Temporal Mechanics, and EM-DIR "particle pair production"

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Abstract: Presented here is the Temporal Mechanics EM-DIR theory for "particle pair production" in detailing the derived EM temporal wave function and its associated transverse and longitudinal polarized quasiparticle features (and associated "phonon" phenomenon) in then explaining the process of "destructive interference resonance" (EM-DIR) of the temporal wave function, of the longitudinal wave function quasiparticles, as the key process of particle pair production. The phenomenon of symmetry breaking shall then be explained, following which the actual scales of the electron and proton derived and how those scales can be most accurately measured/verified, thence resolving the "proton radius puzzle". Two experiments shall then be proposed in demonstration of this new particle pair production process. As this paper shall highlight, time as an a priori is proposed to be the underlying principle to the existence of matter.

Keywords: temporal mechanics; temporal calculus; particle pair production; destructive interference resonance; DIR; antimatter; positron; quasiparticle; phonon; black body radiation; symmetry breaking; inertia; proton radius puzzle; EM-DIR thruster

1. Introduction

Here is presented what is proposed to be the underlying problem in contemporary physics, namely the photon model of light, what that model is based on, why, and to what effect, detailing the fundamentals of the current photon model and highlighting those evidence-based associated problems, and then how Temporal Mechanics can present a solution to those problems, both in the form of a *new model* for light (without corrupting the known data for light), and thence a new *modelling* for particle creation, metric scaling, and associated phenomenal calculation (without also corrupting that data),

thence proposing mechanisms of proof, basing all of such on the previous works and associated evidence of Temporal Mechanics, a body of work of 37 papers [1-37] thus far.

The key proposal here by Temporal Mechanics is that there exists a more fundamental basis for a model of light than the electron analogue proposed by Max Planck, his particle-wave model, that in fact it is possible to dive into the *temporal* nature of the atom itself and uncover a time-equation code to elementary particles that prescribes a temporal wave function manifesting as an EM signature the base of which incurs a lowest temperature value of $2.725K$ for the vacuum of space, proposed and derived here as the basis of baryonic black body radiation, all of such *without needing an exclusive* ***primary*** *electron-analogue model for light*.

Thus, presented here is a more fundamental aetiology for EM phenomena, not dependent *primarily* on the *inertial* qualities of a charged particle in space.

The basis for the underlying principle being proposed is a description of the most fundamental relationship between an axiom of time in relation to space, as was presented in the previous paper [37], and how that temporal wave function as an EM signature is related to both the microscopic atomic locale (subatomic and elementary particles) and the macroscopic scale (per black body radiation and associated vacuum energy scale), all of such having successfully derived the mass of the proton and neutron, lightest neutrino, electron, and Planck length. In short, the black body nature of the atom, of baryonic matter, is explained in using the more fundamental axiom for time prescribing an EM signature temporal wave function for space as per quantifying a proposed time-equation with Pythagorean space. Here in this paper shall be derived the actual metric spatial scale of the electron and proton, and how such can ideally be measured/verified.

In presenting such, here in this paper the weakness of the current photon model for light shall be exposed in demonstrating such a model not being able to describe how the process of particle pair production results in two particles, $e+$ and $e-$, as particles that do not self-annihilate at their genesis thus warranting a need for either a new fundamental field force to keep them separated at their genesis or at least having a distance separating them in play at their genesis, something the current photon model for light and associated context of particle physics do not explain.

In presenting such, this paper shall dive into the current model of the photon and how the "particle collision" path became *the process of choice* to effect particle pair production. This paper will then highlight a *non-inertial* path as per the theory of Temporal Mechanics to demonstrate the particle pair production effect, a wave function "destructive interference resonance" (EM^{DIR}) path to generate the same result while detailing how $e+$ and $e-$ do not self-annihilate on their genesis.

To reach this proposal, this paper will be segmented as follows:

1. Introduction
2. History of "particle pair production"
3. The limitations of inertial physics in explaining light and particles
4. Proposing a solution
5. Temporal wave function logistics
6. The EM quasiparticle and phonon

7. EM^{DIR} particle pair production
8. Symmetry breaking
9. Particle metrics/scales; the electron-quantum unit (EQU)
10. Particle measurement: resolving the “Proton radius puzzle”
11. Electron black body radiation
12. EM^{DIR} utility
13. Temporal Mechanics in perspective
14. Conclusion

Here therefore is presented the theoretic basis for *particle pair production* via a new process termed EM^{DIR} (EM-DIR, EM destructive interference resonance) field generation whereby EM^{DIR} field generation is a proposed destructive interference resonance EM field resulting in the coagulation of matter and antimatter (as per *particle pair production*).

The intended proof of this theory is in it demonstrating that an EM^{DIR} field can bring into effect *particle pair production* and thus electron and positron formation as theorized in paper 36 (there in correctly deriving the mass of the electron and positron via this particle pair production EM^{DIR} mathematical calculation process), a resultant process not entirely dissimilar to the standard described CERN mechanism of particle pair production, the similarity here being that light is still being held in a context of annihilation, yet here not in colliding *photons* together as particles, yet by using a process *destructive interference resonance* (DIR) of a high energy temporal EM wave function, a similar concept as per the photon model of light being annihilated, yet here what can be proven to be a more versatile background theory allowing this just as versatile process of proof not allowed by current Einsteinian relativity or quantum mechanical theoretic formalism owing to the *inertial* limitations of those theoretic designs.

In short, Temporal Mechanics presents a new mathematical formalism termed *temporal calculus*, fundamentally different to the idea of Einstein’s Special and General relativity theories, a step beyond Quantum Mechanics in employing a new axiom for time thus leading to the new experiment proposals. Such is not to say that Temporal Mechanics is a solo effort yet depends on the vast theory and associated known qualified data and experimental results of Einsteinian relativity, Quantum Mechanics, and the standard model of particles, all thoroughly referenced through the works of Temporal Mechanics [1-37].

2. History of “particle pair production”

The basis of physics and associated use of mathematics is central to Einstein’s Special and General relativity theories and associated “photon” particle model for light, coupled with the required quantum mechanical wave theory, all still using a basic *classical mechanical* approach to particles (inertia and momentum), while then using *particle collision experiments* to determine particle and photon logistics.

In short, the whole basis of modern particle physics as the photon model and associated classical mechanics collision experiments, more precisely the applied mathematics and physics of inertia, is being questioned here. Consider the following diagram:

Figure 1

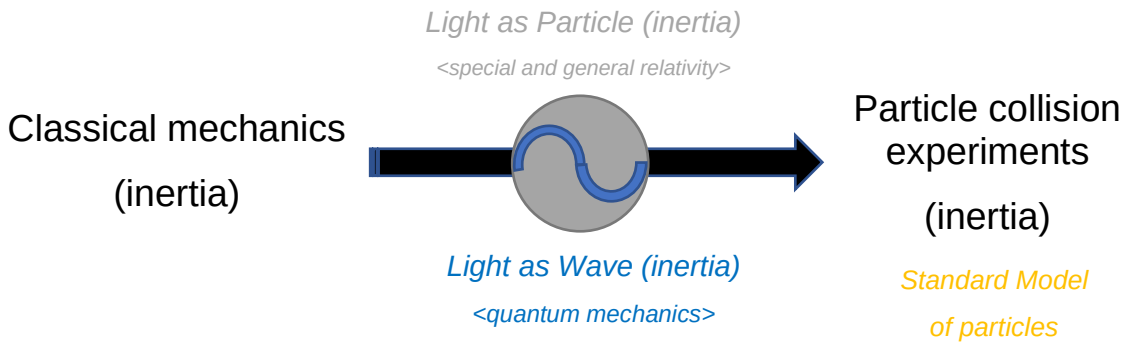


Figure 1: a basic portrayal of time's arrow and associated time-equation as the process of entropy noting from paper 36 ([35]:

The real idea to note is how the model for light took its shape for that model's proposed electric and magnetic transverse field (polarized) features as *a particle*.

The basis there is to ask, "what is a basic particle" and more importantly, "how is a basic particle associated to the idea of EM radiation as polarized electric and magnetic fields"? To answer such is to address a "black body", namely:

- An idealized physical body that *absorbs* all incident electromagnetic radiation, regardless of frequency or angle of incidence.
- A physical body that *emits* black body radiation.

Black body radiation is also called thermal radiation, cavity radiation, complete radiation, or temperature radiation. In contrast, a hypothetical white body is quite simply the opposite, namely one that can only be a type of rough surface that reflects all incident rays completely and uniformly in all directions.

It was thence proposed that a black body in thermal equilibrium with its environment emits EM black body radiation, the issue being, "where does EM actually come from in that process, from a particle, from its motion in space as black body radiation, or from something more fundamental?".

A few specifics to note about black body radiation:

- All baryonic matter emits electromagnetic radiation when it has a temperature above absolute zero.

- EM radiation represents a conversion of a body's internal energy into electromagnetic energy and is therefore called thermal radiation as a process of entropy.
- All normal matter also absorbs EM radiatoin to a certain degree.
- An object that absorbs all EM radiation falling on it, at all wavelengths, is called a *black body*.
- When a black body is at a uniform temperature, its emission has a characteristic frequency distribution that depends on the temperature, and its emission are called black body radiation.
- The concept of the black body is an idealization, as perfect black bodies do not exist in nature.

According to Max Planck, the radiation emitted by a black body constitutes discrete *quanta*, as per Planck's law, as per a spectrum determined by *the temperature alone* and not by the body's shape or composition. Through experiments, Max Planck established that EM radiation emitted by a perfectly absorbing “black body” comes in the form of discrete packets of energy called *quanta*; here Planck considered the black body as the atom per the associated electron making quantum jumps between shells, if not the motion itself of the electron in its quantum shells, prescribing the atomic locale as the nominated black body and that the packages of this atomic locale black body radiation are due to *quantized* electron jumps.

What Albert Einstein did with Planck’s proposal was interesting, for Einstein gave EM the *signature* of a “particle” itself, *in not only* assuming *quanta* (packages of EM) to be real, yet that all EM must act like discrete particle-like entities called *photons*.

The next step of course was found in the 1920’s where it was proposed that the discrete electron particles responsible for the quanta also come with a wavelength in behaving like a wave themselves. In other words, here was the proposal for the source of Max Planck’s black body radiation, namely the behaviour of the electron, to behave like a wave. Was the implication there that the electron as a particle traced a wave pattern in its shell to give rise to atomic black body radiation, or that intrinsic to the electron is a signature of a wave itself?

3. The limitations of inertial physics in explaining light and particles

To understand the aetiology of black body radiation, one needs to first look at the aetiology of the processes seeking to *measure* black body radiation, primarily through the *inertial* lens of physics theory, and thence through particle collision experiments, as per the following:

- 1905 Albert Einstein outlined his theory of Special Relativity, explaining the relationship between space and time (and between energy and mass as $E=mc^2$.) in using Planck's idea of quanta to describe how light is proposed to travel through space.
- 1911-1912 Victor Hess measured radiation in the atmosphere through balloon experiments in looking for the source of an ionizing radiation that registered on an electroscope, questioning the

then idea that the radiation came from the rocks of the Earth, thence discovering what appeared to be a natural source of high-energy particles beyond Earth, namely cosmic rays.

- 1920s, physicists applied Planck's quanta to the atom and its constituents with Erwin Schrödinger and Werner Heisenberg inventing a new quantum theory of physics as *Wave Mechanics* , the problem there though being that quantum theory worked only for particles moving slowly yet not for those at high/"relativistic" velocities (at or near c), and thus not accommodating for time approaching zero as speed approaches c.
- 1928 Paul Dirac combined quantum theory with special relativity describing the behaviour of an electron moving at a relativistic speed, allowing atomic locales to be Einstein-relativity compatible, such though with the idea that for every particle there exists a corresponding antiparticle, exactly matching the particle but with opposite charge.
- 1932 Carl Anderson discovered these antielectrons in a cloud chamber, each produced *alongside* an electron from the impact of cosmic rays in the cloud chamber, naming them “positrons”.

The quantum “answer” there was per using the mathematics of inertia and momentum to describe both light and particle dynamics. Currently, the only way to describe the genesis of black body radiation is to do such with an *inertial* reference of a particle in mind, and thus a process of *reaction*, as much as “inertia” is a “reaction” process.

As per the work of Ernst Lawrence, inertial physics subsequently became dedicated to the idea of high energy particle collisions to reveal the fundamental nature of particles, based on the work of Dirac linking special relativity with *quantum wave theory* in establishing particle pair production (electrons and positrons) and those features of genesis via a classical mechanical approach. The classical mechanical (inertial) description there requires the following:

- energy must be conserved for pair production to occur, namely the incoming energy of the photon must be above a threshold of at least the total rest mass energy of the two particles created, and thus *conservation of energy and momentum* are the key constraints.
- All other conserved quantum numbers (angular momentum, electric charge, lepton number) of the produced particles must sum to zero; thus, the created particles are proposed to have opposite values of each other.
- Thus, if one particle has electric charge of +1 the other must have electric charge of −1, or if one particle has strangeness of +1 then another one must have strangeness of −1.

Today, the current thrust of such research is aiming to suspend antiparticles for a certain length of time to measure their spectroscopy and play under the influence of gravity, to find any consistency there with electrons and thus to highlight basic symmetries.

In short, modern physics is still in the process of discovering a host of particles and particle-atom processes using the principles of *inertia* via collision experiments and spectroscopy.

Despite such processes of research, the theme of Dirac’s work remains, namely linking the particle and wave features, of light with the electron, of Einstein’s special relativity photon particle

description with the quantum mechanical description. In fact, Dirac succeeded in taking the focus of physics theory *to the modelling of the idea of light itself **on** the electron*, for if indeed the electron can be both a particle and wave, be both *relativity* and *quantum-mechanics* compatible, why cannot light? Yet to posit the electron as both a particle and a wave is precisely the issue with light, light as a particle and wave, except that light has no mass yet the electron has mass and thus there the electron is given priority over light itself when in fact it is the *charge* itself of a motioning electron that should take priority. The real question there is, "what makes charge?". Temporal Mechanics aims to resolve this issue with its description of particle pair production in a way that derives both the charge and spin of electrons and positrons.

4. Proposing a solution

Temporal Mechanics is a body of work proposing "*time*" to be the primary feature of mathematical analysis of physical phenomena, and *not inertia* as the primary feature of mathematical analysis.

In being as such, Temporal Mechanics is able to highlight the fundamental problem with physics, namely how physics as a discipline is structured as a hierarchy of defining space, time, and mass, the problem there being that physics holds mass to be primary, and that space is a metric that can expand, extend, and that time is a result of mass and how it moves with other masses as per gravity, and thus that time is a *result* of mass primarily yet per gravity, as a type of *reaction*, as *inertia* is a process of *reaction*.

The disciplines of inertial physics (classical mechanics, quantum mechanics, special relativity, and general relativity) have all worked well with inertial mechanisms of measurement, yet the three fundamental processes of inertial physics remain upheld throughout all the mathematical formalisms and applications in physics:

- Priority of mass.
- Time *emerging* from mass-gravity as a reactive entity, as though representing a principle of anti-time (time looking back).
- Designing the photon accordingly as a non-zero mass *particle and wave as one* albeit with the features of *inertia and momentum*.

One of the consequences of making mass primary as per inertial physics is that it *requires* its version of time to exist *exclusively* in the datum reference of "time-now", yet as an emergence, a *reaction*, in the particle phenomena locale.

To be precise, if time is a *reaction* to inertial bodies in relative motion and to then localize an actual event under the spectre of inertia is to ask time to dive back into the past, as much as inertia is a reaction still dominated overall though by the domain of time's arrow forward, and yet the protocol of inertia-time technically is a basis for *anti-time*, *reactive-time*, a concept which Temporal Mechanics considers as a violation of the known constraints of the passage of time. As such, Temporal Mechanics

proposes that such inertial reactive-time standing of inertial physics represents *the key obstacle* for modern physics, especially so if indeed time can exclusively represent an axiom as an arow with space that is not violated, as *timespace*, as Temporal Mechanics shall demonstrate.

Paper 1 of Temporal Mechanics, "*Gravity's Emergence from Electrodynamics*" [1], presented the case that our primary awareness of/as/with time and thence *theoretic utility in explaining phenomena associated to time and space* (a basic process involved in the modelling of theories) requires certain qualities of time, namely time-before t_B (past), time-now t_N (present), and time-after t_A (future). From certain axiomatic constraints of these three temporal parameters can be formulated a "time equation" as $t_B + 1 = t_A$ (where $t_A = t_B^2$) presenting the two solutions of the golden ratio, *proposed as a hypothesis*, the hypothesis being that such a time-equation can be applied to space to thence derive a basic atomic locale with known physical phenomenal features to physics. Yet what makes the time-equation even more useful if not complex is that the time-equation is forever incomplete, an endless loop, by its "Fibonacci-style (golden ratio) construction, and yet when that endless loop is applied to the idea of space, interesting things start to happen. Ultimately to note there (from paper 2 [2] where time is applied to space), the concept of time-now *is the datum-reference of reality* which is where everything is defined in the context of time-now=1 ($t_N 1$). Consider figure 2:

Figure 2

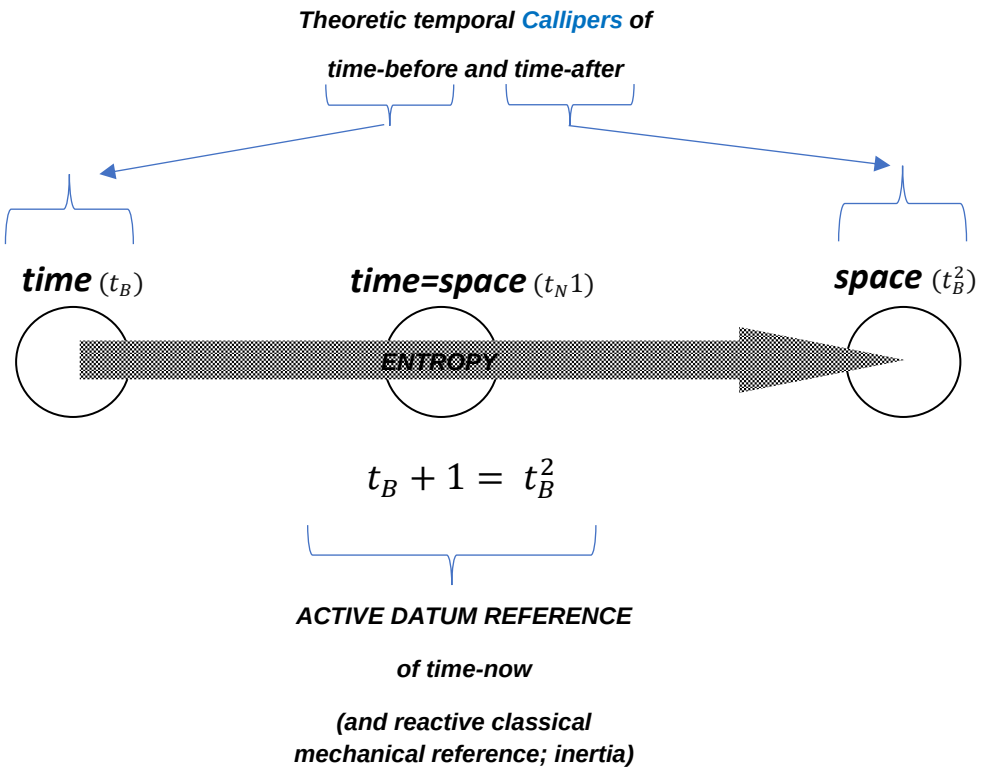


Figure 2: a basic portrayal of time's arrow and associated time-equation as the process of entropy in regard to the proposed time-equation.

Key to the proposal here is that *spacetime* theory (as gravity) leads to violations of *causality* regarding *mass/inertia and gravity with time,* paradoxically presenting the case of *anti-time*, as presented in paper 28 [28], "*Temporal Calculus: Resolving Einstein's Theory of Relativity (Special and General)*", namely the Penrose Stairs scenario. There, the problem of using inertia became apparent as an aberrant way of appreciating time converse to standard causative time, leading to the notion of "*anti-time*", or more precisely, "*reactive-time*", which as $time = 0$ at c highlights, is *forbidden*.

Temporal Mechanics asks, "How does the idea of **inertia** *precede* **time** as an idea of an event?"

The only way to properly understand causality without falling into the anti-time ruin of a Penrose Stairs event of mass/inertia and gravity is to take the idea of time by the horns and make it an axiom as a description that *suits* ***our*** temporal perception ability. As such, Temporal Mechanics upholds the idea that inertia is technically a secondary event, namely "resistance *to* change", a reaction, and thus should ideally not be used to define the *primary* nature of something. The thinking here is that time is the more primary process that instigates inertia as a body resisting fundamental features consistent with time.

Thus, the request here is to consider the time-equation as a set of callipers that holds the events of time-now, of the datum reference, within it.

Consider an *hourglass*; the time equation is like an hourglass if one can imagine *time-before* as one glass bulb end, and *time-after* as the other glass bulb end, with the datum reference in between the glass bulbs as *time-now*, with of course a particular mathematical representation. Consider also that an hourglass presents the working of *gravity* (as the sands fall from *time-before* to *time-after*), as does the time-equation, as presented in figure 2; Temporal Mechanics considers the sands of the hourglass first present in the *time-before* glass bulb as non-local time-points, and *time-after* as the bottom empty glass bulb region, and the narrow aperture connecting the two chambers as *time-now*, as $t_N = 1$, the datum reference. Paper 37 details the specific "axiom of time" [37] and how the time-axiom is related to time's arrow as *entropy*, and how such is related to gravity as per papers 36-37 [36-37], resolving relativity's virtual *anti-time* violations.

Above all, the primary feature for Temporal Mechanics is to explain all events in *time-now* ($t_N = 1$) as a hypothesis, in asking, "can such represent a basic temporal reservoir for the reality of *time-now*, for the datum-reference?". For Temporal Mechanics to derive what it has thus far, as shall be presented in section 12, the answer is that it can.

Five fundamental features of Temporal Mechanics need to be highlighted as compared to Einstein's spacetime theory and Quantum Mechanics, namely:

- time is ***not*** an independent reality in Temporal Mechanics,
- time is an axiom which then *derives* space, and thus what we have is ***timespace*** (***not*** spacetime, as spacetime has already been named in a certain inertial/anti-time context).
- Quantum Mechanics is unable to formulate a wave function ***where at c time is as 0***.
- *To understand/recognize/**institute** causality* one needs to construct a set of ***callipers*** as time-before and time-after *between which* is the datum-reference of time-now.
- All the fundamental tenets of physical phenomena *must be derived* by this new axiom for time (and space).

In short, Temporal Mechanics has developed a spacetime analogue in creating the required wave function, yet names this spacetime analogue as *timespace*, as technically it is a different process of formulation to that of Einstein as a more correct account of time. By such a process, a more fundamental basis for physical theory is achieved, and thus a more fundamental description for black body radiation, a description that accommodates for time not passing at c.

The question now for this paper is, "*how does the time equation and associated temporal wave function derive the manifestation of matter and with what resultant phenomenal field force features of energy, temperature, and force?*".

5. Temporal wave function logistics

Temporal Mechanics proposes that the basic architecture of *timespace* is the time equation and its association with space, as per paper 2 pages 4-11 ([2]: p4-11),

> *Note the following five key points:*
>
> - *The two possible wave function outcomes for the x-axis (nominated here as the spatial axis) in space represent the two directions the temporal wave function would move along each axis in space, one needing to be the opposite direction of the other in space, and thus inverse wave-sign value (y-axis -ve, and +ve) at the "0" point of the x-axis and y-axis in recognition of this basis.*
>
> - *Therefore, along those two directions of space (along the x-axis) for this wave function would represent two temporal phase alignments, one positive (y-axis +ve), the other negative (y-axis -ve), suggesting a type of paradoxical condition of time-forward and time-reverse for the wave function moving along either direction of the x-axis from 0.*
>
> - *Paradoxically therefore, this wave function, having both positive and negative temporal features, would appear to have time stand-still, not pass, as it travels along the x-axis in either direction from 0, despite it representing a speed of transmission along the x-axis from 0 as an overall time-equation in space.*
>
> - *Along each directional x-axis from 0 we must also nonetheless satisfy each wave function step to having traversed along each directional axis (here the x-axis) the value of "π" as a "unit" wave function length in space.*
>
> - *The question to ask is how well this wave function is able to prescribe the value of π based on how it is mathematically defined from the temporal*

realm and associated time-equation in its application to space (here as the x-axis).

On simple observation, we can suggest that we have developed a sinusoidal time-wave along a spatial axis given that time must move a value of π in each directional axis from the 0-scalar spatial reference point "0".

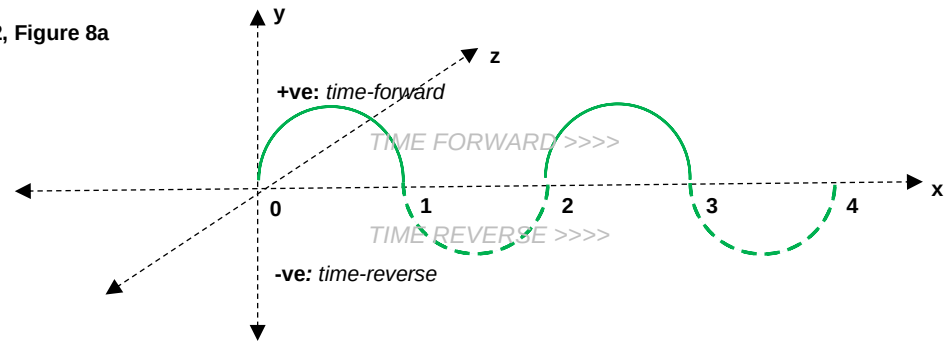
Yet is such a standard sinusoidal wave as mathematics/physics knows it? No it is not. The important features to note here are that:

- *this is **not** a simple linear wave in space,*
- *this is a time-wave in space with both positive and negative temporal features,*
- *the implication being that time forward is positive and time-reverse is negative (y-axis).*

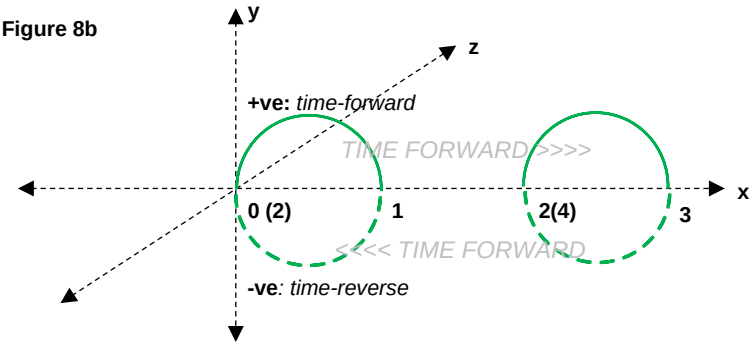
*Although the direction in space may appear to be positive or negative in terms of a reference from "0" on a mathematical grid, space here is space, it is not considered positive or negative, and yet what to note here with this temporal wave function is that the temporal function itself of the time-wave, the vertical y-axis, is the temporal feature of the wave having both **positive** or **negative** values, as **time-forward** and **time-reverse** respectively.*

This feature will ultimately play a key role in explaining the particle nature of light and how at c time does not pass, to be presented in subsequent papers. Consider nonetheless an adaptation of figure 8, here as figures 8a and 8b:

Paper 2, Figure 8a



Paper 2, Figure 8b



Paper 2, Figures 8a-8b: note the primary temporal wave function as figure 8a, and the secondary time-circle "particle" effect of that wave function as figure 8b, both wave functions demonstrating the idea of time being an overall loop (not passing) as the progression of the temporal wave function, yet figure 8a being the primary focus for this paper and subsequent papers. Note also in figure 8b the time-reverse feature of values in brackets for the x-axis, as from figure 8a.

Note the time-circles in figure 8-b, how the negative region of the y-axis as time-reverse brings that part of the x-axis wave function back a step (in being time-reverse), twisted backwards, creating a time-circle as a type of time-now "virtual particle-ring", giving light an almost particle-hopping nature as it would progress along either direction of the x-axis from 0, almost like the light particle-ring is tunnelling as it trains along each direction of the x-axis from 0.

This particle feature though is a secondary effect of light and as such is not considered part of the primary focus of examining the temporal wave function, yet will be pursued as a discussion point in subsequent papers.

In short, the focus primarily here is how well this temporal wave operates primarily from first principles, and subsequently here how it must deliver π, and this will be a consistent theme through this paper and subsequent papers, namely focussing on the primary temporal wave function and not its secondary apparent particle effects, which without understanding the fundamental processes at play would be a misleading investigation.

Indeed therefore, the issue with π is the question of, "why assume that time as this wave would "move" through the axes of space continually as though beyond the length of π, extending outwards to infinity from 0, as opposed to just going back and forth along a "0.5" and "-0.5" x-axis grid presuming to trace π?".

Note therefore the following:

- *It is all about the time equation and how we have installed time into space.*
- *Yet installing time into space requires the time equation to be modified, adapted, given space is a different creature to time, as per equation 2.*
- *To note is that we cannot modify t_N, only how time as φ or a $\frac{-1}{\varphi}$ entity is applied to space as an "after" and "now" event.*
- *We do know though that t_A must aim (as a mechanism of a spherical wavefront in time, a future placement of the wave function, a t_A event) to ultimately most basically for one axis (here the x-axis) **equal the value of π**, the length in space time has moved along an axis (as per equation 2).*

To note is that this is not a standard linear-time wave function expressed according to standard wave function mathematics, as the problem here is that time is both forward *and reverse* (a violation *that is corrected in reversing the spatial direction of that feature of the temporal wave function*) with an overall arrow of time feature, and thus three functions in one, and thus *cannot be described according to standard*

wave function nomenclature. It is still a wave function nonetheless, a *temporal* wave function, with specific conditions preventing it from being labelled in the same way as conventional linear-time wave functions.

Contemporary physics defines a wave function, mathematically, as follows:

$$i\hbar\frac{\partial}{\partial t}\Psi(x,t)=\left[-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}+V(x,t)\right]\Psi(x,t)$$

The problem there is "time", namely that in that expression time is linear (x,t). With Temporal Mechanics though the run of time *is already an equation* (t_B+1=t_A) and so can only be expressed *as a geometry*, a geometry of time being applied to space. Thus, the mathematical description of the temporal wave function, as presented in paper 2 [2], is to explain the actual *scalar* and *vector* representation of the temporal wave function (*there expressed only in one x-axis direction for simplicity*).

The task there in that construction process was to address:

- how that time-equation and associated temporal wave function directly relates to the mass of a particle,
- how the time-equation and associated temporal wave function make particles manifest,
- and how the time-equation and associated temporal wave function gives baryonic matter its black body radiation quality.

Contemporary physics is currently exploring the idea of using photons to generate particles per the Breit-Wheeler process [38][39]. However, one key over-looked feature of the *inertial* physics approach to particle pair production (as per particle collision experiments) is that it is fine to propose that colliding particles together can produce subsidiary particles, in measuring the energy stamps of the resultant particle debris, yet with the idea of matter and antimatter the question needs to be asked, "at what precise distance are the electrons ($e-$) and positrons ($e+$) created distinct from each other in their genesis *if indeed when they approach one another* (and thus *if they are formed upon one another*) *they would annihilate*?". Simply, to consider that $e+$ and $e-$ are separated at their genesis (owing to the energy used to make them manifest in the first place) is to propose that there is a type of accessory energy requirement in play separating the genesis of $e+$ and $e-$, which is an erroneous suggestion as all the current data central to particle pair production does not confirm such.

Fundamentally, the $e+$ and $e-$ formation cannot be explained as a decoupling *properly* as a footprint in time without first acknowledging that the "decoupling" would be a "process" of "time" that must overcome the EM attraction between $e+$ and $e-$ in the first place, hence the suggestion by Temporal Mechanics being that their ($e+/e-$) existence/coagulation is by virtue of them being *separated* in *the first instance* of their genesis as a condition of their manifestation (given that the energy otherwise required for a decoupling force to take effect in overcoming their ($e+/e-$) EM attraction is *not* a notable feature of the known data for particle pair production).

Simply, the proposal here is that the $e+$ and $e-$ particles are *separated* when they formed in that *they form separate to each other **in their genesis***. The question is, "*what is the underlying process*

that explains this "separation" in their formation?". Such should be the most fundamental question of physics theory, as it approaches the idea of particle creation as a temporal event in different areas of space as though at the one time and presumably by the one process.

In the case of particle pair production, what needs to be established is:

- *why* positrons and electrons form with particle pair production,
- *why* their exact masses and charges are what they are,
- *why* the instance of CP violation exists,
- *and thus why* $e+$ and $e-$ exist separately through the same process of genesis.

Temporal Mechanics has accommodated for all such issues (as shall be outlined in section 12). Conversely*, spacetime* physics in being inertia-momentum based does not know the *why* of particle pair production other than through its reactive inertia-momentum lens of particle collision experiments, as *spacetime* theory does not theorize the existence of particles, nor theorize their mass, nor theorize their charges, nor theorize CP violations, yet merely tries to correctly label the phenomena it has come across through observations of physical phenomena with light and more recently particle collisions.

For particle formation, Temporal Mechanics proposes that to locate if not derive something is to locate its footprint *in time*; such is converse to the notion of inertia which technically has no reference, as inertia is a *hypothetical* force of *resistance*, a *reaction*. Temporal Mechanics on the other hand considers that *time* is required to have an *active* reference as ***the*** reference of locating an object in space. In short, Temporal Mechanics proposes that to properly model light is to *move away from the inertial particle locale analogue of the electron* and consider what light is as a wave function, purely from the basis of how time could operate with space as a process of information transfer at c, constant for all frames of reference, where at c time does not pass.

Fundamentally, Temporal Mechanics considers that if a wave function can be derived for EM, namely a wave function that explains the electric and magnetic features of EM, one that can derive c and its constancy for all frames of reference, and then incorporate time not passing at c for that wave function, while then deriving the fine structure constant (α) for the atomic locale for that wave function, and then the Planck scale, then the charges and masses of the subatomic and elementary particles, all from a basic set of new axioms for time relating to space, such can rightly considered to be more precise than presuming what light could be as an analogue of the charged non-zero mass motioning electron as an inertial event (reactive time, *anti-time*).

6. The EM Quasiparticle and Phonon

In taking figures 8a-8b of paper 2 ([2]: p9, fig8a-8b) therefore, let us look at the proposal of particle pair production as a process of destructive interference resonance (EM^{DIR}) as a scalar and vector representation of the time-equation when applied to Pythagorean space, the basics of which (temporal wave function) are as derived in paper 2 ([2]: p3-7).

Consider figures 3a-3b as the next step of paper-2's figures 8a and 8b, here showing the overall run of time locating the quasiparticle references of A and B.

Figure 3a

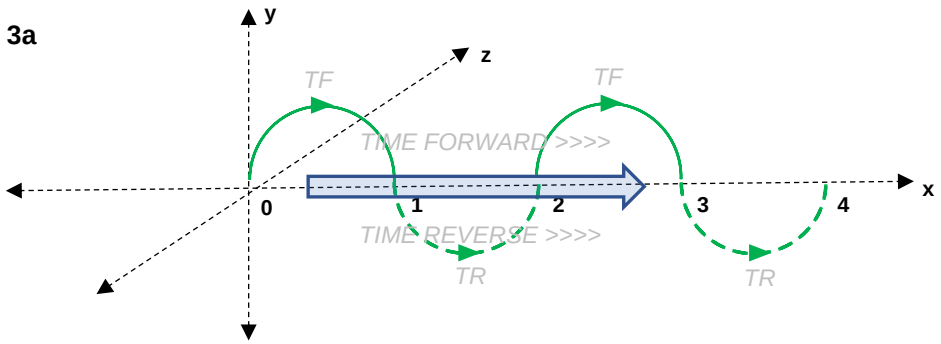
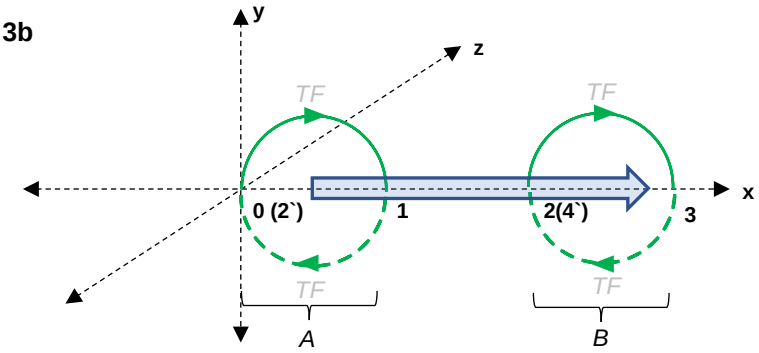


Figure 3b



Figures 3a-3b: the two quasiparticles A and B of the temporal wave function in this temporal description along the x-axis with the blue-arrow showing the general direction of movement of the temporal wave function (TF=time forward, TR=time reverse), leading to a type of quasiparticle hopping effect in the direction of the blue-arrow.

Once again to note here is that **only *time-forward (TF)* *is* *allowed***, that *time-reverse* (*TR*), as *anti-time*, ***is not allowed***, considered a violation of time and space; to resolve the time-reverse violation, to uphold the arrow of time, time-reverse must be flipped in the temporal wave function to make it time-forward as highlighted in figure 3b compared to figure 3a. In doing such, when the time-forward $+ve$ y-axis and $-ve$ y-axis combine, they form $time = 0$, which technically is what Einstein's relativity understands for time at c, a "virtual" effect of light. Here Temporal Mechanics considers this time-loop construct of the temporal wave function as a "***quasiparticle***", proposed by Temporal Mechanics to be the particle nature of light, how light is given a type of "virtual" particle effect, a "***quasiparticle***" effect. Here in this temporal frame of consideration (time-0>time-4) it is proposed there are the two quasiparticles of A and B.

Contemporary inertial physics understands a ***quasiparticle*** as an emergent phenomenon that occurs when a microscopically complicated system such as a solid behaves as if it contained different weakly interacting particles in vacuum. Those weakly interacting particles, as Temporal Mechanics

considers, are the EM quasiparticles, the EM field, the longitudinal temporal wave features of the basic temporal wave function, made more pronounced in a sold crystalline network of atoms.

Here, the temporal wave function (EM) ***quasiparticle*** (say, an EMQ) can accommodate for both the particle nature of light and how that relates with actual particles themselves, as shall be shown ahead. This also is a type of longitudinal *Kangaroo hop* wave function, much like how sound travels through air (air molecules). As such, one would consider that light would have a type of *longitudinal wave effect*. Does it? Indeed, it does, namely as a "*phonon*". What is a "phonon"? A phonon is considered by quantum mechanics as EM quantized sound waves, similar to *photons as quantized light waves*. Here the principle is no different, yet here though as a longitudinal temporal wave mechanism, considered to be the primary mechanism in play, a primary mechanism of itself as a quasiparticle and a resultant excitation in a periodic elastic arrangement of atoms (or molecules) in condensed matter.

This run of time, this Kangaroo hop longitudinal wave, was derived in paper 37, page 14 ([37]: p14):

> *The issue here with this temporal wave function proposal is that the temporal wave function as presented in figures 8a-8b of paper 2 ([**Error! Reference source not found.**]: p8, fig8a-8b) are technically static waves in that they could move in either a time-forward direction or a time-reverse direction. Such is the key problem of quantum mechanics also, namely not delivering a reason for the run of quantum mechanical systems along the line of thermodynamical temporal runs.*
>
> *Yet, the reason why it is considered that the run of the time equation as equation $t_B + 1 = t_A$ $where$ $t_A = t_B^2$ is a time-before>time-after event owes itself to the non-local time-before time-point realm and its association with the time-equation in that $t_A = t_B^2$, and thus there is an enhancement of the t_B microstate from t_B to t_B^2, if indeed a time-before (t_B) time-point can be considered as a theoretic microstate. To demonstrate this, and how the time-equation is related to the idea of entropy, a description of entropy is now in order.*

To note, there are 6 key ideas (scalar and vector) to be aware of with figures 3a-3b:

- naming of the axes:
  - y (+) as time forward (TF) for the electric feature/polarization of the temporal wave function.
  - y (-) as time reverse (TR) for the electric feature/polarization of the temporal wave function.
  - x (+) as the considered spatial direction of the temporal wave function progression.
  - x (-) not considered here in this frame of reference discussion.
  - z (+ and -) not considered here, although would be the magnetic feature/polarization of the temporal wave function, as derived in paper 2 ([2]: p10-14).

- temporal direction:
  - the two components of temporal direction for the y-axis (as above).
  - the overall temporal direction (blue-arrow).

- temporal polarization:
    - y-axis (+ and -).

- spatial direction:
    - x-axis (+).

- spatial polarization:
    - electric polarization transverse wave as the *primary* feature.

- resultant temporal wave function particle locale (photon):
    - the reversed x-axis temporal features of time-2` and time-4` from time-2 and time-4 respectively.
    - quasiparticles A and B.

In all, this results in a type of *Kangaroo hop* longitudinal wave progression of the basic transverse temporal wave function from A to B, and so on and so forth. Yet there is a clear stand-out feature here of this *Kangaroo hop* ***quasiparticle*** temporal wave function, namely its universal reference in space as a wave function. In other words, if there is an ultimate "0" reference for space, given space is being defined as a pure vacuum, a veritable nothing, only though given dimensions by the application of the time-equation to the idea of Pythagorean space, as constructed in paper 2 ([2]: p3-7), and if at $c\ time = 0$, as derived in paper 2 ([2]: p16, eq10), and re-demonstrated here, and $time = space$, as derived in paper 36 ([36]: p22-29), when therefore time exists as "0" with space *then a specific condition must applied* namely *a universal timespace reference* such that c is always conserved *despite the relative motion of objects in space*.

Basically, *the relative motion of objects* ***is inconsequential to the speed of light***, simply because at $c\ time = 0$ anyway, and motion though of an object infers time, yet at $c\ time = 0$.

Thus, the question of, "how is the universal *timespace* (or even Einstein's spacetime) reference measured, namely is there a collective flow of reality, a type of aether wind in play perhaps?" The Temporal Mechanics proposal there is that everything becomes calibrated, all motion calibrated, to the feature of $time = 0$ at c, and thus *there is no particle aether or aether wind*.

7. EM^{DIR} particle pair production

The next question to ask is, "*what happens when the temporal wave function reflects at a wall, say wall "W"?*". Indeed, how can the temporal wave function reflect, what type of wall enables the temporal wave function to reflect, and what exactly reflects a temporal wave function?

The reflection of a non-linear time *temporal wave function* has a number of things going on not according to a standard linear-time temporal wave function, and all of these features need to be investigated.

Firstly, *what can make a temporal wave function* ***reflect***?

If it can be assumed that the Temporal Mechanics temporal wave function is an EM wave function (the evidence for which has been provided throughout paper 2 [2] with those analogous EM definitions, explained in temporal terms), then it would be logical to consider that the reflection of this wave function would abide by the same conditions as a standard reflection for a wave function, the same ideas of transverse polarization reflection protocols, as the mathematics of the wave function would hold, here more especially though in considering how the temporal wave function must reflect as a spatial direction in time, which needs particular note, namely how the temporal wave function would reflect as an x-axis in regard to the y-axis, both as scalar and vector principles of play.

Consider therefore figures 4a and 4b now facing wall W:

Figure 4a

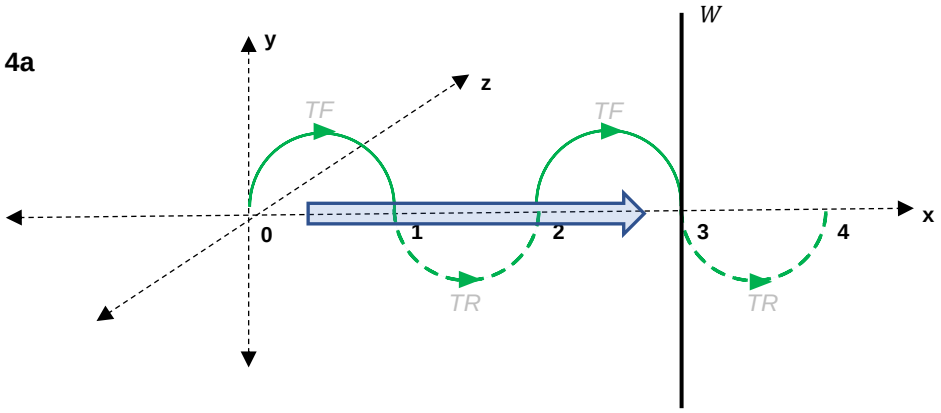
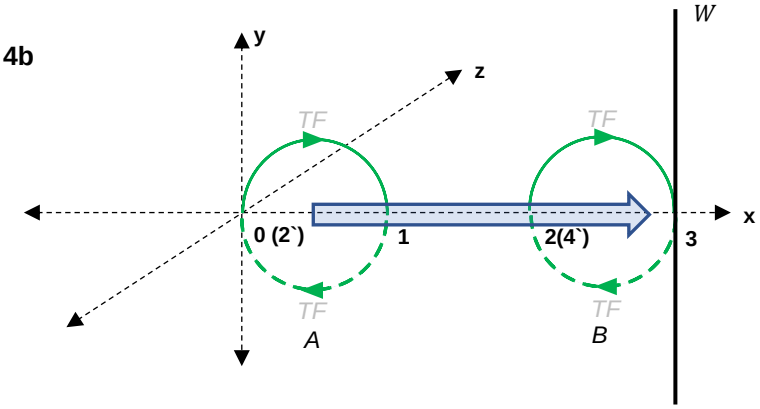


Figure 4b



Figures 4a-4b: the x-axis transverse temporal wave function from time-0 to time-4 in noting it is necessary to repair time-reverse with a time-forward aspect.

As a sidenote, consider in the above diagram how there is a portion of the wave function that naturally tunnels ahead, as the region beyond W from time-3 to time-4 on the x-axis. It would be logical to consider that if the reflective wall is *less* in value from the spatial distance of time-3 to time-4 (of the x-axis) in figure 4a then there would be in effect a type of *tunnelling* of light, of the temporal wave function

in play owing to the Kangaroo hop feature of light. Physics knows this as "*quantum tunnelling*", namely the quantum mechanical phenomenon where a quantum wave function can propagate through a potential barrier. This was explained in paper 2 along with the other associated features of this model for light, specifically "particle uncertainty" and "quantum entanglement" ([2]: p20-21). Here Temporal Mechanics explains how that quantum tunnelling can happen in explaining the nature of the temporal wave function itself, in *deriving* such a phenomenon.

Thus, for the purpose of mandating a reflection for the temporal wave function, presumably for instance in an EM resonance chamber, let us assume that quantum tunnelling is not in effect here at wall W, namely that wall W is greater than ½ the wavelength of the temporal wave function.

Now consider the proposed reflection from wall W as a new y-axis yet the spatial direction now heading in a -ve x-axis direction, as *time-forward* nonetheless, and thus considering that the y-axis has also reflected with its functionality with time, namely that the $-ve$ region of the y-axis is now time-forward (TF) and the $+ve$ region is time-reverse (TR), as figures 5a-5b:

Figure 5a

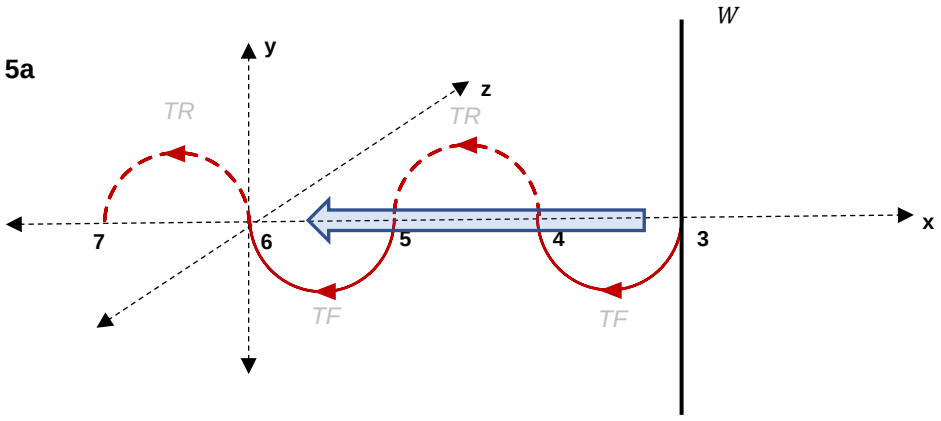
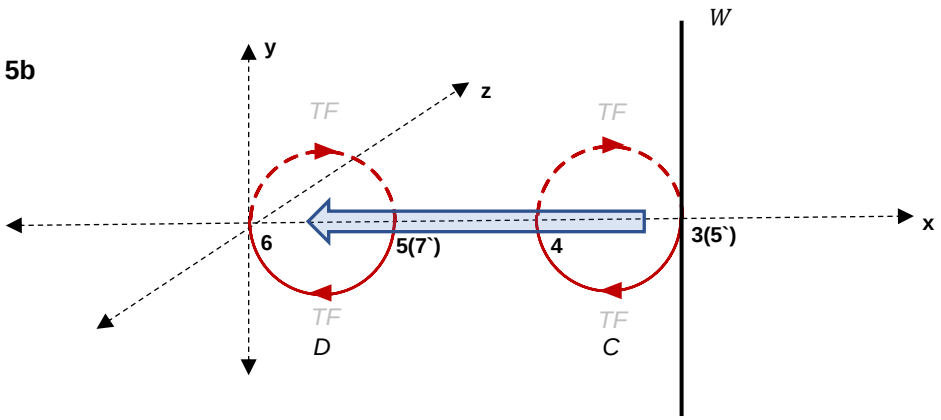


Figure 5b



Figures 5a-5b: the x-axis transverse temporal wave function from time-3 to time-7 in noting it is once again necessary to repair time-reverse with a time-forward aspect.

Therefore, to note are the new conditions for this reflection:

- naming of the axes:

  - y (+) as time forward (TF) for the electric feature/polarization of the temporal wave function.
  - y (-) as time reverse (TR) for the electric feature/polarization of the temporal wave function.
  - x (+) as the considered spatial direction of the temporal wave function progression.
  - x (-) not considered here in this frame of reference discussion.
  - z (+ and -) not considered here, although would be the magnetic feature/polarization of the temporal wave function.

- temporal direction:
  - the two components of temporal direction for the y-axis (as above).
  - the overall temporal direction as the blue-arrow.

- temporal polarization:
  - y-axis (+ and -).

- spatial direction:
  - x-axis (+).

- spatial polarization:
  - *electric* (not magnetic) polarization transverse wave as the *primary* feature.

- resultant temporal wave function particle locale (photon):
  - the reversed x-axis temporal features of time-5` and time-7` from time-5 and time-7 respectively.
  - quasiparticles C and D.

What therefore happens to the scalar and vector components of the temporal wave function when we combine both the temporal wave functions, of the x-axis *forward* temporal wave function (figures 4a-4b, quasiparticles A and B) with the x-axis *reflected* temporal wave function (figures 5a-5b, quasiparticles C and D)? Consider figures 6a-6b:

Figure 6a

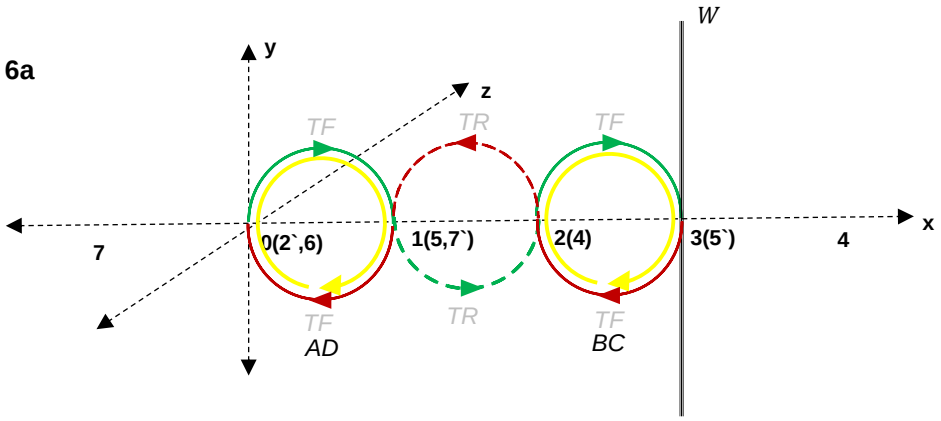
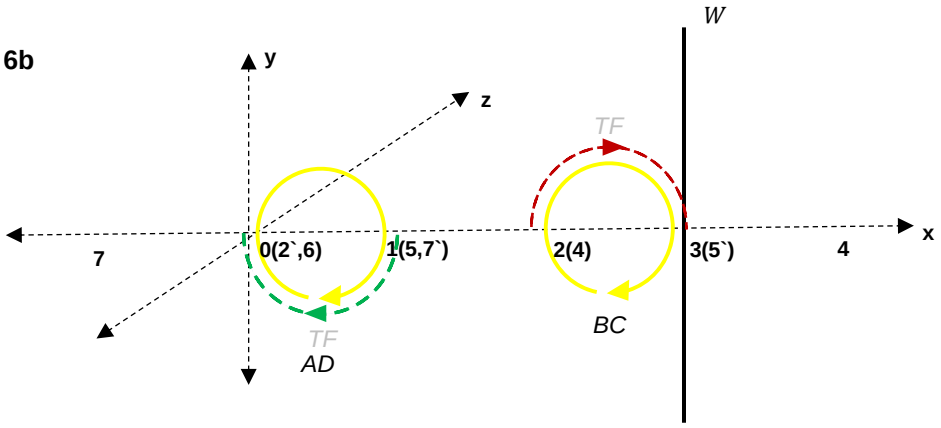


Figure 6b



Figures 6a-6b: Note here how the green and red full-line (not dotted) temporal wave function steps are combined as a *full-particle* (yellow) and no longer *quasi-particle*, time-loops D and E.

The result of this EM^{DIR} effect is that there would be four key features:

- time circles/loops as mass, as the primary EM^{DIR} phenomenon:
    - the green and red full-line (*both not dotted*) temporal wave function steps are combined as a *full-particle* (yellow) and no longer *quasiparticle*, as the particle-EM^{DIR} zones of AD and BC.

- *the same spin* of the AD and BC particle-EM^{DIR} zones:
    - this spin is considered to be a feature of the particles in their manifestation.
    - it is known that positrons and electrons have the same particle spin.

- There is time-forward motion *away* of these AD and BC particles from one another:
    - There is temporal motion of the EM^{DIR} zones away from each other as non-zero mass motion (AD moving away from BC according to their respective y-axis arrow markers of spin).

- AD and BC particle-EM^{DIR} zones have a different temporal *polarity*
    - AD has a -ve y-axis polarity
    - BC has a $+ve$ y-axis polarity
    - This difference in temporal polarity is proposed to be the different *charges* of particles AD and BC.

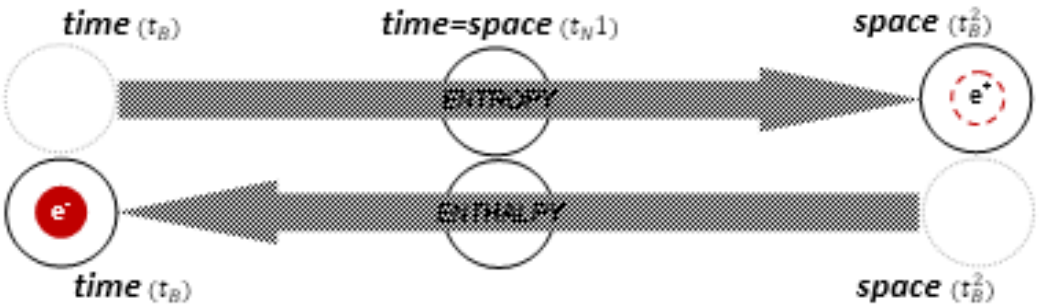
Temporal Mechanics has already derived the mass of the electron and positron in paper 36 ([36]: p14-18), and so the question here is, "how does this system of the EM^{DIR} phenomenon foretell *where* the electron and positron are formed, in which AD and BC particle-EM^{DIR} zone?". The answer here is that there is no actual foretelling, that at play here is a fundamental concept of "*symmetry breaking*", of uncertainty, as shall be now explained.

8. Symmetry breaking

Note in paper 37 the idea of *positron formation being entropic* and *electron formation being enthalpic*, pages 17-18 ([37]: p17-18, fig2):

> *Simply, the proposal is that particle pair production is an entropic-enthalpic event that leads to two key particle results, standard particle formation as being enthalpic (the resultant mass) and antiparticle formation being entropic (and thus proposed to be absorbed by the time-equation process given the time-equation is primarily entropic as the run of time); such is as though the antiparticles themselves (and their entropic status) are proposed to fuel the process of the time-equation in their being absorbed by the time-equation process, the process of entropy and thus gravity itself, fuelling the so-called force of the time-equation and thus entropy itself. Consider figure 2:*

Paper 37, Figure 2



Paper 37, Figure 2: a basic portrayal of time's *arrows* as the entropic and enthalpic processes of antimatter and matter formation respectively in the process of particle pair production.

Here, the description is central to entropy being a process of antimatter (e^+) formation, and enthalpy being a process of matter (e^-) formation. Note that electron formation (e^-) is the fundamental basis for a t_B result ([23]: p13-14).

The key implication here with this proposal is that matter (e^-) would be favoured over antimatter (e^+) as a resultant particle datum reference, simply because the process of entropy represents a t_A result with an increasing microstate load (t_B^2). Such a process is proposed to resolve CP violations, namely that in the process of particle pair production (as a general entropy-enthalpy event in a steady-state reality) "matter" is preferred over antimatter ([25]: p48-49, fig15).

Note that the above figure (paper 37, figure 2) is not a description of time or anti-time, as anti-time is considered by Temporal Mechanics to be forbidden; the above figure is representative of the two types of energy *transference*, entropy and enthalpy, regarding positron and electron genesis respectively.

The following references for the idea of symmetry breaking in Temporal Mechanics are worthy of consideration in being consistent with the proposal here: ([1]: p4, eq3), ([25]: p47-49), ([27]: p3-6), ([30]: p19-21), and ([35]: p10-13).

In particular reference to figure 6a therefore, it would be logical to consider that two possible outcomes exist for the process of particle pair production, as per figure 7.

Figure 7

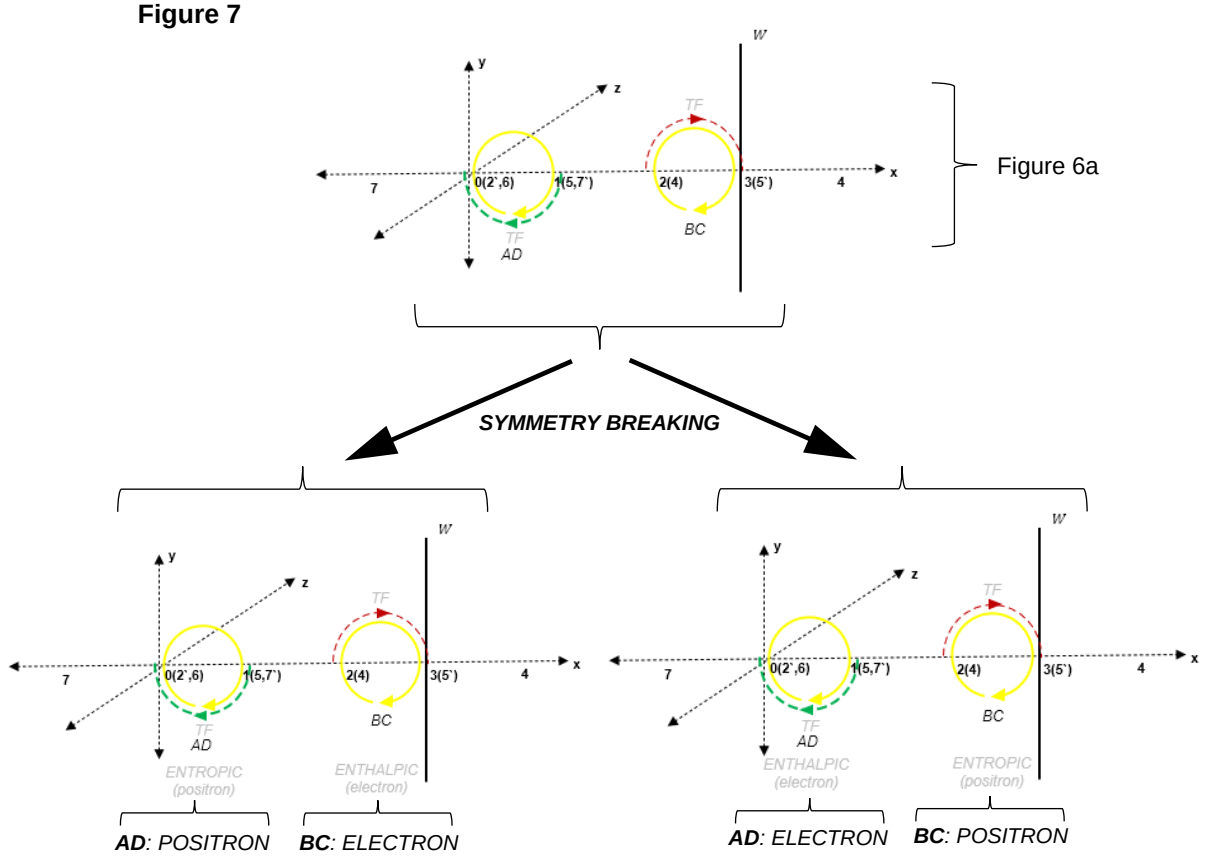


Figure 7: an expression of "symmetry breaking" in the context of particle pair production in labelling positron and electron formation each with either entropy or enthalpy.

The idea of symmetry breaking is thus proposed to be:

- the potential outcome of an electron being either AD or BC.
- the potential outcome of the positron being either AD or BC.
- the only outcome of an electron and positron being of differing AD and BC conditions to each other.
- *conservation of energy* given the entropic and enthalpic features of the positron and electron respectively.
- the symmetry of an underlying timespace system being broken.

In all, the theoretic result here for the EM^{DIR} effect matches known principles of symmetry breaking.

9. Atomic and particle metrics/scales; the electron-quantum unit (EQU)

The next step to ask is how this would lead to the construction of the *atomic locale*. The atomic locale construction has been provided in the following papers, noting the imperative *primary* feature of the electron and associated electron shell structure:

- Paper 2 ([2]: p3-23):
  - the temporal wave function atomic locale
- Paper 5 ([5]: p2-9):
  - the entropy-enthalpy atomic locale manifolds
- Paper 23 ([23]: p12-20):
  - the time-equation and the atomic particles (the time-space template, TST)
- Paper 24 ([24]: p20):
  - the atomic locale as an *energy* TST
- Paper 25([25]: p40-52):
  - the elementary particle subsets of the TST subatomic particles
- Paper 27 ([27]: p9-12):
  - particle formation and confinement in the TST (atomic barrier enhancement, ABE)
- Paper 30 ([30]: p15-22):
  - the magnetic quantum shell (electron shell, MQS)
  - nuclear shell geometry
- Paper 35 ([35]: p27-28):
  - Planck length deriving the neutrino-antineutrino pair mass
- Paper 36 ([36]: p15-19, p27-28):

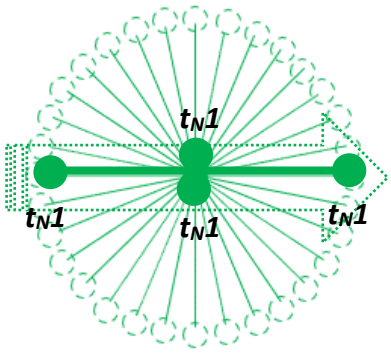
- Planck length deriving the electron-positron pair mass
- derivation of Planck length

The issue to note is the atomic locale, and *where* along the temporal wave function destructive interference resonance *quasiparticle-pairing train* the particles are *formed*.

The developed idea presented by Temporal Mechanics via the temporal wave function modelling with the atomic locale (with the time-equation in mind for the manifestation of the subatomic particles) was that the basic subatomic particles would manifest in regions of *greatest/optimal* EM^{DIR} resonance, namely at the *reflection* (perimeter) points (for $e-$) and in the *centre* of the DIR field (for $p+$ and n), to give the basic overall particle manifestation feature, as per paper 23, pages 18-19 ([23]: p18-19), as follows:

> *Five key principles have thus far become apparent with this proposed time-space dimensional mechanics:*
>
> - *TSU (time-space uncertainty) principle:*
> - *The idea of the time-points forming an uncertain cloud with a central certain time-point structure ([20]: p11-13)*
> - *TSC (time-space context)*
> - *The use of a relative time-space frame of reference ([21]: p16-17))*
> - *TSG (time-space groove)*
> - *The idea of the time-space connection, as a conceptual time-space ring, as an underlying association between time and space ([21]: p20-22)*
> - *TSS (time-space spin)*
> - *A proposed feature between time and space as per the TSG using multiple TSC's to provide the idea of a relative motion in time-space for time-points.*
> - *TSF (time space field)*
> - *The general tapestry of TSS time-points in an overall TSG context.*
>
> *Now the proposal is to take the TSG as the ultimate context and then bring the TSF to accord with the initially proposed basic temporal linear function, as presented in paper 20 ([20]: p11-12), to bring into effect the idea of linear axes for space with time, and therefore allow standard Euclidean topography to take shape. The idea here is to take the standard triple (or more correctly, quadruple) time-point t_N1 time-algorithm as presented in paper 20 ([20]: p11-13, fig1-7), here as figure 7 presented in the previous section as figure 3, with the added TSU backdrop.*

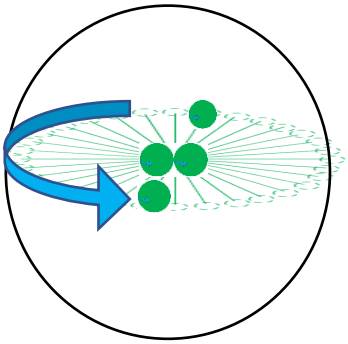
Paper 23, Figure 7



Paper 23, Figure 7: the overall arrow for time using the four basic t_N1 points on the TSU-TSG backdrop.

The idea of the straight line effected through the central t_N1-t_N1 region is as though taking two TSS time-points to form the basis of a mathematical "time-line". Note that in this case there are two $t_N1$points in the centre and two other t_N1 points diametrically opposed which could exist anywhere on the sphere according to the TSU principle. The result this would have would be the as per figure 8, namely "four" "now" zones of time. The implication then is that each of these points would have an inherent "spin" by virtue of the more fundamental TSS principle which is now relayed to this new conceptual level of thought for time and space, as per figure 8.

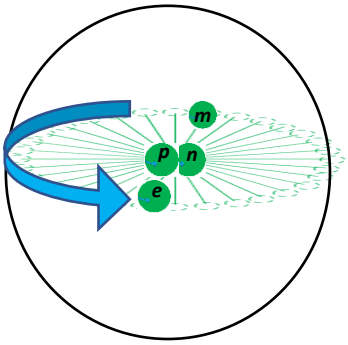
Paper 23, Figure 8



Paper 23, Figure 8: The time-points depicted on the TSG flat-plat each with their own spin.

Here is developed the basic atomic template, the time-space template (TST). The issue is to now give these points unique features. The proposal is that there is a magnetic time-point (m), an electron time-point (e), a proton time-point (p), and a neutron time-point (n), as per figure 9.

Paper 23, Figure 9



Paper 23, Figure 9: The time-points depicted on the TSG flat-plat each with their own quality as electron (e), proton (p), neutron (n), and magnetic (m) time-points.

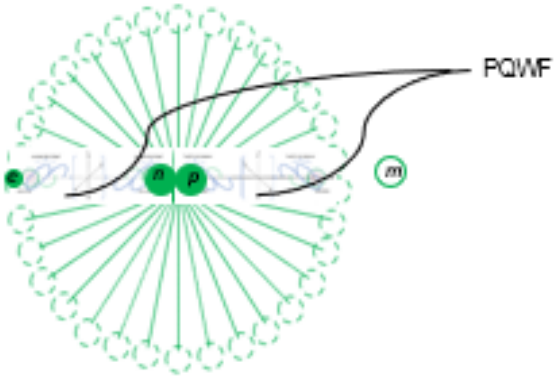
There are though two questions to be addressed here:

- What are the proposed *scales* of the electron and proton (namely, proton and electron particle radius)?
- How is the electron associated to a "quantum" electron shell structure (MQS) system, namely how can such be derived from the time-equation and associated temporal wave function?

First it is necessary to present the atomic locale regarding the *atomic* temporal wave function. This was presented paper 23, pages 24-25:

The EM signature has been the primary structure explained in the papers, first developed as the phi-quantum wave-function (PQWF) in paper 2 ([2]: p4-12). Applying that to the idea of the time-space template (TST) is as follows, as per paper 20 ([20]: p13, fig7), re-adapted with the TST as figure 10.

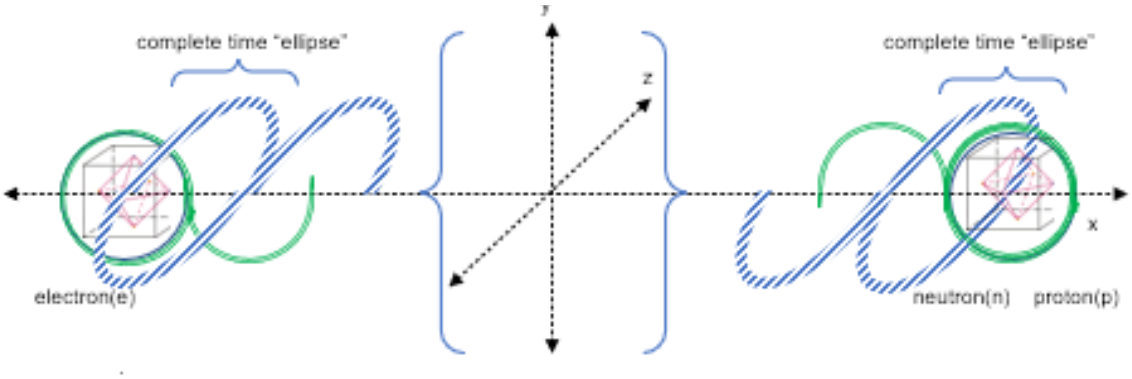
Paper 23, Figure 10



Paper 23, Figure 10: The PQWF being adapted to the TSU-TSG-TST scheme, noting the basic particles "e" "p' "n" and "m", "m" the only t_N1 point not being a particle.

Now, as a field interaction in its most basic sense, it needs to be applied to the TSS construct. The proposal is that the wave would be conceived most basically (as such is all that can be proposed, namely conceiving the structure of the wave-function) in accordance with two axes (y, z) travelling along a third (x), of course in any direction, spherically from a point particle reference nonetheless at "c", This was presented in paper 4 ([4]: p13, fig14), here as figure 11.

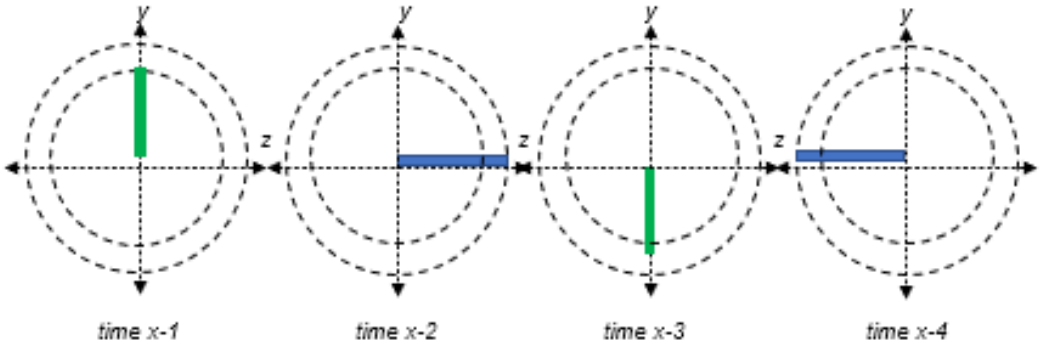
Paper 23, Figure 11



Paper 23, Figure 11: Note here wave-function for the electrical component (green) and magnetic component (blue), yet primarily note the axes being used, "x" being used for the progression of the wave-function.

Here, this can be represented as per figure 12 according to 4 time steps (x-axis; time x-1 to x-4) showing the development of that wave-function as though sinusoidal in accordance with the outlying TSG function, view looking into the page as though along/into the x axis of the previous figure (figure 11).

Paper 23, Figure 12



Paper 23, Figure 12: symbolic representation of the wave-function temporal steps along the x-axis, the green symbolic of the electrical function, blue symbolic of the magnetic function, through the x-axis time-steps of x-1 to x-4.

Once again, this would propagate through the TSF as a spherical wavefront, which is a little difficult to draw as this EM-TSS field, so left with an explanation here. Simply though, the wave function along the x-axis could be neatly described as a compound representation in time as per figure 13.

Paper 23, Figure 13

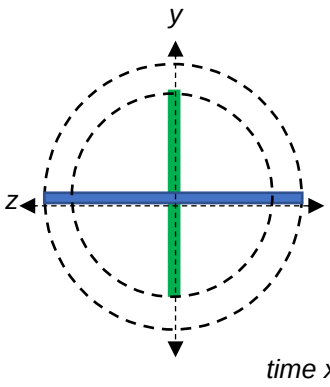


Figure 13: symbolic representation of the EM wave-function (PQWF) for time x-1 through to time x-4.

Therefore, let us consider the following diagram as a type of focus of reference for how we are to now determine the metric spatial scale of the electron and proton. Consider figure 8 as a basic pictorial description of the hydrogen atom:

Figure 8

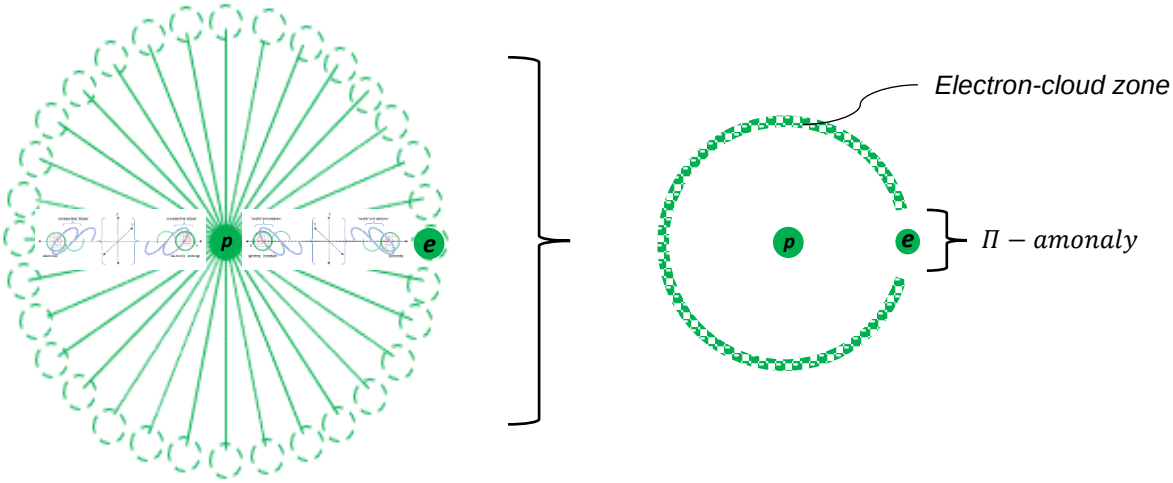


Figure 8: The time-space template of paper 23 ([23]: fig10) being simplified to examine the nature of the atomic circumferential π-anomaly.

From the very start of the theoretic development of Temporal Mechanics, there was encountered the "π-anomaly", namely *that the temporal wave function seeks to define* π ***in needing to prescribe a spherical wave front in space***, however the constraints of the time-equation govern that the derived temporal wave function can only go ever so close to π. This was considered as the π-anomaly, and such an anomaly has defined the atomic locale through using the best approximation for π that the time-equation and associated temporal wave function in the atom, as the structure of the atom, as presented

in paper 2, ([2]: p5-14), ***could allow***, namely the use of π via annexing the *magnetic* feature of the temporal wave function ([2], p12, eq6) to arrive at the value for the fine structure constant ([2]: p15, eq9).

The primary equations responsible for this atomic radius temporal wave function proposed in paper 2 ([2]: p12-13, eq5-6) are as follows:

> *So, how do we perfect the wavefront value of π as a t_A result for $\frac{-1}{\varphi}$ as t_B^2, given $t_A = t_B^2$ is a condition for applying time to space as a perfect circle?*
>
> *If we consider that $t_A = t_B^2$ (in ignoring the value of π as t_A for the moment) we get the following results for the golden ratio equation:*

$$(\frac{-1}{\varphi} \cdot -2\sqrt{3})^2 = 4.583533 \quad (5)$$

$$(\varphi \cdot -2\sqrt{3})^2 = 31.416253 \quad (6)$$

> *Note the squared value for $\frac{-1}{\varphi}$ (electric component, equation 5) is roughly the negative of the value of time for φ (magnetic component, equation 4), suggesting an embedded "negative" connection between the electric and magnetic components of the wave function in this networked time-looping structure; basically, when the electric component ($\frac{-1}{\varphi}$) is used as t_B^2, then the result should be roughly a value of 4.6 as what the magnetic component per equation 4 proposes except with equation 5 as a positive value. The thinking here is that such is an underlying basis feature of the interlaced temporal sinusoidal wave going from a positive curve to a negative curve divining the concept of EM induction, to be discussed further in a subsequent paper.*
>
> *To be noted more importantly though is the squared value for φ (31.416253) for equation 6, namely a close value for 10π in considering equation 3, the electric component step, closer than the initial equation 3 process for $\pi's$ formulation.*
>
> *We can propose therefore that the value for φ in the context of equation 6 offers a closer value for π as the idea of a recalibrated "10" π electric component step process of equation 3, and thus what would appear to be the almost exact value for π, as the more correct scale to be put in play, as a type of compromise given the electric and magnetic components are intricately linked as the golden ratio anyway.*

It was then proposed that it is the idea of "mass" that seeks to rectify the π-anomaly, and this was expressed in paper 4 ([4]: p3-11) with the idea of how a destructive interference of the atomic *radius-based temporal wave function* would lead to mass/particle formation in a "*crystal geometrical spatial*" format, considered as *"phi-quantum wave-function crystal dynamics*", which was an initial proposal for the formation of particle mass *from a destructive interference resonance of the atomic radius temporal wave function*. Such was a proposed *spatial arrangement of the particles*, as a hypothesis. What was developed there though at that stage of theoretic development was the *mass-effect*, and *the relevance of the incremental error to mass formation*. Such a process of examination was executed by:

- taking the temporal wave function scale between the proton/neutron and the electron (19.8 wave function steps), as a radius value of temporal wave function units,

- taking the value of the π-anomaly ($3.27 \cdot 10^{-5}$),
- and then factoring those two values then with a new π factor translating to the circumference of the atomic circle with a greater circumference factor of $\frac{21.8}{22}$ (overall atomic compression factor).

To note is that *the backdrop atomic locale* being employed there was not the "hydrogen atom (1p,1e), yet a standard time-equation Temporal Mechanics *Deuterium* atom (1p,1n,1e). The issue was then to find the scaling error for the average proton-neutron value as per the calculation of Avogadro's number based on this principle, as per the following ([4]: p11-13):

1. Atomic Phi-Quantum Wave-Function Error Gradient

One overlooked feature of the time-equation and associated wave-function is the condition of time to define/trace π and the associated error there on the atomic level, overlooked in that it would more than likely point to a type of phenomena known in the form of observed data, observed data not accustomed to a potential time-equation atomic error-gradient explanation. So, let us look at this.

The error on the phi-quantum wave-function level is of the order of the actual value of π (3.1415926) subtracted from the atomic value of π (3.1416253) as per equation (3):

$$3.1416253 - 3.1415926 = 3.27 \cdot 10^{-5} \quad (3)$$

That is the value per unit increment of π on the phi-quantum wave-function level. If we then factor this in with the 19.8 length between the proton/neutron and electron on the elementary particle scale level (not the "extra-atomic (21.8) quantised level, as we are considering the idea of "mass" scaling error here), we get the following:

$$3.27 \cdot 10^{-5} \cdot 19.8 = 6.475 \cdot 10^{-4} \quad (4)$$

This value is the overall atomic-scaled error. If we consider that "mass" (proton and neutron) is the feature of the atom that accounts for this error, and according to the paper here "mass" represents a complete "π" circle, then we must now factor in a value of "π" as follows, in assuming that this $6.475 \cdot 10^{-4}$ *value can be translated into the value of a diameter of a circle to account for a complete circle. Note also the overall atomic compression factor of* $\frac{21.8}{22}$ *would need to be accounted for. Thus the following would apply*

$$6.475 \cdot 10^{-4} \cdot \pi \cdot \frac{21.8}{22} = 2.016 \cdot 10^{-3} \quad (5)$$

Thus, for the proton and neutron we have a scaling error factor of $2.016 \cdot 10^{-3}$.

Simply, all the increments of error in the phi-quantum wave-function would be brought together as a circle.

What does this mean?

As this is a value for the proton and neutron and electron, the percentage value of scaling error based on mass for the neutron (given the neutron is slightly heavier than the proton) would be the order of $1.0087 \cdot 10^{-3}$*, namely in calibrating for the percentage mass of the neutron.*

This would be the $\pi\ error\ gradient.$

If we now considered this error gradient regarding mass ***per*** *each actual calculated value for mass, say the mass of a neutron, we get the following:*

$$\frac{\pi\ error\ gradient}{mass\ of\ neutron} = \frac{1.0087 \cdot 10^{-3}.}{1.675 \cdot 10^{-27}} = 6.022 \cdot 10^{23} \qquad (6)$$

This value represents that for every gram (g) regarding the neutron, for 1g of a neutron, there exists an error gradient value of approximately $6.022 \cdot 10^{23}$*. We could say the following:*

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

In other words, $6.022 \cdot 10^{23}$ *neutrons with a factored phi-quantum wave-function error gradient would result in the value of 1g.*

This number is demonstrable of Avogadro's number N_A *[16] which holds a value of* $6.022 \cdot 10^{23}$*.*

Thus, the following equation involving an overall phi-quantum wave-function compression factor and Avogadro's number N_A *could be considered:*

$$\frac{N_A \cdot mass\ of\ neutron}{\pi\ error\ gradient} = 1\ unit\ of\ mass \qquad (8)$$

Note that the phi-quantum wave-function (π*) error gradient is a measure of length. Thus, this value states that there would be a standard for the organisation of mass such that a uniform increase in length would exist for the number of associated atoms for any given value of background pressure (heat, pressure, etc.).*

For simplicity, the following would be true:

$$\pi\ error\ gradient = 6.022 \cdot 10^{23} \cdot mass\ of\ neutron \qquad (9)$$

In other words, $6.022 \cdot 10^{23}$ *neutrons with a factored* ***total*** *phi-quantum wave-function error gradient would result in the value of 1g.*

What was being performed there was a *particular type* albeit *provisional* process of mathematical analysis in gauging the π-anomaly *with the idea of mass*, there in using the *Bohr radius* of a Temporal Mechanics atom (1p,1n,1e) with the overall atomic scale compression factor of $\frac{21.8}{22}$ as derived in paper 2 ([2]: p15-16). The reason the Bohr radius is being used as such in this process is owing to the proposal

of mass being a "folding" (EM^{DIR}) of an atomic-based temporal wave function in the context of the proposed temporal wave function compression scale of $\frac{21.8}{22}$, and thus if the atom *as a temporal wave function* represented a *diameter*, then its mass would ultimately be a *halving* of that diameter (as a folding) which when applied to π gives the circumference-factor of the π-anomaly, thus making the value of the *radius* the central focus in this mathematical process.

In short, by that above process it was proposed that the π-anomaly *in association with mass* would result in the Avogadro number feature, which itself as per paper 14 [14] became related to the proposed/derived black body radiation qualities of the atom (to be discussed shortly). What wasn't discussed in paper 4 [4] was the feature of the π-anomaly *associated to the spatial metrics of the electron*.

The clear thing to note with this derivation of Avogadro's number is that the value of the π-anomaly as referenced above ([4]: p11-13, eq3) *is imprecise on two fronts*. The first problem there is using the value of 1.61803 for φ instead of the more correct 1.618034. The second problem is the type of golden-ratio wave function variable being used to explain the π-anomaly value, namely the *magnetic* π-analogue value for π from equation 6 paper 2 ([2]: p12, eq6) as 3.1416253 (also imprecise in not using the more precise value of 1.618034 in its formulation), and not the basic electric value with the more precise value of φ which equates to 3.14093258 (as per equation 1 ahead).

As it so happens, these two problems related to each other cancel each other out through the mathematical process of making the electron charge the focus of the π-anomaly and not mass the focus of the π-anomaly, still upholding therefore the calculated value for Avogadro's number from equation 4 (paper 4) onwards, and thence the derivation of the $CMBR$ (as shall be discussed further ahead).

Thus, here the same value for Avogadro's number N_A shall be derived with this new electron-based process for the π-anomaly, essentially repairing the basis of equation 3 (of paper 4) yet upholding equation 4 (of paper 4) and beyond.

What needs to be achieved now though is a new appraisal and analysis of the π-anomaly using the diameter of a basic Bohr atom (1p,1e) to arrive at the spatial "scale" of the proton and electron masses, *namely their spatial sizes*, by considering *primarily* the phenomenal feature of the *electron*.

Thus, in repairing the π-anomaly in using the electron as the primary feature associated to the π-anomaly, two key repairs are made, first the value for φ used as 1.618034, and second by applying this value to equation 3 of paper 2 ([2]: p10, eq3), namely $\left(\frac{-1}{\varphi}\cdot -2\sqrt{3}\right)+1=\pi$, here as the electron wave function π value as equation 1 as follows:

$$\left(-0.618034\cdot -2\sqrt{3}\right)+1=3.14093258 \qquad (1.)$$

Also note the repair to equation 6 of paper 2 ([2]: p12, eq6), here as equation 2 as follows:

$$(1.618034\cdot -2\sqrt{3})^2 \;=\; 31.4164083 \qquad (2.)$$

These repairs have no impact on the previous steps of the theoretic structure of the previous papers, as the logic of choosing equation 2's 10-step process (10 steps along each x-axis direction, and

thus 20 steps in all for a Bohr radius) for the temporal wave function π-value is still in play ([2]: p11-14) in setting the basis for the 20-step $(20EQU)$ temporal wave function for the Bohr radius a^0. The amendment here is in view of being as exact as possible for π in calculating the value of the radius of the electron and proton.

The next step of required development for the π-anomaly is by simply subtracting the above electron wave function value for π from the *known* value of π, resulting in the following:

$$3.14159265 - 3.14093258 = 6.60072 \cdot 10^{-4} \qquad (3.)$$

This is a provisional π-anomaly value for the electron.

The next thing to consider is what this provisional π-anomaly relates to, and the proposal here is that it relates to the *circumference* of the atomic locale, of the time-space template (TST), the electron shell (MQS) structure where the electron resides, as per figure 9:

Figure 9

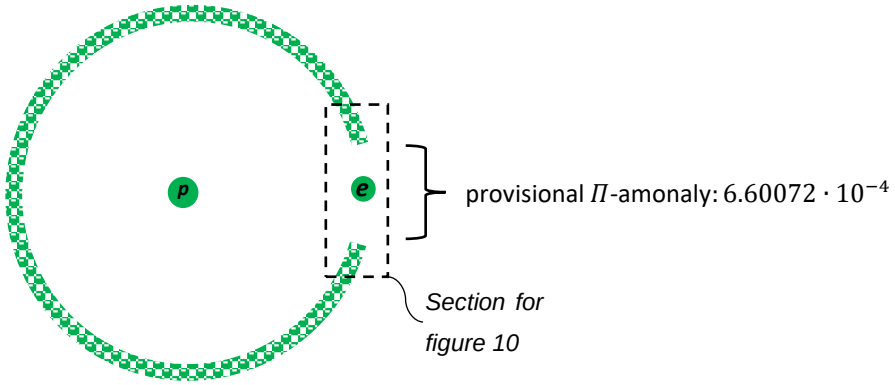


Figure 9: a simple addition to figure 8, including the scale of the π-anomaly.

To note though is that the difference here as a feature of π, as a temporal wave function feature, should be expressed *as a temporal wave function feature* and thus in the *constraint* of a *quantum*, as figure 10:

Figure 10

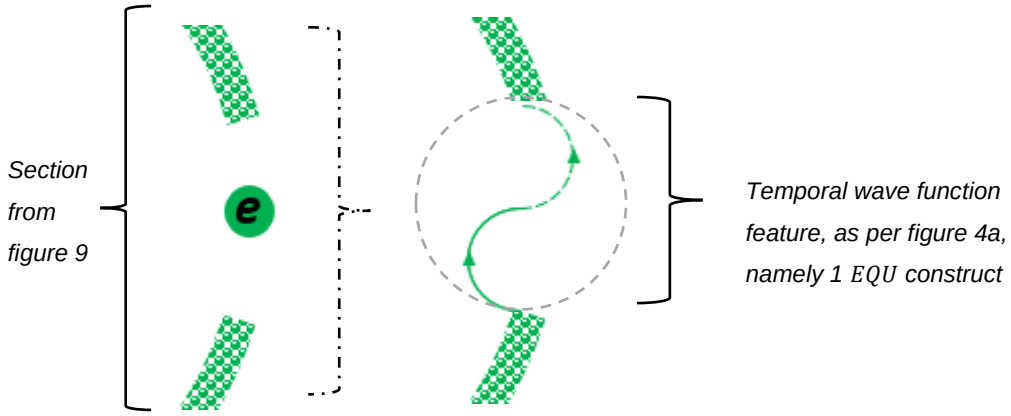


Figure 10: incorporating a temporal wave function unit to the π-anomaly region.

Yet, the electron needs to be associated to the *magnetic* temporal wave function structure, given the electron resides in the MQS, the *magnetic quantum shell*, as derived in paper 30 [30]. Therefore, the thinking here is to not just suggest one temporal wave function unit (EQU), yet the required 20 temporal wave function units ($20EQU$) to be inclusive of the magnetic temporal wave function feature of equation 6, paper 2 ([2]: p12, eq6) for this circumferential π wave function feature, thus complementing the scale of the atom's metrics, namely its radius as the $20EQU$ value. Thus, the following would be in play, figure 11:

Figure 11

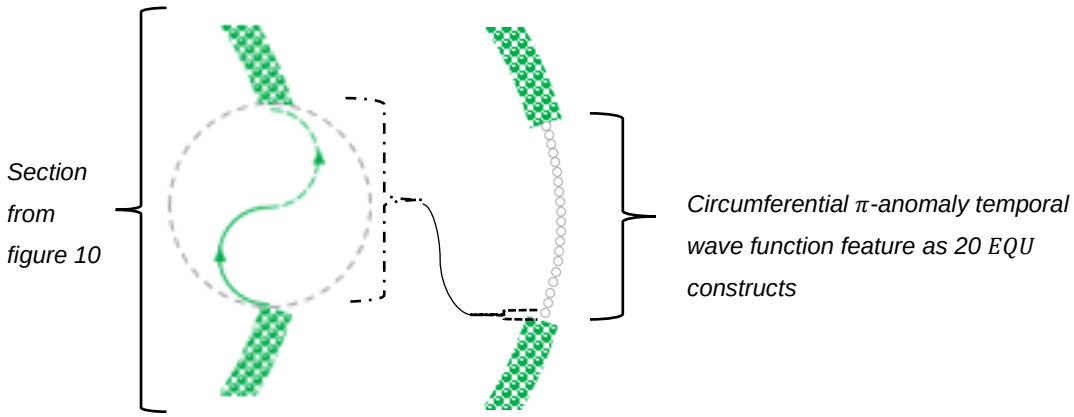


Figure 11: incorporating a temporal wave function unit to the π-anomaly region.

What must now be considered is amending equation 2 to account for these $20EQU$ wave function units for this electron π-anomaly zone, as the next step electron π-anomaly value, as follows:

$$\frac{6.60072 \cdot 10^{-4}}{20} = 3.30036 \cdot 10^{-5} \quad (4.)$$

One final step needs to be applied to this value, and that is the overall $\frac{21.8}{22}$ compression value for the time-space template (TST) atom (the case presented in paper 2 in the derivation of the fine structure constant α ([2]: p15)), and thus the following equation applies:

$$3.30036 \cdot 10^{-5} \cdot \frac{21.8}{22} = 3.270356 \cdot 10^{-5} \quad (5.)$$

Such is the proposed π-anomaly value for the electron.

To note is that this is a new temporal wave function scale, namely for the circumference of the Bohr atom (and Temporal Mechanics time-space template atom, TST); this is not the temporal wave function scale for the Bohr radius of the atomic locale, yet a new scale adapted for the circumference of the atomic locale (Bohr atom and time-space template), namely in *being adjusted to the Bohr radius temporal wave function* (as per the $20EQU$ feature).

The issue to now note is that the electron and positron are associated to quantum units (EQU), as follows, here as the electron whether as AD or BC, here as AD in figure 12:

Figure 12

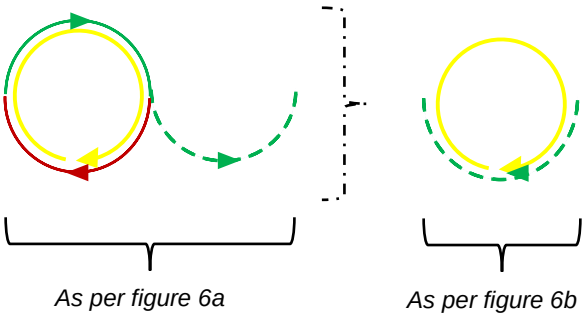


Figure 12: Adapting figures 6a-6b to the π-anomaly region.

Basically, the electron can only be associated, intimately by its genesis and existence, to a *primary* quantum unit ($1EMQ$), hence the labelling of charge with this feature of the particle pair production genesis process. Thus, in all there would be 20 quantum units ($20EQU$) associated to the 1 electron in the context of the electron π-anomaly. These "20" quantum units are proposed to be intrinsic, as Temporal Mechanics has derived, to the functioning of the electron shell system, the MQS, as derived in paper 2 equation 14 ([2]: p17-18, eq14) and then further explained in paper 30, page 16-20 ([30]: p16-20).

And so, in taking a basic electron in the context of its spatial location in the electron shell (MQS), from figure 10, and in noting the required 20 quantum values ($20EQU$) for 1 electron, we have the following, figure 13:

Figure 13

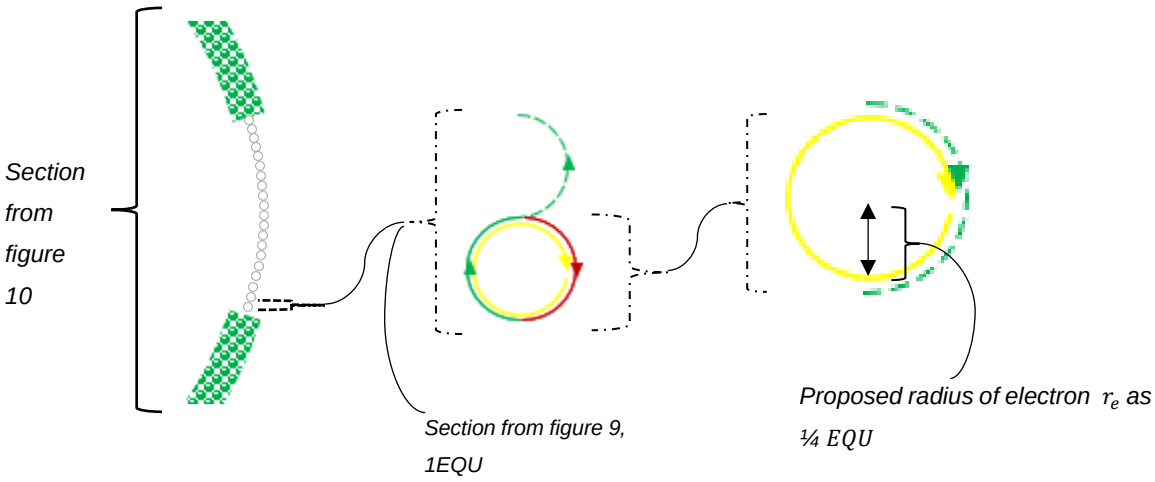


Figure 13: proposing the radius of the electron, r_e, as $(\frac{1}{4} \cdot \frac{1}{20})$ the π-anomaly overall circumference length of $20EQU$ (noting this is an approximation given the distance here of the π-anomaly is an arc and not a straight radius line.

To therefore calculate the radius value of the electron, the following factors must be considered:

- the Bohr *diameter* $(2 \cdot 5.29177 \cdot 10^{-11})$ and π, as the true circumference value),
- the π-anomaly value $(3.270356 \cdot 10^{-5})$, to reduce the circumference down to the anomaly EQU scale,
- ¼ of the EQU, to reach the electron radius value (r_e).

Thus, the following results:

$$r_e = \frac{2 \cdot 5.29177 \cdot 10^{-11} \cdot \pi \cdot 3.270356 \cdot 10^{-5}}{4} = \quad 2.718416 \cdot 10^{-15}\, m \qquad (6.)$$

This value is quite close to the estimated $CODATA$ *classical electron radius* value of $2.8179 \cdot 10^{-15}\, m$ [40], noting the $CODATA$ value is not accommodating for electron relativistic effects, and thus here the advantage being deriving this value in factoring in the relativistic constraints of $time = 0$ at c.

Simply, Temporal Mechanics proposes that the radius of the electron r_e would represent a value derived from the EQU principle, here on the circumference of the atom as the MQS structure, a value of

$20EQU$ for 1 electron, the electron being associated to *one* of those $20EQU$ constructs, the radius of which is $¼\ EQU$.

In continuing, in applying this EQU concept to the idea of the electron shell structure (MQS structure), this MQS structure would represent discrete EQU steps of electron spatial/location status in needing to keep the idea of π patent for the atomic locale, that spatial/location status of which would require the Rydberg formulation as derived in paper 1 ([1]: p16-17) and the MQS formulation as derived in paper 30 ([30]: p15-21). Basically, each shell in the MQS electron shell system would have a π-anomaly requiring calibration, and thus when an electron jumps from one shell to the next, it would do so in releasing that quantum of energy value representative of the difference between the energy states of the MQS shells, and as such there would exist a signature quantum jump descriptive of the energy difference between the electron shells (MQS), *derived* here though by Temporal Mechanics, despite already being confirmed experimentally.

Regarding the proton radius (r_p), the question to be asked is, "*how does the radius of the electron confer to the scale of the proton?*".

The answer is quite straightforward in that:

- if the proton as the centre of the atomic local of the Bohr atom could be considered as a *sphere*,
- and if the electron shell structure (MQS) is a *sphere*,
- and if the electron and proton share the same ***magnitude*** of charge,
- then the electron and proton must also share the same spatial metric "*charge*" feature of the particle pair production temporal wave function,
- and thus, the entire circumference of the proton as a sphere analogue would be the equivalent of the π-error *electron* <u>*diameter*</u> (MQS circumference arc) used to rectify the MQS π-anomaly circumference.

In other words, the spherical metric "fix" of the electron in the MQS (electron shell) to repair the π-anomaly would represent the total spherical metric of the proton, and thus its circumference. Consider figure 14 as follows:

Figure 14

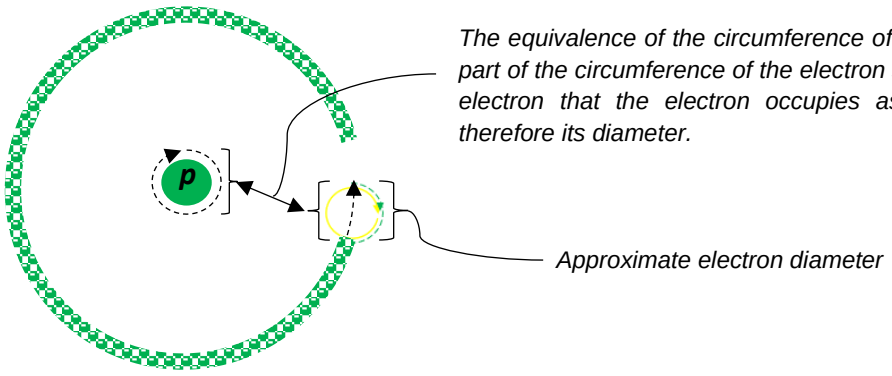


Figure 14: diagrammatically placing the circumference of the proton with the diameter of the electron

To note is that this circumference of the proton in being related to the diameter of the electron is the same scaling process employed in paper 4 ([4]: p11-13) for the mass of the neutron and the derivation of Avogadro's number N_A.

Thus, the value for the radius of the proton r_p would be its circumference divided by 2π, its circumference being twice the radius of the electron ($2r_e$), as follows:

$$r_p = \frac{2r_e}{2\pi} = \quad 0.865299 \cdot 10^{-15}\, m \tag{7.}$$

This arrives quite close to the $2014\ CODATA$ value of a proton's charge radius at $0.8751 \cdot 10^{-15}\ m$, yet central to the proton radius r_p calculation is the "*Proton radius puzzle*" [41], namely the *varying* values based on the varying methods of reaching a value for r_p.

The question now therefore is, "*what could be the reason for any potential discrepancy with $CODATA$ values for the proton radius value, why do the values for the proton radius differ across different methods of measurement?*".

10. Particle measurement: resolving the "*Proton radius puzzle*"

A discussion on particle pair production would not be complete without not only scaling the electron particle, yet proposing how the electron relates with the atom and how its scale value can be then *measured* using sources *external* to the atomic locale and if any contamination of the natural status of the proton radius occurs in its measurement by the measurement processes in play.

The issue that Temporal Mechanics has found with measuring the scale of the electron in using sources *external* to the atomic locale (such as spectroscopy and Lamb shift analysis) is that the electron's

scaled measurement depends on a fundamental condition of the atom related to its π-anomaly scaling system that manifests in the form of *atomic temperature*, and thus what we understand as black body radiation, yet here also the inner mechanics behind such, namely the compression scales of the atomic locale.

Black body radiation will be outlined in the next section, yet here the fundamental platform for such shall be outlined, both on the microscopic and macroscopic scale.

The following figure highlights a number of derived temporal wave function compression scales that act in a temperature context that are in play for the time-space template (TST, atomic locale), figure 15:

Figure 15

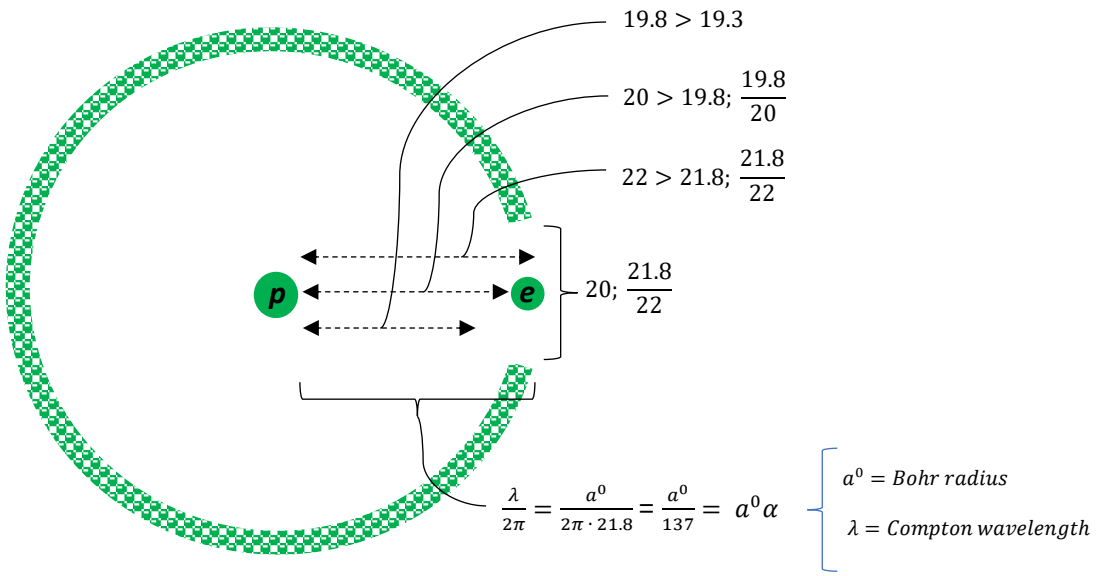
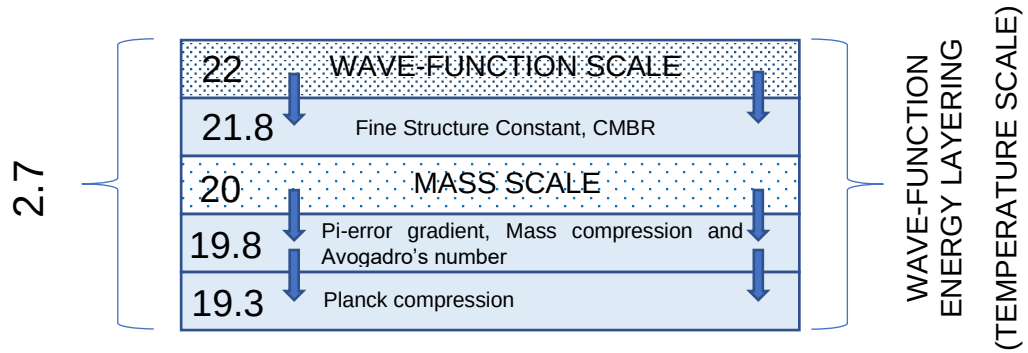


Figure 15: (not *drawn* to scale), highlighting the basic compression scales of the time-space template (atom) and their association to the fine structure constant and temperature scaling system ([14]: p23, fig6).

Figure 15 highlights how there are a number of features to the atom that translate as a compression scale for the temporal wave function (and thence temperature) to accommodate for the fine structure constant value α, derived in paper 2 ([2]: p15), both for the Bohr radius temporal wave function, and the MQS (electron shell) temporal wave function.

Key to note there is the "20" scale used for the Bohr radius, and the overall "22" scale used to accommodate for the *magnetised* feature of the π-anomaly for the atomic locale and not the primary electric π-scale, as derived in paper 2 ([2]:p7-14). These compression scales result in the temperature scale for the atom, from an overall magnetised wave function scale of 22, to a Planck compression scale of 19.3 as highlighted in figure 6, paper 14 ([14]: p23, fig6):

Paper 14, Figure 6



This scale was developed in paper 14 to capture the fundamental idea of the Lamb shift effect, specifically the $CMBR\ GHz$ value, the $CMBR$ *temperature* value, and the vacuum energy value. It was an intentional design to capture such, yet in only using the compression scales of the atom to accommodate the π-anomaly, to then determine how those compression scales relate with one another, namely upon what basic platform, as described above in figure 6 from paper 14 ([14]: p23, fig6). Although there the value of 2.7 is reached as an overall scale, when this overall scaling value is then factored out *beyond* the atom as a measurement of space outside the confines of the atom, the compression scale of $\frac{21.8}{22}$ needs to be removed, and thus a scaling factor of $\frac{21.8}{22}$ applied, thence the actual *measured* value of the $CMBR$ results, as per the following from paper 14:

> *The concept of temperature in the phi-quantum wave-function scaling system employed here would represent a scaling system of energy according to the phi-quantum wave-function scaling system,* ***and thus a scaling factor of that part of the phi-quantum wave-function that is being perturbed****, and here this value would represent a value of 2.7 (figure 6) factored with the maximum length of the scaling system of the phi-quantum wave-function (22)* ***per*** *the CMBR related scaling reference (21.8), the amount from the 22 reference of the wavefunction to the 19.3 level, factored to the overall length (22) per each CMBR (21.8) scale, as a scaling of energy release from the general phi-quantum wave-function. Simply the scale* ***as a scale*** *would need to represent the "amount" perturbed in total (2.7), while being directly proportional to the overall scale (22), "per" the level of scaling the effect is being measured from (21.8). Such would represent the basic scaling of energy as a component of energy scaling,* ***as temperature****, in regard to the phi-quantum wave-function. Here a value of 2.725 for the (21.8) level, as per equation 14.*

$$2.7 \times \frac{22}{21.8} = 2.725\ (temperature) \qquad (13)$$

In now going back to paper 4 and the calculation anomaly there, the proposal is to amend the following (paper 4, page 11):

The error on the phi-quantum wave-function level is of the order of the actual value of π (3.1415926) subtracted from the atomic value of π (3.1416253) as per equation (3):

$$3.1416253 - 3.1415926 = 3.27 \cdot 10^{-5} \quad (3)$$

That is the value per unit increment of π on the phi-quantum wave-function level. If we then factor this in with the 19.8 length between the proton/neutron and electron on the elementary particle scale level (not the "extra-atomic (21.8) quantised level, as we are considering the idea of "mass" scaling error here), we get the following:

$$3.27 \cdot 10^{-5} \cdot 19.8 = 6.475 \cdot 10^{-4} \quad (4)$$

The amendment is to consider the new π-anomaly value of $3.270356 \cdot 10^{-5}$ in using equation 5 of this paper as the more correct *description*, even though it's almost identical in value to that of equation 3 paper 4 ([4]: p11, eq3), a process therefore that does not change paper 4's process of formulation of Avogadro's number N_A from equation 4 onwards when also applying the more precise values for the average mass of the proton ($61.6726219 \cdot 10^{-27} kg$) and neutron ($1.674927471 \cdot 10^{-27}$), noting that the factors of π and $\frac{21.8}{22}$ would still need to be applied to the proton/neutron concept of *mass* in that unique process of deriving Avogadro's number despite $\frac{21.8}{22}$ already being factored into the π-anomaly value from the electron, as $\frac{21.8}{22}$ would still need to be factored again for the *mass*-feature of the proton and neutron, as highlighted in figure 14 on the previous page.

The *derived* $CMBR$ value of paper 14 ([14]: p25, eq12) is thus not affected.

In then explaining the derivation of the Lamb shift from equation 4 in paper 4 ([4]: p22-24, eq6-10), the Lamb shift was calculated in paper 14 ([14]: p23) as follows:

The idea of the pi error gradient was presented to calculate the value for Avogadro's number relevant to the mass of a neutron, as in paper 4 ([4]: p16). Yet there is another feature to the phi-quantum wave-function as it becomes expressed extra-atomically, namely two key perturbation factors in regard to the mass scale, namely a $\frac{21.8}{20}$ *perturbation and a* $\frac{19.8}{20}$ *perturbation, together representing a general pi error gradient perturbation as* V_A*, as per equation*

$$V_A = \frac{21.8}{20} \times \frac{19.8}{20} = 1.079 \quad (8)$$

Another feature to consider is that the compression that occurs regarding mass on this phi-quantum wave-function level is of the order of $\frac{0.2}{19.8}$*, or in other words "0.2" (*$20 - 19.8$*) is lost to space for every phi-quantum wave-function atomic reference 19.8 length result. And this would happen "per" the maximum distance of space in total factored with* V_A*. This is useful in calculating the effect of negative energy (space), the "vacuum energy of space", on the atomic reference, a case of relating this value to the overall maximum theorised distance of light propagating in space. As per paper 13 ([13]: p11), the distance of Oort region to the sun is ~* $1.1 \times 10^{16} m$*. Thus, the factor level for distance regarding* E^2 *for space would be:*

$$\frac{0.2}{19.8} \times \frac{V_A}{1.1 \times 10^{16}} \quad (8)$$

Now, incorporating this in with equation 7, the following value for energy per metric volume of space (in Jm^{-3}) is arrived at thus:

$$\sim 10^{-9}\, Jm^{-3} \quad (9)$$

*This value of energy would represent a basic background level of energy that is absorbed **from** atomic matter, from the fundamental process of $E = hf$, from the atom, a value consistent with the estimated value of the vacuum energy of space [33].*

To explain the Lamb shift is such, as it would be the natural effect of $E = f$ on anything that exists in the system "within" the atom, that which would be responsible for the vacuum energy of space itself to address the idea itself of being that complete $E^2 = (-1)(d)$ construct, a natural background effect on the atom. What "frequency" would such energy be released from the atom at? Here, on the atomic level, in the context of $t_N = 1$, as the spatial reference, as defined by the time-algorithm, $t_N = \frac{1}{f}$ and thus $d = \frac{1}{f}$, frequency would represent:

$$\sim 10^9 Hz \quad (10)$$

This value is consistent with the measured value of the Lamb shift effect of ~ $1GHz$.

The primary issue to note here is that the Lamb shift and $CMBR$, in their both being related to Avogadro's number N_A per that process of derivation in paper 14 ([14]: p22-25), are nonetheless fundamentally related to the electron charge radius r_e as derived in this paper according to those metric compression scales for the atom. In fact, the process of calculating Avogadro's number N_A is to primarily understand how atomic mass as the proton and neutron (and not electron charge, as derived earlier) would relate with the π-anomaly.

The problem then in using the Lamb shift, including spectroscopy, to calculate the electron radius (and thence proton radius) is that the Lamb shift (and spectroscopy) accounts for electron energy, and so when measuring the electron using the Lamb shift (and spectroscopy), technically that value of measurement would relate to an *uncompressed* electron, ***not*** a compressed electron (with those associated required scales), given the Lamb shift atomic energy release is a form of energy spectroscopic expression beyond the compression scale of the atom. Technically therefore, as with the $CMBR$ temperature value, to measure the charge radius of the electron r_e using the Lamb shift effect, using any form of spectroscopy, a factor of $\frac{22}{21.8}$ needs to be applied. Thus, the following amendments need to be made with lamb shift and other spectroscopic measurements of the electron charge radius r_p and proton charge radius r_p, as amendments to equations 6 and 7 respectively, to derive $r_e`$ and $r_p`$:

$$r_e` = 2.718416 \cdot 10^{-15} \cdot \frac{22}{21.8} = 2.743356 \cdot 10^{-15}\, m \quad (8.)$$

$$r_p` = \quad 0.865299 \cdot 10^{-15} \cdot \frac{22}{21.8} \; = \; 0.87324 \cdot 10^{-15}\, m \tag{9.}$$

These values are more aligned with the known $CODATA$ values for the electron radius and proton radius, here as $r_e`$ and $r_p`$ respectively.

The other problem with measuring the proton radius is whether those processes of measurement interfere with the actual distance between the proton and electron, by for instance using a $Muon$ instead of an electron, or an excited atom (and thus changing its temperature and thus compression scale). In those cases, the value of the proton radius would *drop* according to that greater compression scale (temperature) in play for the atomic locale, especially in either heating the Hydrogen atom with lasers to an excitation state or using non-standard Hydrogen particle metrics (such as $Muons$). As such, all of those research processes and current findings [42][43][44][45] violate the natural compression scale of the atom and natural state of the electron, leading to lower than expected values, as they do.

There is it seems a common basis to the compression scales of the atom, that temperature scale fuse box, namely how all the π-anomaly features interact with each other, and the key common basis is proposed to be the following equation:

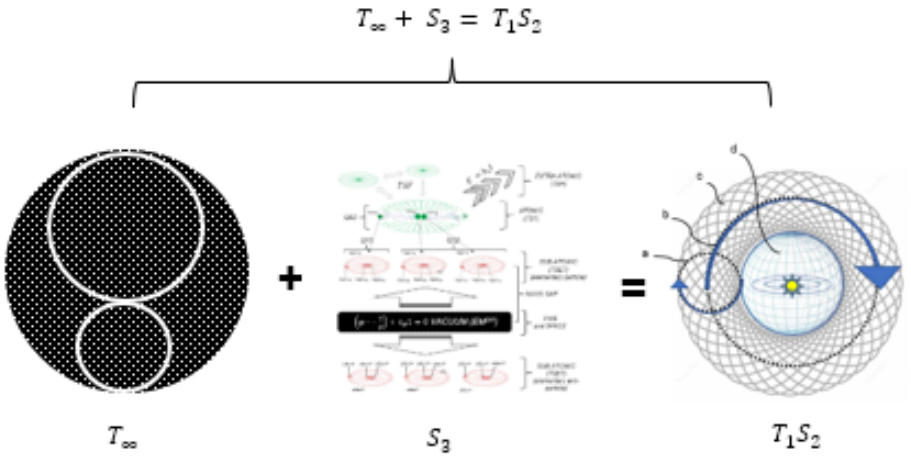
$$\pi = \frac{r_e}{r_p} \tag{10.}$$

Why is this significant? This equation represents how the π-anomaly is resolved by the metric spatial *scale* of the non-zero mass particles for the most basic atom (1p, 1e), even for the standard time-space atom (1p,1n,1e), simply given here the metrical scaling issue is relevant to particle *charge* in calculating the spatial scale of mass derived in the context of an EM^{DIR} event, and to have it referred specifically to the required value (transcendental) for π.

Such a basis can be considered as a principle in play for the atomic temperature fuse box around which the temperature scaling system plays out its processes.

Does this mean that reality can merely exist as (1p,1e) or (1p,1n,1e) atoms in having π so simply achieved on such a basic atomic level? Indeed not, as the problem exists that a single Hydrogen (1p,1e) or Deuterium (1p,1n,1e) atom are neutral and each have an unpaired electron, and thus they are considered as *a reactive free radicals*, which is why atomic Hydrogen is a rarity. Such is why a vast system of *non-local time-points* is required, underpinning the basis of all physical phenomena, defining the time-space manifolds and metrics in play as the universal common denominator upon which atoms interact as they do, restricted by an overall event horizon, as presented in paper 34, "*Temporal Mechanics (D): Time-Space Metrics"*, figure 3 ([34]: p18, fig4):

Paper 34, Figure 3



Paper 34, Figure 3: an amalgamation of the non-local time-point golden ratio field (1.; from figure 2), accompanied to the microscopic scale (2.; ([33]: p11,fig2)), and then applied to the macroscopic scale (3.; (25]: p48, fig15)).

Here, space as three dimensions encapsulates the infinite dimension of time, as T_1S_2*, meaning despite there being 3 dimensions of space and an infinity of non-local time-points processed according to the temporal perception ability prescribed as the golden ratio algorithm, the resultant phenomenal dimension is 2-d, and thus a type of holographic projection as would be perceived, of course by design, yet the important feature being that the information of reality is all based on the surface area membrane of the interaction of time-points and space, that proposed* MQS *scheme [30].*

In short, the π-anomaly scaling system represents a combination of mathematical relationships to accommodate for all the interlinked atomic phenomenal particle processes, functioning like a mathematical fuse box linking processes associated to the core function of the atom seeking to maintain a baseline process of $\pi = \frac{r_e}{r_p}$. And so, given the π-anomaly scaling system is intrinsic to the value of r_e and thence r_p, and how then r_p is associated to Avogadro's number N_A, such can then be applied to the overall system scaling size to arrive at the vacuum energy value as associated to the temperature value of the $CMBR$, as per paper 14 ([14]: p22-24).

The next general task ahead for Temporal Mechanics thus is to knit those manifolds and associated metrics together with known cosmological phenomena, already proposed in papers 32-34 [32-34].

Thus far nonetheless, Temporal Mechanics, in applying the time-equation and associated temporal wave function logistics to the idea of Pythagorean space, as constructed in paper 2 ([2]: p2-9), and then further developed here as an EM^{DIR} field, has demonstrated in this 38th paper addition how:

- electron-positron particles form,
- why the electron and positron are separated and appear to move away from each other at their genesis,

- why the electron and positron have spin,
- why the electron and positron have opposite charges,
- where the electron is located in the atom in regard to the proton,
- the electron-quantum unit (EQU),
- the electron shell structure as a building of the EQU,
- the radius of the electron (r_e),
- and the radius of the proton (r_p)
- the value for π as a fraction of the radius of the electron with radius of the proton ($\frac{r_e}{r_p}$).

The fundamental feature to note here is how all of such is based upon the time-equation and associated temporal wave function when applied to a known atomic locale metric of space, namely the Bohr radius a^0, or in other words, there is **a fundamental principle** *of time and space with numbers* **that is wired to our perception ability of time and space**, ***not*** solely though in the temporal datum reference of time-now (as inertial models uphold), yet in considering how time has three paradigms, *time-before* (t_B), *time-now* (t_N), and *time-after* (t_A), where the relationship between the time paradigms is governed by the time-equation $t_B + 1 = t_A$ as governed by our temporal perceptive constraints.

In short, although it would seem that contemporary physics *models* the behaviour of light, a quantum, on the behaviour of the electron as a primary inertial event and associated model-basis especially so as a concept of electrons in an atomic orbital (as presented in section 3), Temporal Mechanics on the other hand holds that *"time" is a more primary process*, where the distinct connection between an electron (and positron) with a quantum *can be derived* from a time-equation and associated temporal wave function logistics.

What of though the Temporal Mechanics version of "black body radiation"?

11. Electron black body radiation

Now we return to the initial examination of black body radiation according to Quantum Mechanics, as per the discussion in section 2 where it was highlighted how Quantum Mechanics has found:

.

- all baryonic matter emits electromagnetic radiation when it has a temperature above absolute zero,
- EM radiation represents a conversion of a body's internal energy into electromagnetic energy, and is therefore called thermal radiation as a process of entropy,
- all normal matter also absorbs electromagnetic radiation to a certain degree,
- an object that absorbs all radiation falling on it, at all wavelengths, is called a black body,
- when a black body is at a uniform temperature, its emission has a characteristic frequency distribution that depends on the temperature, and its emission are called black body radiation,

- and that the concept of the black body is an idealization, as perfect black bodies do not exist in nature.

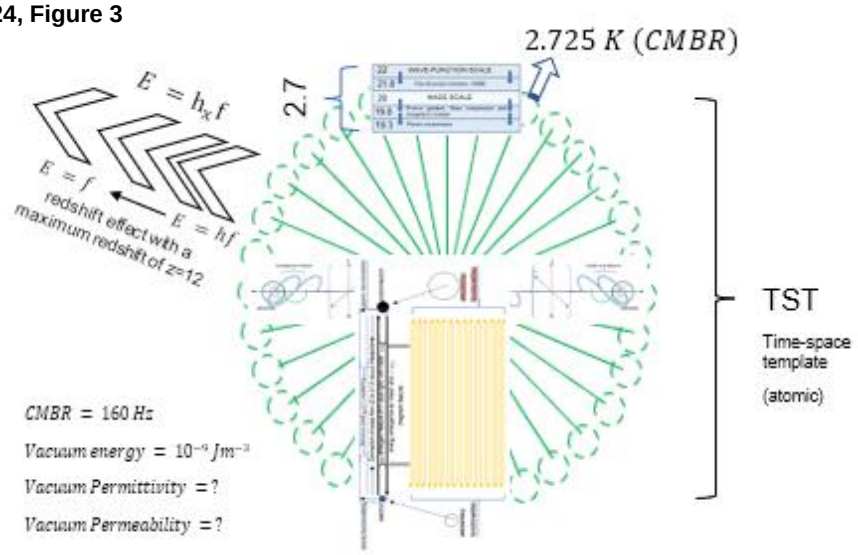
Here now we have a process of the electron in an electron shell system (MQS) calibrated as a scale to account for the π-anomaly, a scale that is associated to the idea of Avogadro's number that itself is *also* calibrated to account for the π-anomaly (as presented earlier in this section), and how such together are related to:

- the Lamb shift effect ([14]: p22-24)
- $CMBR$ frequency ([14]: p24-25)
- $CMBR$ temperature ([14]: p24-25)
- Boltzmann constant (14]: p25-26), ([20]: p20)

The acknowledgement of this for the atomic locale and associated behaviour of the electron shell structure was with figure 3 and associated explanation in paper 24 [24]: p20-21, fig3):

These layers can be thought of as wave-function unit layers within the (atomic) time-space template (TST), as per figures 1 and 2, and figure 10 from paper 23 ([23]: p24, fig10), together as figure 3:

Paper 24, Figure 3



Paper 24, Figure 3: time-space template (TST) showing the general functions from figure 16 paper 2 ([2]: p16, fig16), figure 6 paper 14 ([14]: p23, fig6), and figure 10, paper 23 ([23]: p24, fig10).

The relevant issues with figure 3 to note are as follows:

- *The electron shells (as calculated by the Rydberg constant in paper 1 ([1]: p12-15), and then calculated with the maximum allowable number of shells in paper 2 ([2]: p16-17)) would exist on the mass-scale level (the "20"-layer level, as per figure 2).*

- *The 2.7 factor of temperature scaling (figure 2), in then needing to be related to space outside the template, had to be factored with that outside process, this as a factor of* $\frac{22}{21.8}$*, as a wave-function scale per a CMBR scale, giving rise to a basic temperature value of* $2.725\ K$*, the energy of the CMBR, therefore relating the CMBR to the atomic template (TST).*

- *The vacuum permittivity (*ε_0*) and permeability (*μ_0*), although elusive from papers 15 [15] through to 22 [22] despite all other energy equations being successfully derived using the time-algorithm and associated TST, were derived in paper 23 ([23]: p30); the issue following such was relating the idea of the resistance between space with EM (and thus vacuum permittivity* ε_0 *and permeability* μ_0*) to the CMBR, to demonstrate that the* ***entire*** *process is "steady state", entirely disproving the CMBR as the result of the ΛCDM big bang, yet a value related to something born of the atom itself, namely how an atom's energy is in equilibrium with space, and why (which is what a non-expanding space and time reality would be, namely steady-state, thus requiring a new description for the CMBR and red-shift effect), and how light (EM) is related* ***to*** *space.*

- *The redshift effect was explained by virtue of the nature of light as it propagates beyond the atomic template (TST), in pure space [13], no longer restricted by the Plank equation yet finding itself with a variable Planck constant approaching the value of "1" as light propagates through space, a process which correctly calculated the distance of the Oort cloud from the sun 13 ([13]: p11, eq8), yet more fundamentally in abiding by an EM-space process of interaction, as defined by the EM-EM^{DIR} mechanism ([23]: p24-31).*

Thus, the quest was on to find the relationship between the CMBR and the vacuum permittivity (ε_0*) and permeability (*μ_0*) and that association with the atomic template (and associated energy scaling system) together with space, to complete the equations and associated phenomena.*

That quest provided fruitful later in that same paper, page 25-27 ([24]: p25-27):

3.4 *Deriving the CMBR from the Vacuum Permittivity-Permeability and the TST*

From paper 23, equation 5 ([23] p30, eq5): $\varepsilon_0 = \frac{1}{4\pi} \times \frac{1}{Q_C \cdot c^2} = \frac{1}{4\pi \cdot k_e}$

From paper 23, equation 7 ([23]: p30, eq7): $\varepsilon_0 = \frac{1}{\mu_0 \cdot c^2}$

Then, from paper 14, eq 18 ([14]: p26, eq18): $e = m \cdot c^2.$

Therefore, the following applies: $e_e = \frac{m_e}{\varepsilon_0 \cdot \mu_0}$ *(1)*

Here, e_e is the energy of the electron, and m_e its mass. Why is this significant? Let it be proposed this value for e_e is put into the atomic scale template (figure 6, paper 14 ([14]: p23, fig6), as presented in section 3.2 figure 2), into the TST, and determine what this value of energy represents there. The first thing to note is that this value of energy is a t_A entity, and therefore a t_B^2 entity according the time-algorithm. Why? That is what the time-algorithm prescribes as presented in paper 2 page 11 ([2]: p11), as per:

> *Two results for the golden ratio for $\frac{-1}{\varphi}$ extending a π length in each direction (eq. 3), the other as t_B^2 result extending 22-π lengths (eq. 6). Two results on each axis extending diametrically opposed to each other for 11 electrical wavelength steps. Note that we are using the electrical step because this is considered as the only way for the wave function to satisfy its requirement to trace π.*

Given the electron inhabits this perimeter/shell, then it is represented as t_B^2, as follows:

$$t_B^2 = \frac{m_e}{\varepsilon_0 \cdot \mu_0} \tag{2}$$

Thus:

$$t_B = \sqrt{\frac{m_e}{\varepsilon_0 \cdot \mu_0}} \tag{3}$$

Knowing those values produces the following:

$$t_B = \sqrt{\frac{9.11 \cdot 10^{-31}}{1.11 \cdot 10^{-7}}} = 2.86 \cdot 10^{-12}\ s \tag{4}$$

However, this time is "per" a 0-space point start point moving 10 PQWF time-units in either direction along the spatial axis from the 0-reference, as per the required need to include the magnetic component in this value, as per paper 2 page 10 ([2]: p10), as follows:

> *Note now the squared value for φ; we can say that it appears the value for φ offers the idea of "10" π-steps (eq. 6), and thus what would appear to be 10 ($\frac{-1}{\varphi}$), (the true value for π) steps to arrive at the almost exact value for π. Yet of course this is a value for a t_B value of magnetism (φ) by considering using 10π t_A steps as an "electrical" ($\frac{-1}{\varphi}$) component. How does this look on a spatial grid (fig. 12)?*

Not only this, given this is an entire atomic spatial template (TST) phenomenon being investigated, this value of time needs to be factored with the Fine Structure Constant value of that atomic space template, namely 21.8 (as per paper 14 figure 6 ([14]: p23, fig6) presented here in section 3.2 figure 2), and therefore this value of time for the energy of an electron related to this atomic space template must be factored with a value of $\frac{21.8}{10}$ as follows:

$$t_B = \frac{21.8}{10} \cdot \sqrt{\frac{9.11 \cdot 10^{-31}}{1.11 \cdot 10^{-7}}} = 6.235 \cdot 10^{-12}\ s \tag{5}$$

As a value of frequency, this represents

$$t_B^{-1} = 160\ GHz \tag{6}$$

This value corresponds quite directly with the CMBR value of $160\ GHz$*. This is significant, as contemporary physics regards the CMBR as a result of the ΛCDM model's "big bang" event, as a relic of that event. Here with the Temporal Calculus it is something more local and explainable, if not more reasonable, providing a "steady-state" scenario on three fronts:*

(i) *The* $160\ GHz$ *value ([14]: p25, eq12), as per* $\frac{21.8 \cdot V_A}{N_A}$.

(ii) *The* $2.725\ K$ *value ([14]: p25, eq13), also as presented in figure 2.*

(iii) *The temporal value of this energy, as per the vacuum constant (*ε_0 *and* μ_0*) and the energy of an electron, as per equation 1,* $e_e = \frac{m_e}{\varepsilon_0 \cdot \mu_0}$.

Such eliminates the ΛCDM model in the context of all the derived equations and constants, for what has been achieved with the Temporal Calculus is a statement regarding the energy of an electron (as a temporal expression) in regard also to its magnetic point localised on an atomic space template (TST) featuring the resistance between EM and space ***as*** *this CMBR value directly related to the coupling strength of the atom (internal TST value of 2.7, see figure 2). Or in other words, this TST value for the energy of EM is equivalent to what was calculated for space through a cosmological scale as per paper 14 equation 12 ([14]: p25, eq12) as frequency, and per equation 13 ([14]: p25, eq13) as energy, therefore directly suggesting that there is an equilibrium of energy (steady state) in play, denoting stability to a TST reference, to an atom in space, given this energy equalisation is a temporal entity.*

Essentially, presented here has been the need to confirm the actual scale of particle pair production in play and what those metrics are, and then outline such, as here, in the context of a basic black body equilibrium between the atomic electron and the vacuum permittivity and permeability, as per the derived value for the electron energy (e_e) and mass (m_e), both derived by Temporal Mechanics, in the context of the vacuum permittivity (ε_0) and permeability (μ_0), also both derived by Temporal Mechanics, presented as the equation $e_e = \frac{m_e}{\varepsilon_0 \cdot \mu_0}$.

A complete list of what has been derived by Temporal Mechanics shall be presented in section 12, together with references to their relevant papers.

The real essence to explain though is how the *field forces would work together as one* to *lead* to an atomic locale, and how they (field forces) would hold the particles in play with each other. Key to that was presented in paper 30 ([30]: p18-19) where the electron was proposed as the main pin, presented as follows:

According to Temporal Mechanics, the electron is proposed to be created as a basic time-now time-point per the time-space circuitry ($\boldsymbol{TS\varphi}$*) holding an uncertain location as a cloud of points in space (TSU, ([20]: p12-13)), in energy shells as prescribed by the time-algorithm in paper 1 ([1]: p12-15), yet owing to the* EM *wave function and spatial constraints of that electron existing as a cloud then it, the electron, becomes associated to a central inner* DIR *resonance nucleus, the "p" and "n" particles ([23]: p19-23), which themselves would be structured in their own shell-system, protons in their own shell system, and neutrons independently also in their own shell system. This is understood as the Nuclear Shell model in physics as based on the Pauli exclusion principle [31].*

Temporal Mechanics understands the Pauli exclusion principle as a natural condition that would exist for the atomic nucleus particles (p and n) needing to occupy independent quantum states as dictated by their association to the electron and magnetic time-points of the time-equation and such a basic unique reference requirement for the time-equation's functionality, as much as the basic time-equation requires the setting of the 4 t_N points, as highlighted in paper 23 ([23]: p13, fig3).

What is presented here as an addition to the fundamental field forces at play is that the positron is excluded from the atomic locale in:

- the positron ($e+$) and electron ($e-$) being ushered away from each other at their genesis, a type of natural field force effect (to be discussed in a subsequent paper),
- the electron being primarily associated to the atomic locale, as presented in the above paper links.

How this is proposed to happen is according to a hierarchy of field force effects, ushering the positron away from the atomic locale owing to positron formation being *entropic*, a *primary* feature for time, also a *gravitational* feature, requesting the positron to primarily exist independently, alone, unlike standard baryonic matter which is proposed to exist as the *atomic locale* with a host of other field force features in play. In fact, baryon asymmetry as a type of TP asymmetry is considered a result of this fundamental feature of the *positron* as *entropy*, as detailed in the previous paper, paper 37 ([37]: p14-16).

The hierarchy of field forces from the perspective of Temporal Mechanics shall be reserved for a subsequent paper, where the requirement there will be to explain an absolute event horizon containing all phenomena the way it does, the way we perceive it to, and how physical phenomena is kept in the status it appears to be kept in. The key issue there will be to explain a new cosmology and associated explanation for the redshift effect and black hole phenomena, especially so given the Temporal Mechanics theory here has derived the $CMBR$ to be a primary baryonic operation of the atomic locale, of the time-space template (TST), and not a result of a big bang.

Nonetheless, can new research demonstrate the key theoretic proposals of Temporal Mechanics thus far in a way the physical models using inertia cannot?

12. EM^{DIR} utility

What use is the EM^{DIR} understanding of particle pair production?

What is to note is that four things would result in a chamber capable of harbouring an EM^{DIR} field:

- Electrons and positrons, and thus a form of electric power.
- "Propulsion" of the electrons and positrons, noting that the overall energy and momentum of these particles would need to be conserved in this process.
- Positron annihilation depending on the atmospheric environment it is manifest in.

- Heat from positron annihilation.

The problem with the EM^{DIR} research is properly locating where the positrons and electrons would form in the context of symmetry breaking. Two key applications though can perhaps be put together in demonstration of these proposed $e+$ and $e-$ particles in the particle pair production process, namely:

- harnessing the positron charge and associated annihilation,
- harnessing the electron production in being a potential catalyst for a nuclear reaction (cold fusion), such as with the production of Hydrogen and Oxygen gases from Water.

In one demonstration of an EM^{DIR} field effect, it is proposed that an EM^{DIR} field can be generated and contained in a destructive interference resonance chamber while introducing a positively charged structure into that EM^{DIR} field zone to repel the short-lived positrons, short-lived positrons which in theory would prior their rapid disintegration repel the positive charged structure, and thus create thrust of the positively charged structure away from the short-lived positrons, positrons which would annihilate rapidly on their manifestation owing to their nature as positrons and the environment they would be kept within. In the other demonstration, it is proposed that the enthalpic nature of electron production can be used as a catalyst for "cold" nuclear reactions, producing Hydrogen and Oxygen gas from water.

12.1 EM^{DIR} Experiments 1-6 (EX-1>EX-6)

Temporal Mechanics proposes two things happen with an EM^{DIR} field, the first being *particle pair production*, the second being (associated with *particle pair production*) a gravitational effect in association with such particle formation.

Previous Temporal Mechanics experiments so far have focussed on the gravitational effects of an EM^{DIR} field and how minor those effects seems, understandably so given the "G" constant value ([4]: p7, eq1) compared to the Coulomb constant k_e ([2]: p13, eq13), both values derived by Temporal Mechanics.

To arrive at this proposal, two key things were required to be theorized, namely the mass of the electron and positron as per a supporting theory for the particle pair production effect (paper 36 [36]), and secondary a theory for CP violation, namely why antimatter is outranked by standard matter (paper 37 [37]).

The preliminary *research* preceding the published experiments thus-far, (experiments 1-6, EX-1>EX-6), as contained in papers 7 (EX-1, EX-2) ([7]: p6-16), paper 12 (EX-3) ([12]: p10-12), paper 17 (EX-4) ([17]: p18-22), paper 19 (EX-5) ([19]: p15-19), and paper 22 (EX-6) ([22]: p20-26), started with solenoid coils wound in a forward and reverse fashion to *pattern* the EM^{DIR} field via an electrical current, until it was realised far too much electrical energy as current was required for an open coil system wound back on itself, to a level that it needed impractical levels of EM input. Those EM input levels had to be contained, so it was found to be more practical to use an EM^{DIR} graded resonance chamber for safety and simplicity.

The prior art to this *particle pair production* proposal in this paper is best summarised in paper 32 chapter 6, EM^{DIR} Antimatter Production and Propulsion ([32]: p20-22)

There is a way to demonstrate the particle "pair production" effect.

The basic proposal is to construct an EM^{DIR} field and to demonstrate there is a particle "pair production" in play by measuring two key issues:

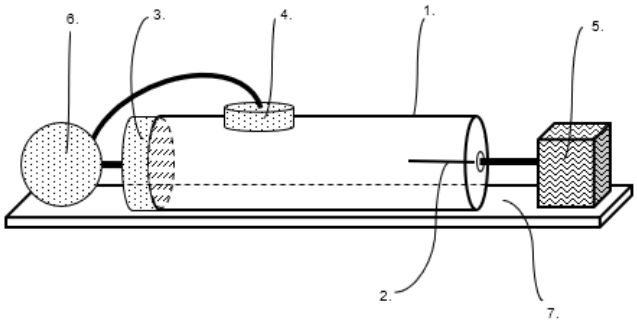
- *Positive charges repel, and therefore positrons would resist a positive charged field.*
- *Positrons self-annihilate rapidly, if not almost immediately.*

The proposal is therefore that there can be constructed an EM-DIR (EM^{DIR}) Antimatter Thruster as an apparatus demonstrating this Temporal Mechanics theory central to the idea of a newly termed electromagnetic destructive interference resonance (EM^{DIR}) field executing particle "pair production", and thus the creation of an electron and a positron.

As per all the preceding experiments (EX-1 > EX-6) [7][12][17][19][22], the EM^{DIR} field is proposed to be created in an EM^{DIR} resonance chamber. In utilising this field, electron and positron production can be demonstrated by having the positrons in the EM^{DIR} resonance chamber repel a positively charged plate in the EM^{DIR} resonance chamber; thrust here would be generated in the EM^{DIR} resonance chamber by the repulsion of the positively charged plate away from the short-lived positrons, creating a singular component of thrust as the positrons quickly annihilate.

As a simple proposal, the EM^{DIR} Antimatter Thruster would comprise of a resonance chamber (1.) that contains the EM^{DIR} field, an internal aerial (2.) providing for the signature destructive interference resonance (the EM^{DIR} field) powered by the RF source (5.), a positively charged EM source located at the distal end of the resonance chamber (3.) or located anywhere else on the resonance chamber (4.) that repels the generated positrons, a RF (radio frequency) power-source (5.) applied to the aerial (2.) within the resonance chamber (1.) to generate the EM^{DIR} field, a positive charge generator (6.) to supply the positive charged EM plates (3.)(4.), and an overall containing bulkhead structure to harness the thrust (7.), all as per figure 3:

Paper 32, Figure 1



Paper 32, Figure 1 ([32]: p21, fig3): basic EM^{DIR} Antimatter Thruster design.

In further describing this process, the resonance chamber (1.) would typically be cylinder designed such that the length and width of the chamber represents any factor of the input RF wavelength of the incoming RF field plus ½ the RF wavelength (out of phase), the point being to effect maximum destructive interference resonance. At the distal end of the resonance chamber (1.) would be placed the positively charged plate structure (3.) to repel the generated albeit short-lived positrons in the resonance chamber,

noting the positive charged plate can be configured anywhere on the EM^{DIR} chamber structure (4.). This positively charged structure (3.) would ideally attach to the same general bulkhead without discharging itself to the wall of the EM^{DIR} chamber (6.) therefore providing a particular zone of thrust for the entire bulkhead EM^{DIR} Antimatter Thruster based on that locality of positive charge on the chamber, a locality of charge which opposes the positrons own positive charge.

Once again, the proposal here is different to the standard theory of generating particle "pair production", entirely the opposite approach to CERN's process. Here, high energy light is not sent into an atomic nucleus. Instead, EM wavefunctions are brought into destructive interference resonance (DIR) to effect particle "pair production". The problem here though, as already noted with experiments 1-6, is that doing such produces a ***large*** *amount of energy in a very short period of time, not fully understood at the time of those experiments, yet now better understood and accommodated for as per the particle-antiparticle generation effect of the EM^{DIR} field.*

The first and second experiments with this EM^{DIR} field, paper 7 ([7]: p6-16), are a good example of what happens there [40], not something to expect after only a few seconds of EM^{DIR} activation using highly inert materials, namely that amount of energy release. So after much theory and associated research, those results were deliberately designed to be toned down, building sequentially with theory a way to contain those energies and what could be going on there, electric, or magnetic, how that could relate with a specific aerial design, and so on, now here though arriving at this new proposal, given how consistently through the testing process the apparatus if given the chance would break down owing to excessive energy production.

The real problem with experiments 1-6 (EX-1>EX-6) was putting the right theory to the EM^{DIR} phenomena being witnessed. Initially, the arcing in the chamber was not very well understood, considered to be a result of fluctuating patterns in the EM field, not understood at the time to be directly associated to the *particle pair production* phenomena. The arcing was also felt responsible for the explosive thrusting on the EM^{DIR} activation (EX-1>EX-2) ([7]: p6-16). Subsequently, all efforts were made to abolish any arcing in the chamber, which was only achieved by limiting the exposure of the chamber to the EM^{DIR} field to about 10 seconds, which then completely removed the explosive thrusting, consequently not demonstrating what was sought, namely the reason behind the thrusting and of course the reason for the arcing.

Through key theoretic steps beyond paper 22 EX-6 ([22]: p20-26), it is now proposed that the arcing was in fact a carrier of positive (positron) and negative (electron) charge discharge, as it only could be, and that in the chamber a *particle pair production* was being made manifest having positrons react with the negative electrical charge of the *particle pair production* process, leading to a continual background and highly explosive arcing (paper 7, EX-2) ([7]: p6-16).

Experiments 3-6 (EX-3>EX-6) were able to produce arcing in the absence of thrust by changing the focus/placement of the arcing in the chamber through a variety of antenna designs and associated structures the antenna would be aligned to. By such, in the absence of thrust in those experiments, yet the persistence of arcing, it is now considered that arcing *alone* would not produce the explosive thrust witnessed in experiments 1-2.

12.2 EM^{DIR} Antimatter thruster (EX-7 proposal)

And so to demonstrate this *particle pair production* effect of the proposed EM^{DIR} field and associated positron-related thrusting, the proposal is for a positive charge to be placed in the EM^{DIR} chamber in such a manner to interact with the manifestation of the $e+$ particles to demonstrate a propulsive effect as per a process of positive-charged plug and $e+$ repulsion, not necessarily eliminating the idea of arcing alone, yet ascribing the EM^{DIR} effects and associated phenomena on what the Temporal Mechanics theory for the EM^{DIR} field proposes, namely *particle pair production*, and thus the formation of $e-$ and $e+$ whereby the $e+$ particles would repel against the introduced positively charge cap/plate, producing what should be positron-cap thrust of both the $e+$ particles and +ve cap/plate away from each other, noting that the $e+$ particles would quickly disintegrate resulting in overall thrust of the +ve cap/plate containment structure, here in this proposed experiment in a more measured and accountable manner though as compared to the Temporal Mechanics experiments 1-2 (EX-1>EX-2).

Figure 14 is a schematic for the proposed EM^{DIR} antimatter thruster (EX-7), as a propulsion mechanism in remaining consistent with figure 1 from paper 32 (in particularly, labels 1., 2., and 3.). Note in figure 14 is the idea of *particle pair production* (selected in region A), together with positron decay (region B), and how despite the arcing/attraction between the positive plug/cap/plate (and positrons, $e+$) with the electrons ($e-$) in region D there is also *repulsion* between the positron ($e+$) and positive plug/cap/plate, a repulsion which outweighs the electron and positive-plug discharge (D).

Figure 16

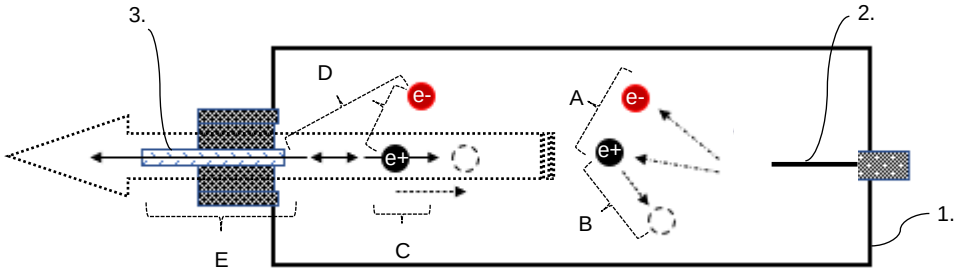


Figure 16: consistent with figure 1 from paper 32 (in particularly, labels 1., 2., and 3.), here the idea of *particle pair production* (selected in region A), together with positron decay (region B), and how despite the arcing/attraction between the positive plug/cap/plate (and positrons, $e+$) and the electrons ($e-$) in region D there is also repulsion between the positron (C) and positive plug/cap/plate (E), a repulsion which outweighs the electron and positive-plug discharge (D).

In short, the EX-7 proposal here aims to not just demonstrate the EM^{DIR} particle pair production effect, yet propose a new mechanism for propulsion systems on the nuclear level, harnessing the production of antimatter in the particle pair production process.

12.3 EM^{DIR} Hydrogen generator (EX-8 proposal)

The idea of harnessing electron production in this EM^{DIR} particle pair production context is the idea of creating nuclear particle entities, and thus a potential catalyst for a nuclear reaction (cold fusion), such as the production of Hydrogen and Oxygen gases from Water, as proposed in paper 27 ([27]: p14), namely that:

- the "confinement" of an atom, as the electron magnetic shell structure (MQS), can be given greater enhancement with a greater EM^{DIR} field strength effect (as theorized in paper 27),
- then a greater atomic barrier enhancement (an enthalpic process) can be brought in effect as a chemical reaction process in harnessing the EM^{DIR} particle pair production effect of electron production being enthalpic

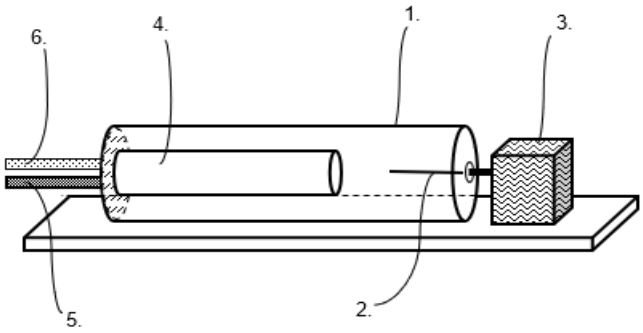
This idea would have useful applications if it were possible to generate an EM^{DIR} field and expose such to a chemical structure for the purpose of atomic particle building (*atomic barrier enhancement*), yet further to this, "molecular" *reconstruction* in the manner of altering how different atoms would share their electron shells in the form of covalent bonds and how exposure to an EM^{DIR} field would effectively aim to bring the molecular atomic constituents into not just a higher enthalpic state yet into a type of molecular break-down with the aim of primary *atomic barrier enhancement*. The following from paper 27 ([27]: p14):

> *The thinking here therefore is that it would be possible to utilise this EM^{DIR} process with electron formation to manufacture certain compounds for fuel, namely the development of compounds in a higher enthalpic state than previously exposed to an EM^{DIR} field, such as for instance in a most basic sense exposing water to an EM^{DIR} field (as an enthalpic process) to produce the higher enthalpic state of hydrogen (H_2) and oxygen (O_2) gas, as per equation 1:*

$$2\,H_2O \xrightarrow[\text{ABE (ENTHALPIC)}]{} 2H_2 + O_2 \qquad (1)$$

> *For instance, as presented in figure 7, an EM^{DIR} Hydrogen Generator would comprise of a resonance chamber (1.) that would contain the EM^{DIR} field, an internal aerial (2.) providing for the signature destructive interference resonance (the EM^{DIR} field) from a RF source (3.), and an EM permeable internal water chamber that would be EM permeable (4.) which would have connected to it a feed-in water pipe (5.) to supply the chamber with water, and a feed-out gas pipe (6.) to extract the formed gases (Hydrogen and Oxygen). The resonance chamber (1.) would typically be an EM impervious cylinder (such as aluminium) designed such that the length and width of the chamber would represent any factor of the input RF wavelength of the incoming RF field plus ½ the RF wavelength (out of phase), the point being to effect maximum destructive interference resonance (EM^{DIR}). The water chamber (1.) and associated feed-in (5.) and feed-out (6.) pipes could be attached to any part of the chamber (1.) provided that they do not interfere with the integrity of the EM^{DIR} chamber in its ability to resonate a pure EM^{DIR} field.*

Paper 27, Figure 7



Paper 27, Figure 7: (1.) the resonance chamber, (2.) the aerial within the chamber connected to the external RF power supply, (3.) the power source, ideally RF field, to feed into the chamber aerial, (4.) the water chamber, (5.) the feed-in water supply pipe, (6.) the feed-out gas (hydrogen and oxygen) supply pipe.

The two greatest problems with hydrogen fuel today are production (given the energy required for Hydrogen production, namely the refinement processes of natural gas, oil, coal, and electrolysis), and storage (given the highly combustible nature of Hydrogen gas).

Here the concept of production is proposed to be on a level of efficiency far greater than that of the four commonly used processes of Hydrogen production (natural gas, oil, coal, and electrolysis) given the nuclear field force driven processes in play with the EM^{DIR} particle pair production process, including how $e+$ particle formation can be harnessed in this process to assist in power-supply systems (an explanation to be reserved for a subsequent paper). Here also with the EM^{DIR} particle pair production proposal the storage of Hydrogen gas should not be an issue if the general transportation of Hydrogen gas is not required, especially given that the process here would allow Hydrogen gas to be produced relatively simply and on demand from water in a broad-spectrum infrastructure system not requiring localized complex central refineries.

13. Temporal Mechanics in perspective

Temporal Mechanics relies only on testable results, from papers 1 to 37 [1-37]. If there were no testable results from paper 1 [1], namely presenting how the time-equation is implicit to the Rydberg equation/constant and can be analogous to the EM and Gravity equations of force, Temporal Mechanics would not have gone ahead. Subsequently, Temporal Mechanics has ***derived*** the following confirmed and testable results using the time-equation and associated Pythagorean (spatial) temporal wave function as being applied to the known metric of the Hydrogen atom, namely the Bohr radius a^0:

- EM and G temporal analogue equations of force ([1]: p9-14)
- Rydberg constant and equation ([1]: p15-17)
- Electric monopole and magnetic dipole as a temporal wave function ([2]: p12)
- Temporal EM wave function related to atomic locale ([2]: p6-15)

- Atomic locale scale with the temporal EM wave function ([2]: p13-15)
- Fine structure constant α ([2]: p15, eq9)
- Value for c ([2]: p16, eq10)
- EM coupling constant k_e for the charge force equation ([2]: p13, eq13)
- Electron shell energy quota ([2]: p17-20)
- Planck equation analogue $E = hf$ ([3]: p3, eq1)
- Chaos equation (initial conditions) ([3]: p4, eq2)
- Gravity constant G (initial proposal) for the gravitational force equation ([4]: p5, eq1)
- EM constant Q (initial proposal) for the charge force equation ([4]: p5, eq2)
- Atomic crystalline structure regarding particle location ([4]: p8-11)
- Avogadro's number N_A ([4]: p12, eq 6)
- Entropy-enthalpy dynamic of the atomic locale ([5]: p3-11)
- Negative energy proposal for gravity ([7]: p2-3)
- EM^{DIR} experiments 1 & 2 (EX1-2) ([7]: p6-16)
- Primary mathematical time-equation derivation ([8]: p3)
- EM^{DIR} experiment 3 (EX-3): ([12]: p10-12)
- Maximum redshift value proposal ([13]: p9-12)
- Variable h equation for extra-atomic light ([13]: p11, eq5)
- Oort cloud distance from Sol ([13]: p11, eq8)
- Atomic temperature scaling system ([14]: p23, fig6)
- Vacuum energy factor V_A ([14]: p23, eq8)
- Vacuum energy value ([14]: p23-24, eq9-10)
- Lamb shift value ([14]: p22-24, eq9)
- Preliminary Boltzmann constant ([14]: p26, eq17)
- Cosmological $CMBR$ value ([14]: p24-25, eq12)
- $CMBR$ temperature ([14]: p25, eq13)
- Perihelion of Mercury ([14]: p27-28)
- π-algorithm ([15]: p4-7)
- Euler's equation as time with energy ([15]: p11, eq6-8)
- EM^{DIR} experiment 4 ([17]: p18-22)
- Energy and mass relationship equation (fundamental properties) ([19]: p10-13)
- EM^{DIR} experiment 5 ([19]: p15-18)
- Entropy-enthalpy equation ([20]: pp10, eq2-3)
- Time-equation electron cloud description ([20]: p11-13)
- Boltzmann constant microstate refinement ([20]: p20)
- Linking EM with G ([21]: p14-23)

- Gravity as entropy ([22]: p4-7, p13-17)
- Mass-energy fundamental relationship ([22]: p17-19)
- Bose-Einstein condensate ([22]: p19-20)
- Atomic pulsar signature ([22]: p20-23)
- EM^{DIR} Experiment 6 ([22]: p23-26)
- Particle location derivation from the time-equation ([23]: p12-20)
- Time-point aether proposal ([23]: p15-17)
- Proton/neutron mass from electron charge ([23]: p22)
- Vacuum permittivity ([23]: p29-30, eq5)
- Vacuum permeability ([23]; p29-30, eq7)
- Alternative-derivation $CMBR$ value (GHz) ([24]: p26-27, eq1-6)
- Elementary particle sets of subatomic particles ([25]: p40-48)
- Higgs mass ([25]: p45, eq9)
- Mass gap (Mass of neutrino) ([25]: p51, eq10)
- Asymptotic freedom, Kaons, Baryon Asymmetry ([27]: p10-12)
- Particle confinement (ABE) ([27]: p12-13)
- Resolving Bell's Theorem [29]
- 5 principles of simplicity (timespace) ([30]: p12-13)
- $X17$ particle as the magnetic quantum shell mass ([30]: p19-20)
- Pauli principle ([30]: p18-19)
- $CMBR$ polarization ([30]: p21)
- Heliopause distance from Sol ([32]: p14-15)
- Bow shock distance from Sol ([32]: p15-16)
- Black hole and stellar phenomena proposal ([33]: p4-17)
- Distance to nearest apparent star ([34]: p24, eq2)
- Apparent age of universe ([34]: p25-28, eq4)
- Apparent age of milky way ([34]: p28-29, eq5)
- Neutrino-antineutrino mass pair derivation from Planck length ([35]: p27-28, eq2)
- G constant from neutrino mass ([35]: p28-29, eq3)
- Mass of the electron and positron from Planck length ([36]: p15-18, eq1)
- $Time = space$ equation ([36]: p19-21, eq3)
- Maximum mass of Sol ([36]: p24-25, eq8)
- Planck length from maximum mass of Sol ([36]: p27-28, eq11)
- The *axiom* of time ([37]: p8-11)
- Entropy and enthalpy as features of time's arrow ([37]: p14-18)
- CP violation aetiology ([37]: p14-23)
- Isotropic $CMBR$ aetiology ([37]: p29-31)

- Quasiparticles and phonons (this paper)
- Particle pair production (this paper)
- Symmetry breaking (this paper)
- Aetiology of electron and positron charge (this paper)
- Aetiology of electron and positron spin (this paper)
- Proposed electron radius r_e (this paper)
- Proposed proton radius r_p (this paper)
- Resolving the “proton radius puzzle” (this paper)
- Π linking r_e and r_p (this paper)
- Electron black body radiation ($CMBR$) (this paper)

All the equations can be confirmed with current and past research in physics, noting that all the above has been “derived” in applying the time-equation to space and thence using the known scale of the Bohr radius a^0, as presented in paper 2 [2]. In other words, a specific equation for time when applied to Pythagorean space with a known scale for space as a reference, namely the Bohr radius, is able to derive the fundamental principles behind physical phenomena. It simply means that there is a fundamental principle of time and space in play with numbers as a process that is wired to our perception ability of time and space, not solely though in the temporal datum reference of *time-now*, yet extending to *time-before* and *time-after*.

It is with some confidence therefore that the two proposed experiments (EX-7, EX-8) should prove fruitful.

In short, Temporal Mechanics links testable results in a way Einstein’s theories of relativity together with Quantum Mechanics and the standard model of particles cannot. How? Temporal Mechanics accepts there is a more fundamental basis to explaining reality than inertia, than "reaction", and thus of going beyond the idea of inertia, of reaction, to properly define *action*, and thus utilize a new mathematical formalism, to go beyond the idea of inertia as reaction to then positing the idea of *action with time*.

14. Conclusion

A list of key features in physics theory have been derived in this paper, including Quasiparticles, Phonons, quantum tunnelling, particle pair production, symmetry breaking, the spin and charge of the electron and positron, the radius of the electron, the radius of the proton, and electron-based baryonic black body radiation, all in the context of the newly proposed EM analogue temporal wave function. Simply, Temporal Mechanics can predict and test for these phenomena with pure theory, already known/confirmed phenomena, and thus seemingly be on the front foot with physical phenomena, and not the *inertial* back foot.

Indeed, inertia is a *reactionary thing*, a *resistance*, primarily, to anything acting against its current holistic context of field force activity and yet more importantly natural *yielding*. *Inertia* is a measure of how a body resists its motion, as a reaction; it is a great way to put everything on the back foot, especially time, having time paradoxically ask us to search into past events as a process of practical examination of events, a virtual anti-time exercise.

As a species, it is becoming apparent that we're at the point of pushing on reality and reality pushing back in a way we can't accommodate for other than we understanding how to be active with reality, in time, and not guiding ourselves on being inertially reactive as we have per our sciences; in other words, we've reached a point in our history where we need to be on a proper front foot with physics theory, something consistent with what's real, what's ideally ahead for our survival, to have us be a proper part of the natural action in play. Here Temporal Mechanics can conclude that time is a key underlying principle to the existence of matter best appreciated *on the front foot*.

Conflicts of Interest

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

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For ease of search functionality, the complete PDF of Temporal Mechanics containing all its current papers as listed here [1-35], is available from the following link (Non-Open Access):
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