

Golden Ratio Photonic Crystal Dynamics

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Abstract: In this development upon three previous papers [1][2][3], we shall explain how photonic crystal constructs emerge from the elementary particle level in being associated to electron shells and how they then fractally develop to a macro-world scale per a golden ratio sequence of atomic association. We will couple this with chemical-bond modelling between atoms, while then moving on to an explanation for the Avogadro number. The emphasis of this paper is to highlight the continued utility of the golden ratio modelling for time as a fixed standard for time, the great implication being the need to understand “spatial contraction” (not “time-dilation”) to satisfy ideas of relativity forwarded by Einstein a century ago. We shall highlight how this is possible by examining the *phi-quantum wave-function* scale as a new wave-function template for electromagnetism, as initially developed in paper-2, Golden Ratio Axioms for Time and Space [2], now carried and further developed here to explain spatial contraction and associated elementary particle dynamics (including particle spin and anti-matter/particles dynamics). Considering this phi-quantum wave-function scale, we will then finally uncover the problematic process of the Cartesian coordinate system of mathematical execution for space.

Keywords: photonic crystal; elementary particle; golden ratio; fractal; Fibonacci; Avogadro number; wave-function; electromagnetism; anti-matter; Cartesian; relativity; anti-particle; Chirality; Brownian motion; particle spin; black hole; Topology; manifolds; Geometric topology; strong nuclear force; weak nuclear force; neutrino; platonic solid; blue-shift; red-shift; chaos theory; logistic map equation; gravielectric field, gravielectric field generator

1. Introduction

We're at the point in this series of papers [1][2][3] where we can give a detailed enough analysis of Einstein's proposal for relativity [4] theory citing the malleability and primary function of space and not time; here we are not challenging the idea of relativity, how time can appear to stretch/slow, yet we are making the statement (in using the golden ratio for time) regarding time not being malleable beyond that algorithm of determination, and that it is in fact space that is malleable care of our new wave-function for space, the phi-quantum scale; the wave-function is addressed in the need for the initial condition of the axiom definition of phi time to find π in space. This poses problems of course to the use of a fixed Cartesian manner of spatial appreciation [5]. Harder still is the notion of how it could be possible to insert an arbitrary equation within a new axiomatic determination for time and space

without recognising any new underlying feature of temporal and spatial congress? So, the task has been to derive “all” known equations relevant to physical matter, and it is no different in this fourth paper.

The first chapter will discuss exactly how different the theory presented in this series of papers is to Einstein’s proposal of relativity and by what manner of change in algorithm is being exercised; we shall explain exactly how the dialogue presented here is different as to the employment of a different set of mathematical tools and algorithms, not fixed spatial grids that transform to one another that describe wave-functions [6], yet a fixed time-algorithm that employs topographical 0-scalar space that is able to contract/bend according to relativistic demands on the phi-quantum wave-function scale. The dialogue here nonetheless, although different to contemporary physics owing to its development in stride with Einstein’s ideas, reaches “more” accurate results while being able to link all the general equations of force, motion, energy, and mass from the one axiomatic base in “not” considering time to be the 4th dimensional entity of space-time that gives space-time its malleability. For although Einstein considered spatial malleability, he only did so in coupling space to time as spacetime. The difference with the theory here is time is in no way “malleable”, only space.

The big question is though from this change, how are all the other features, the granularity of the elementary particles, being addressed? Have we addressed those issues in this series of papers thus far? There “are” features we have yet to discuss that research in contemporary physics has addressed albeit per a descript manner that upholds Einstein’s explanation for relativity and associated employment of mathematics. For instance, the spin of particles, the force behind Brownian motion, and a few other elementary particle exotic features such as the neutrino and anti-matter; we shall explain particle spin by addressing how a gravity field is effected by the folding /coupling proposal presented in the first paper [1]:

- How this spin relates with electromagnetism/gravity.
- How spin relates with the proposed electron shell photonic crystal.
- Why there are 30 or so elementary particles.

Then, we shall explain “Interatomic interactions” involving

- Chirality.
- Brownian motion.
- Atomic fractal development.
- Avogadro’s number.

Not just particle spin, yet also the subatomic realm of neutrino’s, quarks, and so on, needs addressing. All these features shall be explained. Most fundamentally, the actual propulsion mechanism of elementary particle spin and Brownian motion shall be explained. First though, we shall undertake an analysis of the two types of relativity being proposed, Einstein’s fixed spatial relativity, and the one proposed here as a fixed temporal and warped/compressed space relativity. Then we shall move to a more thorough explanation of gravity on the atomic level discussing its emergent features from the atom.

2.1 A Review of Relativity

Einstein employed the idea of “time” to measure references in space, time that could though be fluid and recalibrated with a fixed spatial reference given the different motions between different spatial references. Space was the fixed entity in his appraisal of relativity. Consider figure 1:

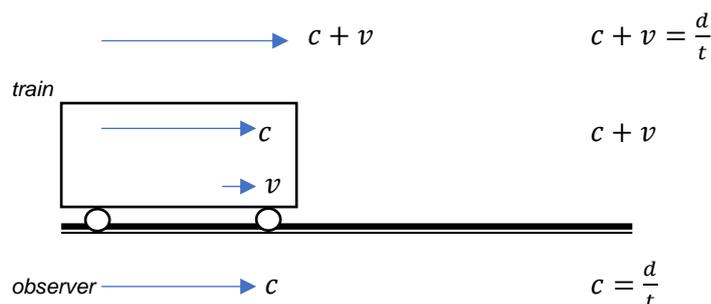


Figure 1: Einstein reasons the idea of light on a train and how time is elongated to preserve the constancy of the speed of light from any frame of reference, and here that of the observer. This is explained as “time-dilation”; the resultant “ c ” care of “time” must be slower on the train with the effect of light relative to the observer by making “ t ” longer.

Einstein’s work depended on a few key findings, the main one being the bending of the light of a star hidden behind the sun to be viewed by the Earth during an eclipse [7]. Yet does gravity bend light or is there a feature to a massive body that is essential to electromagnetism itself that results in an emergent effect of gravity seeming to bend light? Could there be a self-repelling effect on a more fundamental electromagnetic level such that light would seem to bend around massive bodies? The “self-repelling” concept of electromagnetism (and how that can work) shall be addressed in this theory. Einstein also proposed that time would slow as one’s own velocity sped up. Atomic clocks in spacecraft show this to be the case [8]. Yet the dilation (slowing) of time in the context of high speed space travel using atomic clocks that show time to be measured more slowly should be examined more closely for the processes going on there; per the theory presented here, ultimately “atomic” clocks measure differently at different speeds because of the change in *spatial* mechanics of recording time, “time” which remains constant (as a golden ratio). Although time appears to slow at very high speeds over time, yet what is happening is the contraction of space. Contraction of space per the theory presented here means a higher “binding” force between atoms and thus **less** radioactive decay (as is evident in the ultimate case of a black hole), and thus an apparent slowing of atomic clocks (and thus “apparent” time); think of a black hole [9] with light trying to escape the surface of that massive structure, it’s like travelling at the speed of light but not being able to breach it, time seems slowed, yet everything at the speed of light becomes so weighty, as with a black-hole. Simply, time as light doesn’t slow but rather folds back onto itself as mass in a process of contraction. Furthermore, the fact that gravitational waves [10] can be emitted by black hole interactions suggests that time is not distorted, but rather space. Yet the most complicated feature of physics that has resulted from Einstein’s work was the need to use spatial grids in mathematical transformations [11] to measure ideas of spatial symmetry between particles in the context of misread relativistic effects which look for fluctuations in time and not fluctuations in space (spatial compression).

In this series of papers [1][2][3], including this paper, we are doing something quite different. We are considering time to be fixed with the golden ratio (albeit in search of perfecting the trace of a circle), while space is the malleable/warp-capable feature; “space” is the feature that would need to undergo a type of “contraction” as a process of it being manifest, as on the level of the atom, and even more precisely the level of the elementary particles. To achieve this though we need to construct a mechanism for the contraction of space as much as Einstein developed a mechanism for the dilation of time. What is used here is the constancy of golden ratio temporal dimensions warping space. It means that all the mathematics employed subsequent to Einstein’s ideas of relativity have been replaced here with a new scaling system that represents the golden ratio for time and factors in spatial

compression (in accommodating for relativistic effects between moving particles/bodies). Einstein used the idea of space-time as 4-dimensions, to tack on a variable time dimension on a fixed 3-d space, to gauge space for relativistic effects in space with moving bodies and the constancy of the speed of light. In this series of papers, we have so far explained time as the golden ratio in terms of an algorithm that defines the arrow for time, and how it imprints on space as a three-dimensional bi-directional entity. Yet let's be more precise with this new scaling system given that it is the "new" wave-function algorithm for electromagnetism and as it would seem "gravity".

2.2 The "Phi Quantum Wave-Function" scale

We need to become clear on the new phi-quantum wave-function scaling system, as this is the new wave-function descriptor for electromagnetism and gravity. Here we are replacing all the mathematical matrices and spatial grid-transformations and associated wave-function equations used in contemporary physics. We are not abiding by the Cartesian fixed approach, clearly, although we are using a 3-d spatial grid that accounts for a quantum-scale where the wave-function "seeks" to trave a value of π for each quantum step. Let's though be mindful of using the relevant terms as they exist with our spatial construction process:

- Topology [12] as a discipline of mathematics concerns the properties of space preserved under continuous deformations such as stretching, crumpling, and bending, not tearing or gluing.
- Topology's origins can be traced to early twentieth century, yet some ideas can be traced back several centuries. For instance, Seven Bridges of Königsberg by Leonard Euler [13] could be regarded as one of the first demonstrations of topological thought; Euler had realized the importance of the *edges* of a polyhedron--which led to his polyhedron formula, $V - E + F = 2$ (where V , E and F respectively indicate the number of vertices, edges, and faces of the polyhedron).
- It wasn't until the 19th century until the term *topology* was introduced by Johann Benedict Listing and it wasn't until the first decades of the 20th century that the idea of a topological space was developed. Nonetheless, by the middle of the 20th century topology had become a major branch of mathematics.
- Topology has many subfields, but here in this paper we will use Geometric topology which primarily studies manifolds and their embedding's (placements) in other manifolds. More specifically, we will investigate low-dimensional topology, (which studies manifolds of four or fewer dimensions).
 - o What we're considering here are manifolds of 1-2-3 dimensions, topological space that resembles Euclidean space near each point.
 - o we are not considering topological quantum field theory (or topological field theory or TQFT), a quantum field theory that computes topological invariants, as this is relevant to fixed spatial matrices and time dilation.

It is considered that the following golden ratio time 3-d 0-scalar space figures and equations are sufficient to prepare the processes forwarded here by this theory: ([2]; p4-11, fig. 1-13, eq. 1-9). In general review of those pages and associated figures, one clear feature we have done other than compressing space as opposed to dilating time is introduce a scaling system for the atom based on the golden ratio algorithm for time in aiming to trace π . This phi-quantum wave-function scale is the fundamental process of alignment for the subatomic structure, and

above all how the extra atomic structure emerges ([2]; p16, fig. 16). Once again, the diagrams contained therein highlight just one axis of determination, in this case the “x” axis; this was considered logical as defined as a t_N event ([1]; p4, eq. 4), $t_N = 1$. The other two axes will be demonstrated to represent the spin of the elementary particles, or rather how the electric and magnetic components rotate “around” the x-axis. Before we discuss the nature of particle spin though, the fundamental feature we need to acknowledge is the electromagnetic coupling context 32c for emergent gravity of the 22-quantum length wave-function ([2]: p16, eq. 16) and how this is contracted space ([2]; p12. eq. 9) (a relativistic requirement here, and not time-dilation). The following is the wave structure that results, a standing wave:

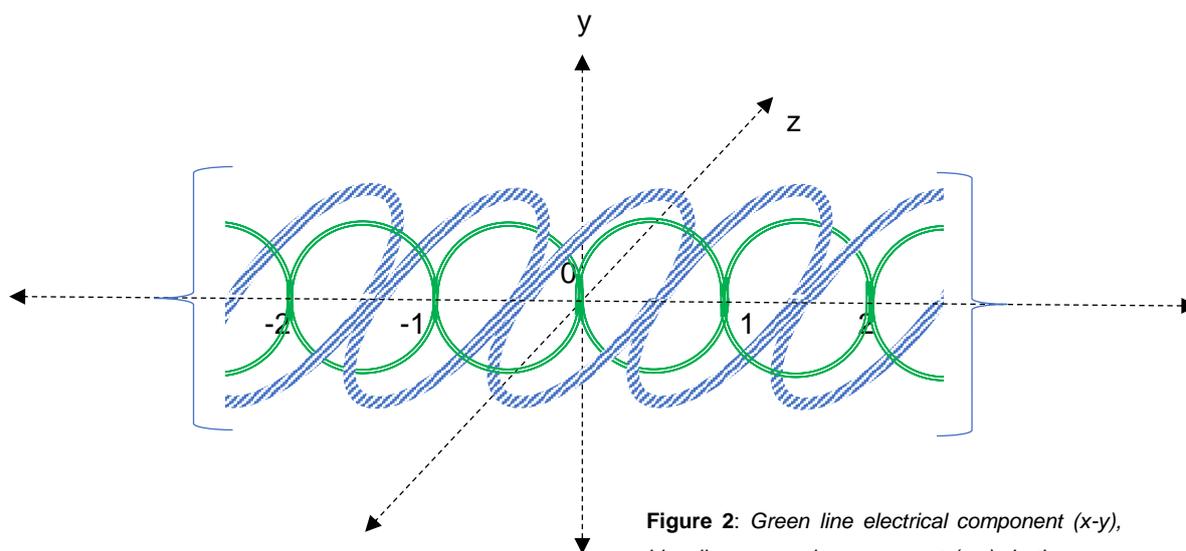


Figure 2: Green line electrical component (x-y), blue line magnetic component (x-z), both waves out of phase with each other and perpendicular to each other, folded-over/coupled. The values on the x-axis represent $\frac{1}{2}$ quantum length increments.

Here with this “coupling (folding-over), we have a new type of wave structure for both the electrical and magnetic wave components. For the electrical component, we have perfect circle traces at the ends of each 22-quantum length. The thinking here also is that given we have a perfect π trace, we are creating a precedent for the a “reaching” of π in a complete 3-d 0-scalar space context (time “circle”), and we have this at two points on each circle on the x-axis, each point representing a key “particle” manifestation:

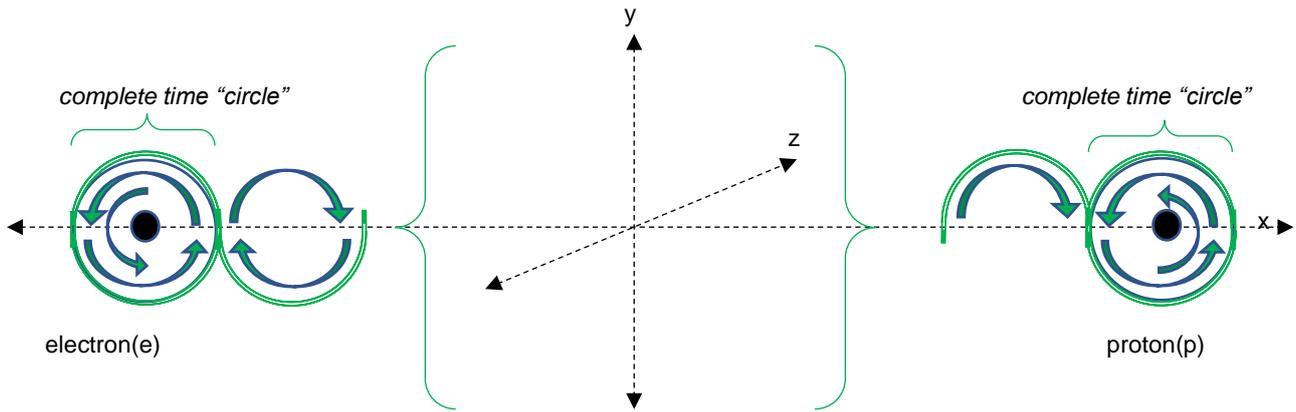


Figure 3: The thinking here with these points is that they are associated to a complete time-circle, a 3-d circular time-entity that would emerge as “mass”: this would happen for the proton and electron; only the electrical component of the wave is shown here (proton (p) and electron (e)).

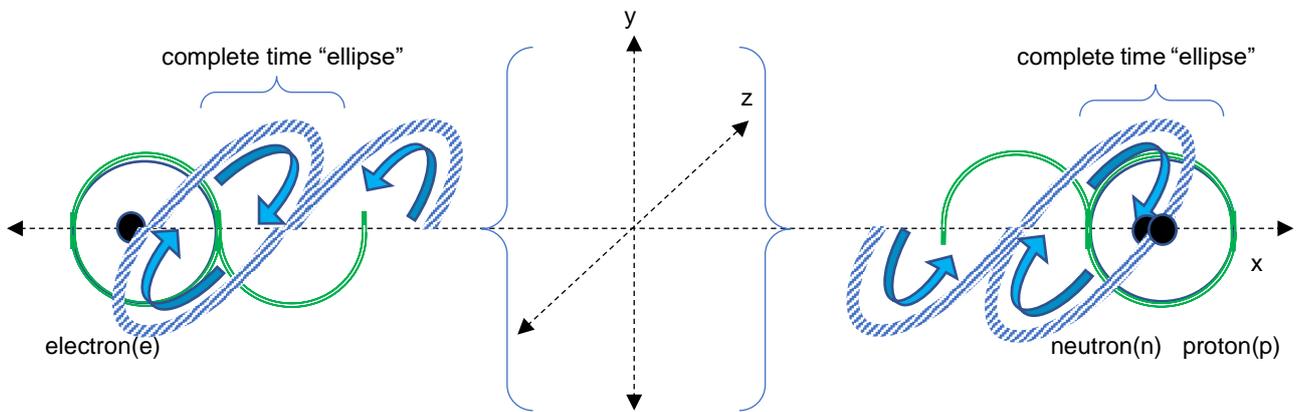


Figure 4: the thinking here with the neutron point as the “magnetic” component, is that the neutron is associated to a complete time “ellipse”, a 3-d ellipsoid time-entity that would emerge as “mass”. Note, the electrical component of the wave is also shown here in green, and that the manifestation of mass would still need to abide by the electrical quantum component of light/time (the fundamental axiom to be considered). The idea of an electron “partner” is not considered as shall be explained further on in the theory.

Regarding how the proton and neutron spatially relate together, and how this relates to their elementary “30” substructure (15 for the proton/neutron axis, 15 for the electron axis), there is still some preliminary theory to go through before we can discuss that elementary particle domain. Nonetheless, for now the equations pointing to the manifold topology of these points at either end of the 22-quantum length phi-quantum wave-function scale now seems to unfold with greater clarity. On the proton/neutron scale (M_p) we must consider the emergent feature of mass and thus a squared value of “2 results per 3 dimensions” as a value of the emergent gravity context (universal) as M_C :

$$M_C = \left(\frac{2}{3}\right)^2 \cdot M_p \tag{1}$$

On the electron end of the scale (e_c) we would have an inverse negative value (golden ratio to the proton/neutron) yet not squared (as this is not an emergent gravity feature), as “3 dimensions per 2 results” yet the two results “factored as a quantum wavelength (λ)” (given the electron is the effector of quantum determination) as a value of the electrodynamic (universal) context as Q_c :

$$Q_c = \frac{3}{2} \cdot \frac{1}{\lambda} \cdot e_c \quad (2)$$

These equations are relevant to the derived universal contexts for mass and charge respectively, which when each is multiplied by c^2 we arrive at G and k_e respectively. What of the dynamic between the particles on this new folded level with its $32c$ emergent gravity manifold? Here we must be arbitrary; the idea forwarded is the electron being “self-repulsive” on this emergent mass/gravity level, and the proton-neutron being “self-attractive”. Thus, the negative end would almost seem to assume the identity of “anti-matter”, the positive “matter” (figure 5):

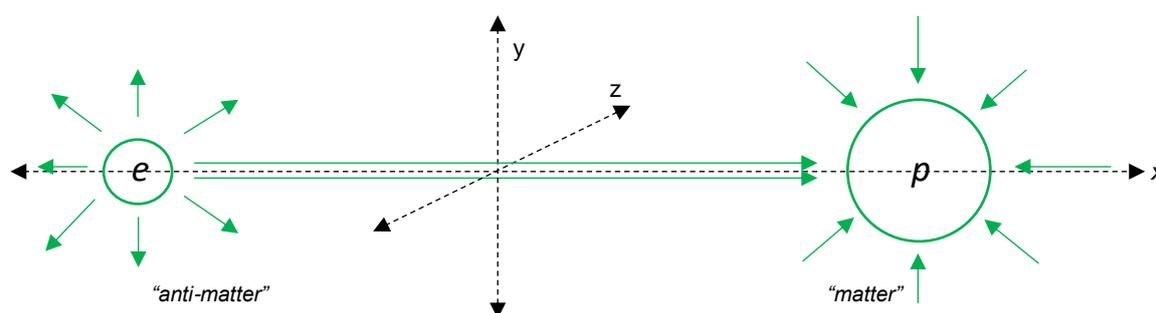


Figure 5: note the following diagram relevant to the flow of mass away from the negative (dissociative) and towards the positive (associative). This is an arbitrary determination and could be either end of the x axis, the point of arbitration here is that the p-n area would be self-attractive, and the e-v region self-dissociative

This then grants each of the 15 “matter” subatomic entities on the proton/neutron axis an association with the 15 “antimatter” subatomic entities on the electron axis. It’s as though the 15 “antimatter” elementary particles would be the “antimatter” versions of the proton/neutron axis. What we are considering here is the effect of the proton/neutron being “self-associative” (and this would represent the strong nuclear force [14]), and the electron being “self-dissociative” (and this would represent the weak nuclear force [15]). Note that the strong nuclear force is indicative of the electromagnetic coupling strength of the atom, 137 times as strong as electromagnetism. Gravity though as an emergent feature would represent 3 key features; the protonic, the electric, and the magnetic, and not just a protonic feature introduced here.

2.3 Protonic Gravity (EG1)

As just introduced, this is the folded electrical component of the standing wave along the x-axis (and thus apparently invisible as a folded over electrical wave). This is the process of determining the force from one end of the phi-quantum wave-function scale (electron) to the other (proton) as the electrical component would have the flow of charge as the direction an electron would move, and that is towards the proton. Coupled with this emergence is the contraction of space which accounts for the relativistic effects between the “p” and the “e”, not to mention

their inherent electrostatic attraction. The feature here is the attraction of the electron to the proton. Essentially, we are confirming that the contraction prescribed as in previous papers ([2]; p12, eq.9) represents an emergent feature that is coupled to the idea of the mass-based endpoint time-circles/ellipses.

2.4 Magnetic Particle Spin (EG2)

One key under looked feature to our phi-quantum wave-function is that thus far we have considered the wave-function to develop along the x-axis, the electric component rising and falling in amplitude along the y-axis, and the magnetic component rising and falling along the z-axis. In fact, both the electrical and magnetic components would rise and fall in amplitude in both the y-axis and z-axis, and they would achieve this by their respective rotation "around" the x-axis (figure 6):

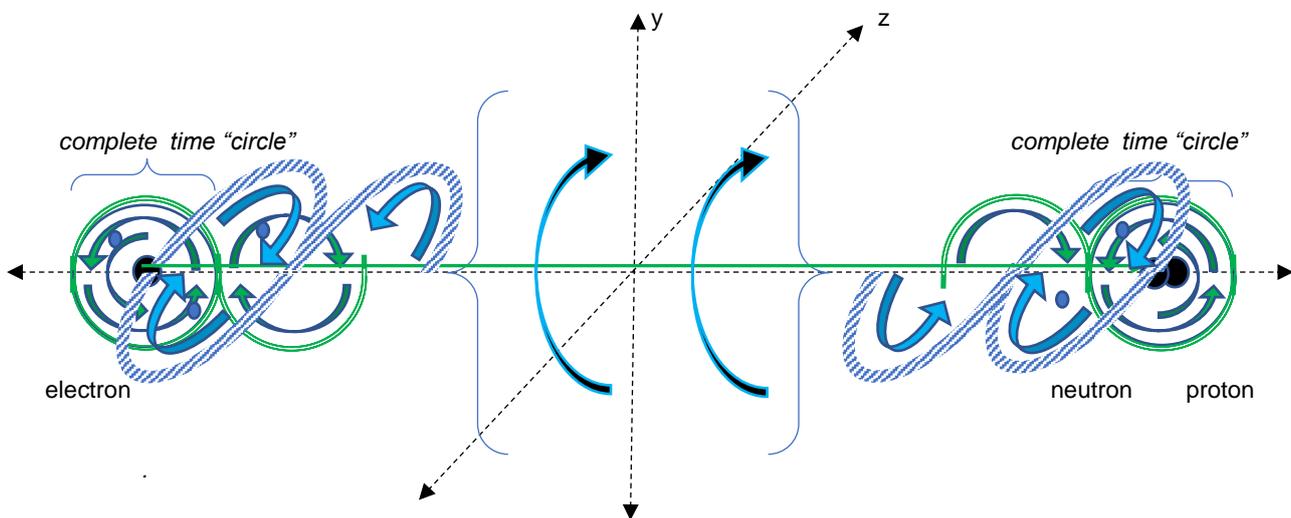


Figure 6: arbitrarily chosen direction of emergent gravity (EG2) around the x-axis. Note also that the effect of this spin on the x-axis electrical field component would result in a time "sphere" at each end of the x-axis

This rotation "around" the x-axis is a feature of the idea of creating a time-front mimicking the complex (i) time wave-function t_B that represents a concentric front around the direction of resultant time t_A . And this would represent the "spin" component of the elementary particles. More to this though, as there exists an emergent gravity field from the negative to the positive plate, this concentric field would emerge in line with the resultant "magnetic" component of the phi-quantum wave-function, implying the nature of the magnetic field that results "around" the electric field (figure 7). Note also that the effect of this spin on the x-axis electrical field component would result in a time "sphere" at each end of the x-axis.

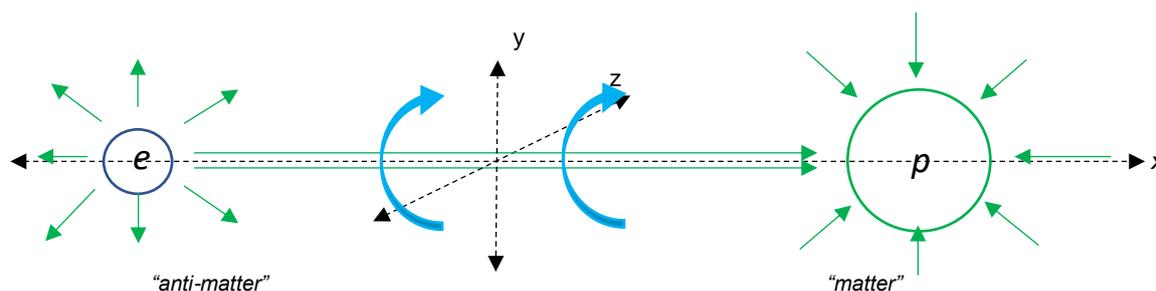


Figure 7: note the proposed (arbitrarily defined) direction of the magnetic component of force (blue) compared to the electrical (green). The actual direction of the magnetic component would be determined by the manner of emergence of the gravitational spin from the subatomic to the macro-scale. Shown is the accepted direction of magnetic field strength.

As the particles are inherently related to the phi-quantum wave-function, and this wave-function is spinning around the x-axis, then we have a particle spin likewise around this x-axis (figure 8):

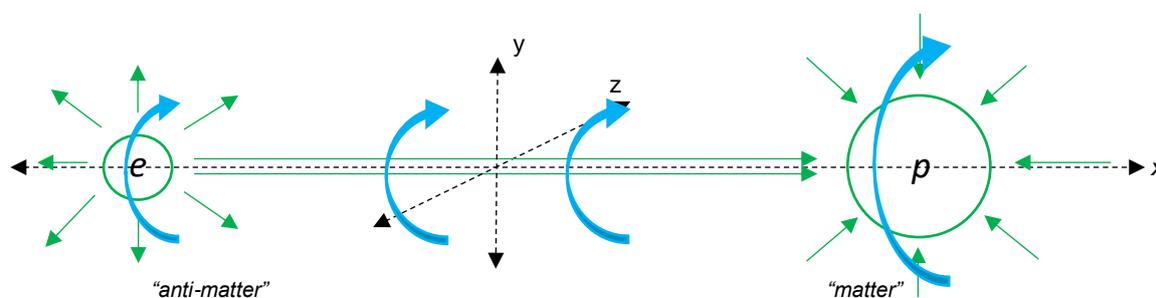


Figure 8: note the rotation of the particles as a magnetic component spin. Note the time-spheres represent the proton and neutron electrical components of the x-axis.

Although we commonly associate gravity as the attraction to a more physical mass, or more appropriately as the force between two masses, and how we explained that in the previous chapter while focussing on the positive aspect of electricity, the “self-associative” nature, we must also note that gravity is emergent from the idea of magnetism. The proposal here is that this standing wave unit of magnetism ($\frac{1}{2}$ a quantum in relative electrical/quantum length), would cause a spin of the phi-quantum wave-function and thus particle around the x-axis by the magnetic $\frac{1}{2}$ q-unit line of force that as a coupled entity emerges as this gravitational spin; the spins in being magnetic “stepped” (use new definition of the scale), represent $\frac{1}{2}$ a quantum,

Per contemporary physics, spin was originally conceived as the rotation of a particles around an axis. Note that spin here regarding a quantum is a $\frac{1}{2}$ quantum value, as contemporary physics accepts. Given the condition of the speed of light on this scalar level, although the direction of spin can be changed (depending on type of polarity in play), an elementary particle cannot be made to spin faster or slower. And of course, as highlighted here, the spin of a charged particle would be associated with a magnetic dipole moment [16] with a g -factor [17] differing from 1. This could only occur classically if the internal charge of the particle were distributed differently from its mass or as presented here by the process we are suggesting with the phi-quantum wave-function scale.

The conventional definition of the spin quantum number [18], s , is $s = n/2$ (where n can be any non-negative integer); hence the allowed values of s are 0, $\frac{1}{2}$, 1, $\frac{3}{2}$, 2, etc. As we know, the value of s for an elementary

particle depends only on the type of particle, and cannot be altered in any known way. The spin angular momentum, S , of any physical system would thus be quantized, as is the basis here for the $\frac{1}{2}$ determination of spin.

2.5 Electric/Photonic Crystal Shield (EG3)

The final idea of the emergence of gravity takes root from the “self-dissociative” effect of the electron on the folded electromagnetic wave scale (see fig. 5). We suggested that the electron could take on 15 locations in an electron cloud format ([2]; p15, fig.15). This would still be true, yet now (as we are suggesting electron is “dissociative”) the electron would thus arrange in this cloud according to points that would transcribe most basically a platonic solid [19] (fig. 9), as the platonic solid represents geometrical shapes that would fit in a sphere where the points are a maximum distance from each other as a process of the points seeking maximum equal distance from each other, of course depending on the number of electron orientations we are considering.

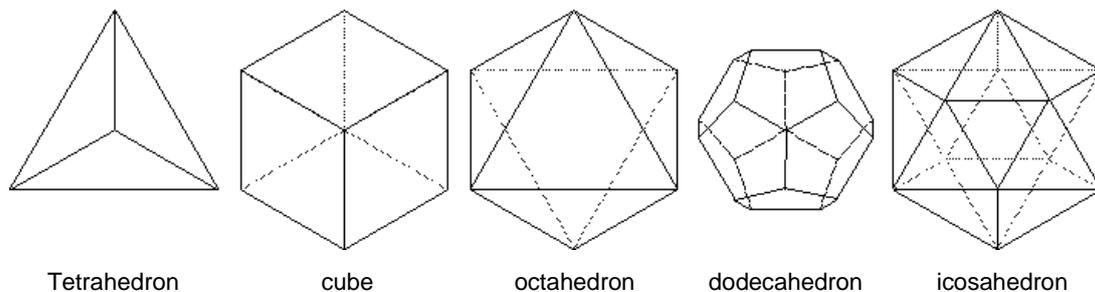


Figure 9: *The 5 platonic solids whose points/vertices represent the maximum distance the points can be locate from each other in the context of a point/crystal-sphere association of alignment.*

In this way, the gravity emerging here care of the electron being “self-dissociative” could be considered as “anti-matter” [20]. Yet this would be a “weak” emergent force owing to the dominant force itself of electromagnetism and the force of electric charge. What though is the force of this so-proposed anti-matter spreading the points despite its relative weakness? Is it gravitational or electric? It would be anti-electric, as per the electrical equations, and thus what the name of it prescribes, a “weak” force (and thus would be more fundamental as a concept, more suitably explained in the context of the elementary particles, as shall be shortly addressed). Nonetheless, this field effect in between the proposed anti-matter points care of the standing wave electrons would represent a 2-d manifold. This surface area would represent the strongest region of disassociation between the electron anti-matter particles, logically, and thus a type of energy field effect representative of the anti-matter effect, a boundary if you will, to matter. The centre of these manifolds is where matter would likely accumulate and thus these points would form lines with gravitational associative properties:

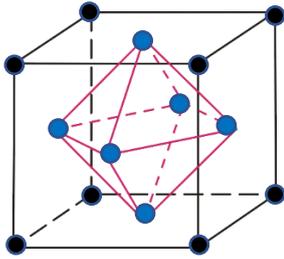


Figure 10: black dots on the photonic crystal as the “anti-matter” particle zones that would be inhabited by electrons in the electron shell, and the blue points as the “virtual-matter” particle zones. Note the interchange of shape of platonic solid, and this “virtual-matter” photonic crystal would be merely a bridge of association by definition, as the actual “matter” points would exist centrally as the proton/neutron”.

So, on the outer photonic crystal we would have the anti-matter effect, and in the centre of each surface of the manifold flat plane joining these points as the crystal surface would be points representing the mass obeying gravitational attractive properties which themselves therefore would emerge as true “crystal “solids” of mass. Something to consider is that the type of crystal employed by the electrons would be determined by the number of electrons in play in each shell and how those electrons would be involved with electrons from other atoms.

2.6 Photonic Crystal Dynamics

What therefore is the idea of mass? We presented that mass would represent a complete “pi-singularity” as a time/quantum-loop (fig. 3-4). Not only this, yet the emergence of mass would be associated to a contraction of distance in the phi-quantum wave-function. When all these features emerge together, they would do so as a singular emergent entity we would know as “mass”. Exactly how though in considering the deeper functionality of the elementary particle level? We know we need to have 15 elementary features associated to each the proton/neutron and electron axes, and that these elementary features would be relevant to the “time-circle” regions (fig. 3-4) for the proton/neutron and electron. Logically we should only consider a crystal structure once again. Which crystal structure though? Let’s go back to how we developed the spatial axes. We started at a 0-point for 0-scalar space, and developed three axes each with two directions. Joining any equidistant point on each of the axes results in an octahedron (figure 11):

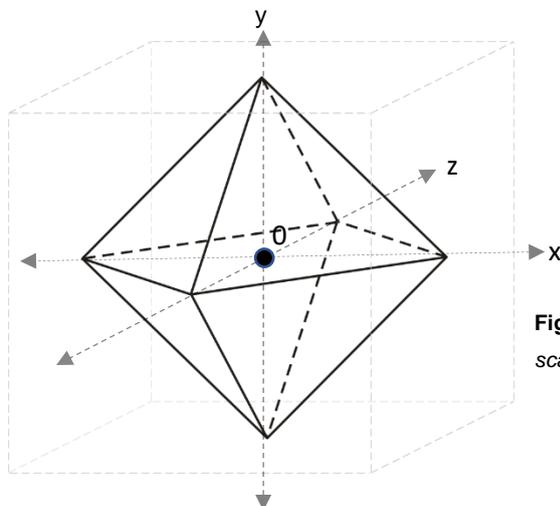


Figure 11: creating an octahedron from 0-scalar space for a time-circle/sphere

Let's now consider Figure 6 again, as it demonstrates an octahedron and a cube, which together in terms of vertices/points calculates the value of "14", "15" if we include the "0-scalar" reference point where the axes converge. Here in figure 12 we shall enlarge the view of the folded electrical component of the phi-quantum wave-function. Note that incorporating the idea of spin around the x-axis (electrical wave rotating around that x-axis) we form a virtual electrical wave "sphere".

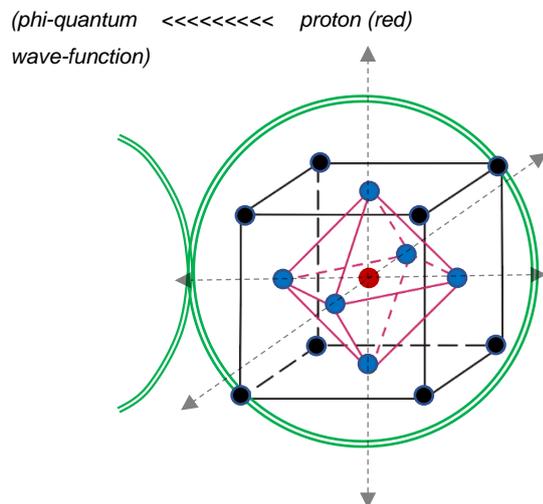


Figure 12: 15 particles/points, three zones: inner most 0-reference (red), middle octahedron (6-points, blue), outer cube (8-points, black). The proposal is the 0-reference is the Higgs particle, the middle-octahedron representative of the generations (particle-spin) as "quarks", and the outer-cube the 8 types of "gluons" responsible for the "strong" nuclear force.

Essentially, we have 15 points including the start point as point zero, and this satisfies our requirement for the 15 subatomic entities for the proton/neutron axis. Yet what is "mass" (regarding the time-circle)? The first structure with points we encounter is the octahedron with 6 points. These 6 points would be divided between the concept of the proton and the neutron. Beyond this would be the cube with 8 points which would also be related to the nature of the proton and the neutron binding together. These "8" counterpart points would represent the structure that binds the neutron to the proton, representative of most likely the "strong" nuclear force. This is interesting, for in suggesting the proton and neutron each have 3 points associated to them (and they form an octahedron) then associated to this octahedron are 8 other points. Note that our aim here is to find "15" elementary features to the proton and neutron (we've found 14 so far).

In giving more contemporary meaning to these proposals, we could suggest that there would be a fundamental point in the centre of the octahedron equidistant from the surrounding 6 points, a fundamental point representative of perhaps the most fundamental idea of "mass" (perhaps the Higgs particle). We could also suggest that the points on the octahedron represents ideas of "spin" and "orientation" (cleaving to the 3 axes (6-points) of determination) of the proton and neutron, and that the proton and neutron would each represent different combinations of 3 types of spin each (6 in all, symbolic of the 6 directions in all of the three axes, x-y-z). We could also say that the surrounding "8" points of the cube-construct would be relevant to the overall "strong" force binding the proton and neutron together ("gluons") [27]. Note that the important thing to consider here is the fundamental feature of the 0-scalar "0-reference" mass-point being used, the concept for "mass", and in this case the proposal of using the "Higgs" particle; this would then express itself as "mass" through the other 14 elementary particles in this domain, noting that within this domain as "1/2" a quantum we have a situation in all experimental fact not being able to measure the exact location of any of these particles using "light" without interfering with their states of both spin and position, and perhaps even energy.

The electron though would be different in that it would need to obey the "negative-inverse" (golden ratio) condition with respect to the proton/neutron, together with allowing for the functionality of "anti-matter" for the

proton/neutron. The first thing to consider is that according to how the electron is defined as the primary electrical component of time, it would need to exist almost as a primary independent entity, and thus occupy the most fundamental “0” spot (coloured red figure 13), which explains why it manifests as a “singularity”, as compared to the proton/neutron pairing. Around the electron would logically be the anti-particles of the proton/neutron “spin” category (cleaving to the 3 axes (6-points) of determination). Beyond this we can only suggest the cube would represent the “anti-matter” elementary particle set of the “matter” elementary set, the “weak nuclear force” manifold compared to the “strong nuclear force” manifold of the proton/neutron.

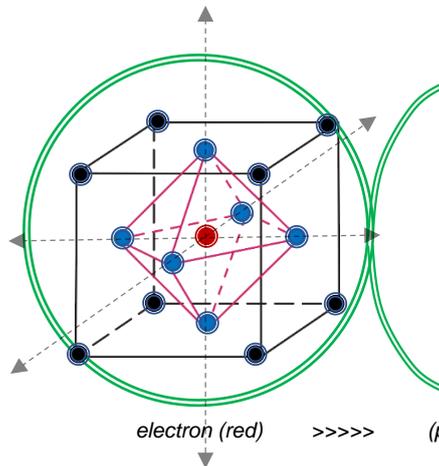


Figure 13: 15 particles/points, three zones: inner most 0-reference (red), middle octahedron (6-points, blue), outer cube (8-points, black). The proposal is the 0-reference is the electron, the middle-octahedron representative of either the generations (particle-spin) as “leptons” or the anti-quarks, and the outer-cube the 8 types of “anti-gluons” responsible for the “weak” nuclear force.

The complicated feature here though is that on the one hand we have the “anti-particles” of the proton/neutron domain, but on the other hand the electron in occupying the “0” domain would express itself as a distinct feature “through” those antiparticle domains; the electron thus in being the central particle feature would have associated to it “6” types of generations of itself (perhaps as the “neutrino” [28] set of particles), and beyond that another “8” features indicative of the “weak nuclear force”, once again noting that within this domain as “1/2” a quantum we have a situation in all experimental fact not being able to measure the exact location of any of these particles using “light” without interfering with their states of both spin and position, and perhaps even energy.

It is understood that particle physics is a vastly complicated yet highly technical and exact branch of physics, cataloguing hundreds of pages of exact data regarding the energy, decay, spin, location, dynamic, interactions, and so on, of all the thus far discovered particles. No contest is being offered there with this theory and the proposal of the elementary particles presented here. This theory “proposes” more exactly though “why” the elementary particles cannot be measured exactly where they could stand, “why” trying to measure elementary particles effects their status, and above all “why” they even exist in the first place. This formal theoretical presentation is thus coming from a different level, not to challenge, yet shed “more” light, albeit from a different perspective, on the nature of time and space, and here directly the nature of the elementary particles.

If the above proposal for the mechanics of the elementary particles can suffice for now, associated to mass would be three types of emergent features of gravity as follows:

- (i) ultimately gravity would have a type of monopolar positive-type “associative” feature (proton/neutron),
- (ii) a negative-type “dissociative” feature (electron),
- (iii) and a magnetic-type “spin” feature (around the x-axis).

Currently we only give gravity credit for its protonic features of “association”. The “dissociative” feature would have something to do with a type of shield effect by the effect of highly charged negative particles, and the

energy/light/heat, (much like the electron in an atom), but it would also have repelling effects, perhaps in the form of shock-waves and ejections, which it does. Yet this is the 3rd emergent feature of gravity. The great implication here is that if there is starlight behind the sun, then this light would bend around the sun given the repulsive nature of this outer dissociative layer. Given also the second emergent feature of gravity, spin, then this starlight would track around the sun likewise. Both these emergent features of gravity would allow light from behind the sun to be viewed in front of the sun, for instance during a solar eclipse. This is how Einstein was granted accreditation for his theory of relativity, namely that gravity bends light, yet although that may “appear” to be the case, what is more accurate to note is “why”.

Regarding the dissociative effect of the third emergent feature of gravity (EG3), if light were to approach that effect head-on, such as light approaching a reference on a celestial body, it’s wavelength would be compressed, “blue shifted”. The reverse would be true also, namely if light is moving away from this dissociative effect, it’s wavelength would be lengthened, “red-shifted”. As we therefore look away from the sun through our own atmosphere which would have a certain EG3 effect, we would note light passing from the sun out to the stars to be red-shifted. We would also note through our atmosphere light coming directly to us from the sun would be blue-shifted. Naturally the sky is blue, and we perceive red-shifted stars. The problem with the red-shifting though is that it has lead us to believe that the universe started from a big bang, creating an accelerating expansive effect that we attribute to the red-shift effect. Yet in paper 2 we highlighted this was a time-anomaly, the effect of t_A , and nothing more ([2]; p18-19). Here though we are adding more scope to that claim.

2.6.3 *Phi-Quantum Wave-Function Error Gradient*

One overlooked feature is the condition of time to define/trace π . The error on the phi-quantum wave-function level is of the order of the actual value of π (3.1415926) subtracted from the true value of π (3.1416253) per the value of π as per equation:

$$\frac{3.1416253 - 3.1415926}{3.1415926} = 1.04087 \cdot 10^{-5} \quad (3)$$

That is the value per unit increment of π on the phi-quantum wave-function level. This value of π used on the phi-quantum wave-function level was an adjustment from a “10” factorial, which with spatial compression (relativistic) effects incorporated becomes the value of 9.9 (19.8 for a double length, both directions of the axis. Yet the calculation of the error is relevant to 10 (9.9) units (by-definition). On an extra atomic scale though this value is squared, 9.9^2 . So, multiplying the error per π value by $(9.9)^2$ as per equation gives us:

$$1.04087 \cdot 10^{-5} \times (9.9)^2 = 1.0202 \cdot 10^{-3} \text{ (length}^3\text{)} \quad (4)$$

If we now calculated a value for this error regarding the most basic weight of a particle, let’s say the neutron in aiming to a concept of pure mass without electromagnetic implications, the following equation would apply:

$$\frac{\pi \text{ error gradient}}{\text{mass of neutron}} = \frac{1.0202 \cdot 10^{-3}}{1.675 \cdot 10^{-27}} = 6.0907 \cdot 10^{23} \quad (5)$$

This value represents that for every gram(g) regarding the neutron, for 1g of a neutron, there exists an error gradient value of $6.0907 \cdot 10^{23}$. We could say the following:

$$\frac{6.0907 \cdot 10^{23} \cdot \text{mass of neutron}}{\pi \text{ error gradient}} = 1 \text{ unit of mass} \quad (6)$$

In other words, $6.0907 \cdot 10^{23}$ neutrons with a factored phi-quantum wave-function error gradient would result in the value of 1g. This number is remarkably close to Avogadro's number [26] which holds a value of $6.022 \cdot 10^{23}$. The difference between these values is only ~1% suggesting extra-atomically there could be a compression effect we haven't factored in, resulting in a slightly lower value than what we've calculated, such as a macro-scale resting level of compression. Thus, the following equation involving an overall system compression factor k_s , a value of 1.0114, and Avogadro's number N_A as follows:

$$\frac{6.022 \cdot 10^{23} \cdot \text{mass of neutron} \cdot k_s}{\pi \text{ error gradient}} = 1 \text{ unit of mass} \quad (7)$$

Quite possibly the mechanics of Avogadro's number is what we're presenting here. Note that phi-quantum wave-function (π) error gradient is a measure of length³ (and thus volume). Thus, our value basically states that there is a standard for the organisation of mass such that a uniform increase in volume (length³) would exist for the number of associated atoms for any given value of background pressure (heat, pressure, etc.). And so quite clearly with this new explanation for relativity (spatial compression), the laws of chemistry would be upheld, for no atomic congress of equations and constants for mass and energy have been disrupted, only a new explanation for known phenomena, the key feature being spatial compression and not time-dilation.

2.7 Demonstration: The Gravielectric Field Generator

All the lead up theory essentially has pointed to an invention, yet not outlined what this demonstration of proof would be (including schematics). In the first paper ([1]; p17), an invention was proposed in the context of an aim to demonstrate the then (paper-1 level) proposed theory, as follows:

"Current research [34] aims to demonstrate that it is possible to produce a gravity field effect from electromagnetism using a dual coil structure (out of phase) wound according to a wavelength that is 1/137 that of the length of the coils in between a positive and negative charge structure, a fractal stepped up version of the gravity/electrodynamics of the atom."

Research was conducted in a transparent manner yet the results were inconclusive, requiring an upgraded theory; the one problem there was that the calibration was false, as it represented a simple scale-system between the fine structure constant, the Bohr radius, and the Compton wavelength, and for lack of clear theory it proposed a current moving in the same direction in each coil. What was required was to understand what the quantum activity would be on the level of the atom, and the way the step-up to the macro world that could take place, and what type of gravity field effect would emerge. It has taken nearly 40 or so pages of theory from the first paper to determine how the stepping-up to the macro-scale process may work. It can be stated now in this 2nd

edition paper-4 version (1st August 2017) how to present a case of proof by putting all these prior-art pieces together:

- On a workable level, the process would involve creating a “folded”/coupled electromagnetic field that essentially blocks its own induction, interfering with the electromagnetic induction process by forcing “induction-blocking”, in which case the idea of forced induction-blocking would in-theory “force” spatial compression to comply with spatial relativistic conditions, and thus generate a gravitational field via electromagnetic means, yet according to a particular scale of solenoid wind-length and overall solenoid length, wavelength of alternating current, and with a particular exposure to an electric field.
- Achieving forced induction blocking would be as simple as taking one electromagnetic wave (as what a standard solenoid carrying current can produce) and supplanting it with an out-of-phase electromagnetic wave, as per using an “out of phase” current carrying solenoid parallel to an “in-phase” current carrying solenoid, the alternating currents in each solenoid opposing the direction of each other, thus per the proposal here incurring a spatial compression, yet according to a particular scale of solenoid wind and placement and current wavelength.
- To achieve the fractal stepping-up process, a key fundamental equation needs to be acknowledged, namely the Fine Structure constant equation for the atom, as follows:

$$\lambda = 2\pi \cdot \alpha \cdot a_0 \quad (8)$$

- Here, α is the Fine Structure Constant of the atom (a value of $\sim 1/137$, symbolic of the strength of atomic electromagnetic coupling), λ the Compton wavelength (electromagnetic wavelength of a basic quanta regarding the proton (p) and electron (e) atomic construct), and a_0 the radius of the atom (as the distance that separates the proton (p) and electron (e)).
- When we step this equation up fractally to a workable level, not losing the scale of dimensions, the following equations are proposed:

$$\lambda_f = \frac{\Omega_f}{21.8} \quad (9)$$

$$\Omega_f = 21.8 \cdot \lambda_f \quad (10)$$

- Here λ_f is the fractally stepped-up value of the wavelength of electrical current (alternating or pulsing) and the solenoid wind-length, and Ω_f the distance between a positive and negative charged plate/region.
- Thus, there would be ~ 21.8 winds of a solenoid, which is then wound back on itself with a wavelength of current that meets the description of the dimension of the wind-length (solenoid wavelength).
- This equation (eq.10) has been termed the Gravielectric field equation which is considered to represent, in incorporating the Fine Structure Constant (α), a universal equation applying to all scales of wavelength (λ_f) and distance (Ω_f) and thus not to the atom alone.

Practically, if we ran an electromagnetic field as pulsing or alternating current (AC) through two solenoids out-of-phase to each other to incur electromagnetic induction coupling/folding/blocking, an electromagnetic field (alternating current) of wavelength lambda (λ_f), we would incur electromagnetic induction blocking and thus a spatial compression (gravitational field effects) by using a scale of assembly that abides by the Gravielectric field

equation (equation 10.); the solenoids would sit in between a positive (p) and negative (e) charged region according to the scale of the Gravielectric field equation (equation 10.), and thus separated by a value of Ω_f , the wind-length of the solenoids of the order of λ_f , 21.8 winds in all, fed back over onto itself (if a single circuit) or a second circuit wound back parallel to the initial wind, the key point being that a gravielectric field is generated provided the electromagnetic field generated by the solenoids and associated electric field by virtue of the charged plates/regions ((p) and (e)) are represented in their proportional alignments of the Gravielectric field equation (equation 10.).

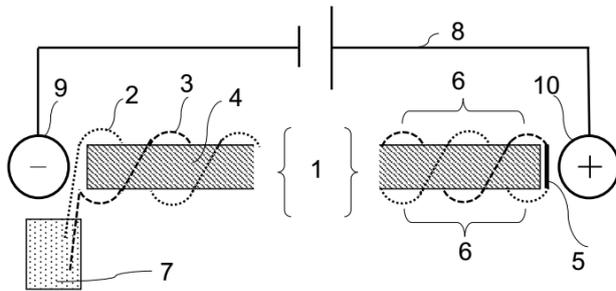


Figure 15: Gravielectric field generator; partial side view with centre cut-away (1.), one solenoid wind (2.), parallel solenoid wind (3.), solenoid core (4.), wire joining solenoids at one end (5.), solenoid wind-length of each solenoid (6.), AC power supply for solenoids (7.), DC power supply for charged plates/regions (8), negative plate/region (9.), positive plate/region (10.).

Another way of achieving a result is to rely on a natural sparking effect of the DC generator (figure 16). There, the sparking effect creates a natural pulsing (AC) wave, although not strictly according to the required AC wavelength matching the wind-length, a non-ideal result would still be yielded. For instance, if the end of one solenoid (2.) were brought close enough to the negative plate/region (9.), drawing a sparking/pulsing current (much like in a Tesla coil [30]), which is then looped back at the same negative plate/region end and fed into with a connecting wire (11.) the solenoid core (4.) then a discharge would occur between the solenoid core (4.) and the positive plate/region (10.).

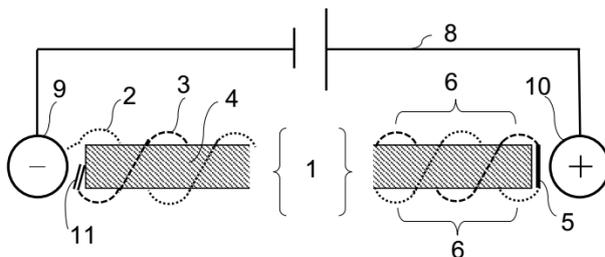


Figure 16: Gravielectric Field Generator; partial side view with centre cut-away (1.), one solenoid wind (2.), parallel solenoid wind (3.), solenoid core (4.), wire joining solenoids at one end (5.), solenoid wind-length of each solenoid (6.), DC power supply for charged plates/regions (8), negative plate/region (9.), positive plate/region (10.), connecting wire between solenoid and solenoid core (11.).

The results should show a general movement from the negative plate/region to the positive plate/region (figure 17, green arrows), from the “dissociative” region to the “associative” region, much like a jet engine having an attractive effect at the front/lead section, sucking in air, and a repulsive effect at the rear/aft section, expelling air.

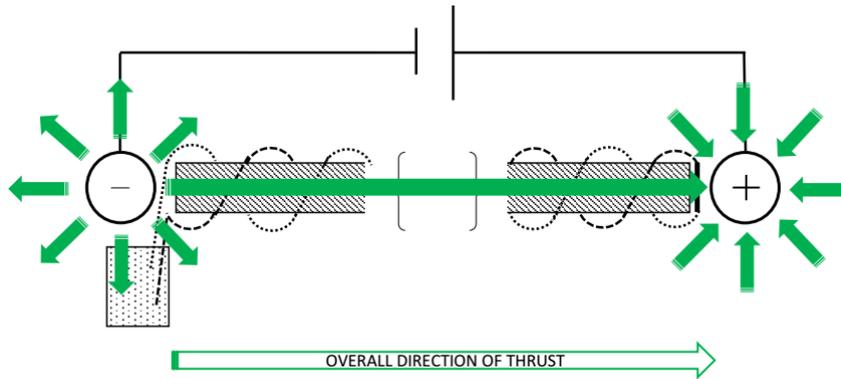


Figure 17: Gravielectric Field Generator; partial side view as per figures 15-16, green arrows depicting the dissociative field at the negative plate/region and associative field at the positive plate/region, resulting in a net gravielectric field from the negative plate/region to the positive plate/region (thrust).

Formal research has yet to be conducted owing to the research requirements (high energy AC and DC power sources), and the caution and thus due diligence and safety provisions needing to be exercised using an AC e/m field of ~16GHz for a 41cm or so solenoid rod. Invitations are currently open for formal research [31].

3 Conclusion

It is difficult to conclude a paper that opens to so many possibilities of actual new a-priori research and development. Perhaps a summary of this paper will suffice. Initially we highlighted the modus-operandi of this paper and its three preceding papers, namely a new explanation for the phenomena of relativity; here we are taking the view of contracting space and not dilating time. This though has an impact on how the idea of a wave-function is developed for light and all its associated intricacies of relativistic and quantum strangeness. We are not considering space fixed to a Cartesian grid though, yet malleable, as we are considering the idea of time as fixed to the golden ratio as per a specific equation for time. It was then our task to derive “all” the equations for energy and mass, all the forces, constants, and so on, everything; everything from this new axiomatic definition for time. We have explained all the features of space and time that have been relevant to the development of contemporary physics, and aligned those observed phenomena with the theory forwarded here. Lastly, we proposed an experiment to confirm this theory, this new interpretation of relativity.

A new theory though with such claims would not be complete without a proper criticism of contemporary directions in physics theory. It is very difficult to criticise contemporary physics though. The theory here has shown the thorough work done by physicists the world and through time over, how very accurate the calculations are “despite” using a different if not more complicated yet less accurate method of relativity. The method of calculation currently used for relativity (fixed space owing to the “Cartesian” adoption of mathematics, forcing the malleability of time) though makes things very difficult if not inaccurate when it comes to measuring and analysing and theorising the nature of reality if the underlying principal of time and space seeks a perfection that the Cartesian coordinate system of determination assumes in its execution of scientific congress. Here in this theory we are not using the Cartesian method strictly to the letter, as owing to the spatial compression effects the Cartesian coordinate system needs some play, especially in the context of time as light “aiming” to reach the value of π as a

quantum step. So, when we as contemporary physicists review this paper, we would ask where the wave-function equations are, where the Cartesian coordinate placement is and those values. Simply, such can't be used here, such is not needed on this phi-quantum wave-function scale; the Cartesian coordinate system "freezes" the idea of space in our minds, it fixes it, pegs it to exact values. Yet in the context of a time and space system that is "seeking" exactness with π , but is unable to find it, which is why it develops so vastly from the level of the atom, to infinity it would seem, the use of a fixed determination of space as per the Cartesian grid "will" result in many problems of formulation. It's almost like there is a splinter in the eye of our perception, yet we are not acknowledging that splinter in our using of fixed if not perfect spatial grids with the assumption thereof by use of a just as perfect process of mathematics. Space quite simply is elastic, time is not.

So how indeed did all this start, why the Golden Ratio for time? The question has been asked, "why the golden ratio for time"? The genesis of the use of the golden ratio, and perhaps the golden ratio itself, is a lot more involved. The key reason the golden ratio was adopted in this theory was owing to the need to summarize a previous paper, over 200 pages long, on complex-number algorithms for time. In summarizing that paper of nearly 20 years' worth of private work, notes, and so on, three key features became apparent:

(i)	Time "now" ideally equates to "1".
(ii)	Time "future" is the "square" of time past.
(iii)	Time "before" subtracted from time "after" equates to time "now".

It was the only way to bring that theory of time out of the realm of complex number equations, and into the "real". Thus the initial paper presented time to represent the three basic equations: $t_A = t_B^2$, $t_N = 1$, $t_N = t_A - t_B$, ([1]; eq. 3, 4, 5), giving rise to $\frac{t_A + t_B}{t_A} = \frac{t_A}{t_B}$ ([1]; eq. 6), providing two outcomes, two concepts, for time, ϕ (1.61803) and $\frac{-1}{\phi}$ (-0.61803), as per the golden ratio. In short, the underlying premise was that time needs to be relative to itself somehow to warrant the idea of "flow". The most basic mechanism we use is "before" and "after", yet as the initial paper [1] highlighted it is more complicated than this. Now through these four papers it appears there is merit in considering the golden ratio as a code for time, given the number of equations it can link relevant to mass, energy, field forces, atomic phenomena, and so on; it hasn't failed, which is something to note.

It's one thing to suggest that the golden ratio is a feature of reality, yet it's another thing entirely to determine "how" the golden ratio is a process of time; the key step is recognising the idea of π , and the need for the golden ratio as time to find π . This would be the first theory to rely on that process. In fact, this theory would be mere opinion without the idea of the golden ratio as a wave-function for time needing to find π . Furthermore, although paper-3 [3] introduced the idea of consciousness, it is perhaps the most important paper in rationalising "who we are" in the grander scheme of things; although we can do our best to work out the codes of time and space, if we forget our own important role in that grander equation we are lost.

The theory presented has taken the shape of four papers including this one [1][2][3]. The idea of joining all four papers into the one paper may seem logical, yet what has been presented is an actual account of how the work has evolved in time, and thus would seem so for a good reason. The first paper [1] tentatively embraced the idea of the golden ratio for time, realising its own limitations in the absence of further discussion. Then the second paper [2] decided to refine the results of the first paper, reaching more accurate results in the context of our known wave-function equations for light. The third paper then made a leap to extra-atomic phenomena, including consciousness, and why not given the importance of our reference in a grander equation. The fourth paper, this paper, with that confirmation of our presence as conscious beings proposed in paper-3 [3] then went into explaining

the very difficult elementary particle world, and a method of how “we” can prove a “new” scientific phenomena. If an overall amalgamated paper is needed as a process of defining reality from the elementary particle level all the way to the universal, it would seem very linear as a concept of spatial growth and associated explanation of phenomena, perhaps leaving us out there to wonder what next. The aim thus with these four papers has been not to forget to localize our importance in the grander scheme, and thus not to have our thoughts and reasoning be theoretically linearly spatially extended out into the universe with a final statement of experimental proof, only to get back to our own reference from such a powerful explanation; that’s not who we are, rather we rely on starting simply, then growing our ideas about our world through trial and error, refining, developing, finding our reference, then really putting the effort in to making this whole thing work. Then ideally we can, using this proof, confirm or deny our ideas about what would seem to be a very difficult lens of stellar phenomenon we all fail to currently agree upon.

Conflicts of Interest

The author declares no conflicts of interest; this has been an entirely self-funded independent project.

References

1. Jarvis S. H. (2017), *Gravity's Emergence from Electrodynamics*, <http://vixra.org/abs/1704.0169>, www.gravielectric.com.
2. Jarvis S. H. (2017), *Golden Ratio Axioms of Time and Space*, <http://vixra.org/abs/1706.0488>, www.gravielectric.com.
3. Jarvis S. H. (2017), *The Emergence of Consciousness from Chaos*, <http://vixra.org/abs/1707.0044>, www.gravielectric.com.
4. Einstein A. (1916), *Relativity: The Special and General Theory* (Translation 1920), New York: H. Holt and Company.
5. *Descartes, René* (2001). *Discourse on Method, Optics, Geometry, and Meteorology*. Trans. by Paul J. Oscamp (Revised ed.). Indianapolis, IN: Hackett Publishing. ISBN 0-87220-567-3. OCLC 488633510.
6. *Bohr, N.* (1985). J. Kalckar, ed. Niels Bohr - Collected Works: Foundations of Quantum Physics I (1926 - 1932). 6. Amsterdam: North Holland. ISBN 9780444532893.
7. Andrzej, Stasiak (2003). "Myths in science". EMBO Reports. 4 (3): 236. PMC 1315907 . doi:10.1038/sj.embor.embor779 . Retrieved 31 March 2007.
8. Uggerhøj, U I; Mikkelsen, R E; Faye, J (2016). "The young centre of the Earth". European Journal of Physics. 37 (3): 035602. doi:10.1088/0143-0807/37/3/035602.
9. Hawking, S. W.; Ellis, G. F. R. (1973). *The Large-Scale Structure of Space-Time*. Cambridge University Press. ISBN 0-521-20016-4.
10. Castelvechi, Davide; Witze, Witze (February 11, 2016). "Einstein's gravitational waves found at last". Nature News. doi:10.1038/nature.2016.19361. Retrieved 2016-02-11.
11. Lorentz, Hendrik Antoon (1904), "Electromagnetic phenomena in a system moving with any velocity smaller than that of light", Proceedings of the Royal Netherlands Academy of Arts and Sciences, 6: 809–831
12. <http://www.dictionary.com/browse/topology>
13. Shields, Rob (December 2012). "Cultural Topology: The Seven Bridges of Königsburg 1736". Theory Culture and Society. 29 (4-5): 43–57. doi:10.1177/0263276412451161
14. Brown, L.M.; Rechenberg, H. (1996). *The Origin of the Concept of Nuclear Forces*. Bristol and Philadelphia: Institute of Physics Publishing. ISBN 0750303735.
15. Brown, L.M.; Rechenberg, H. (1996). *The Origin of the Concept of Nuclear Forces*. Bristol and Philadelphia: Institute of Physics Publishing. ISBN 0750303735.

16. Cohen-Tannoudji, Claude; Diu, Bernard; Laloë, Franck (2006). Quantum Mechanics (2 volume set ed.). John Wiley & Sons. [ISBN 978-0-471-56952-7](#).
17. Povh, Bogdan; Rith, Klaus; Scholz, Christoph; Zetsche, Frank (2013-04-17). [Particles and Nuclei](#). [ISBN 978-3-662-05023-1](#).
18. Condon, E. U.; Shortley, G. H. (1935). "Especially Chapter 3". The Theory of Atomic Spectra. Cambridge University Press. [ISBN 0-521-09209-4](#).
19. Zeyl, Donald. "[Plato's Timaeus](#)". The Stanford Encyclopedia of Philosophy.
20. Tsan, U. C. (2012). "Negative Numbers And Antimatter Particles". International Journal of Modern Physics E. **21** (1): 1250005. [Bibcode:2012IJMPE..2150005T](#). [doi:10.1142/S021830131250005X](#)
21. Shiltsev, V. (2015). "Crystal Ball: On the Future High Energy Colliders". Proceedings of the European Physical Society Conference on High Energy Physics (EPS-HEP2015). 22–29 July 2015. Vienna: 515. [Bibcode:2015hep.confE.515S](#)
22. Eliel, Ernest Ludwig; Wilen, Samuel H. & Mander, Lewis N. (1994). "Chirality in Molecules Devoid of Chiral Centers (Chapter 14)". [Stereochemistry of Organic Compounds](#) (1st ed.). New York, NY, USA: Wiley & Sons. [ISBN 0471016705](#).
23. Einstein, Albert (1956) [Republication of the original 1926 translation]. "[Investigations on the Theory of the Brownian Movement](#)" (PDF). Dover Publications. Retrieved 2017-06-22.
24. Singh, Pamanand (1985). "The so-called fibonacci numbers in ancient and medieval India". *Historia Mathematica*. **12**: 229–244. [doi:10.1016/0315-0860\(85\)90021-7](#).
25. Mandelbrot, B. (1982). The Fractal Geometry of Nature. New York: Macmillan. [ISBN 0716711869](#).
26. "[CODATA Value: Avogadro constant](#)". The NIST Reference on Constants, Units, and Uncertainty. US [National Institute of Standards and Technology](#). June 2015. Retrieved 2015-09-25.
27. B.R. Stella and H.-J. Meyer (2011). "Y(9.46 GeV) and the gluon discovery (a critical recollection of PLUTO results)". [European Physical Journal H](#). **36** (2): 203-243. [Bibcode:2011EPJH...36..203S](#). [arXiv:1008.1869v3](#). [doi:10.1140/epjh/e2011-10029-3](#)
28. Close, Frank (2010). *Neutrinos* (softcover ed.). Oxford University Press. [ISBN 0-199-69599-7](#)Mandelbrot, B. (1982). The Fractal Geometry of Nature. New York: Macmillan. [ISBN 0716711869](#).
29. Homeomorphism. *Encyclopedia of Mathematics*. <http://www.encyclopediaofmath.org/index.php?title=Homeomorphism&oldid=33549>.
30. Uth, Robert (December 12, 2000). "[Tesla coil](#)". *Tesla: Master of Lightning*. PBS.org. Retrieved 2008-05-20
31. http://www.gravielectric.com/index_2.htm