresponds to one of the major unit vectors that we have just defined, and that would be local to each elementary particle or energy quantum and whose origin would be located at the center of the particle. This lets the three standard minor unit vectors subsets remain available to completely describe the specific behavior of the energy in each separate space.

We will see in coming papers how these new major unit vectors integrate into Maxwell's theory and Lorentz equation.

19 Conclusion

Even though it allows defining an electromagnetic mechanics of particles paradoxically requiring neither underlying fields nor any vacuum medium of any sort, this integration remains in perfect harmony with the equations of Special Relativity, Quantum Mechanics and Quantum Electrodynamics with minor adjustments; all electromagnetic properties usually associated with underlying fields becoming direct properties of each individual elementary particle.

While classical mechanics, relativistic mechanics and quantum mechanics **describe** the motion of bodies and particles, this electromagnetic mechanics proposes a description of their fundamental nature and an **explanation** to the cause of their motion and the reason why they

naturally tend to self-propel at constant velocity and self-guide in straight line when no external force is acting on them, on top of possibly revealing **a new and apparently inexhaustible source of energy**.

A new physics that provides a quite unexpected solution to the magnetic monopoles issue and naturally explains in a novel manner light deflection, atomic stability, so-called time dilation, Earth's rotation rate slowdown, the Moon orbit expansion, Mercury orbit precession, the two "so-called" anomalies of the trajectories of both Pioneer 10 and 11 spacecrafts and the electron magnetic moment "anomaly", including providing two new equations for calculating the local electric and magnetic fields of individual photons, and two more for calculating the local composite fields of massive particles in motion.

Surprisingly, this solution draws a natural bridge between Maxwell's electromagnetic theory that it confirms in a manner allowing it to directly describe localized photons, Coulomb interaction and Newton's gravitational theory upgraded to relativistic status, and refocuses in a new perspective the bulk of accepted orthodox theories, namely Special Relativity, Quantum Mechanics, Quantum Electrodynamics, as well as many of the postulates that are now taken for granted.

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21 Other papers by the same author

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