

Abstract

The Extended Rishon Model is currently in continuous development, expansion and clarification, yet with nothing found that is contradictory to its initial foundations as of over three decades ago. However there are a series of recurring themes that have a large body of evidence to support, some less-well-confirmed themes and a body of hypotheses that need significant further exploration. This document - which will be continuously revised - therefore keeps track of the different categories in order to avoid repetition, and to make it much easier for others to understand the Extended Rishon Model.

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1 Introduction

Let $\tau = 2\pi!$ [19] As explained in the Abstract, this document is divided into sections with: first an overview of each section at its corresponding level of "statistical correlation" (from highest to lowest level of empirical confirmation) but without significant or comprehensive justification, followed by a more thorough explanation and in-depth analysis of each.

The sections are divided down as follows:

- High degree of certainty "Fundamentals". For this category there will be a significant degree of independent corroboration from a wide range of independent sources.
- High degree of certainty "Implications". These follow on from the "fundamentals" but are sufficiently large as to warrant their own section.
- Medium degree of certainty. For this category there will be at least one source that supports the hypothesis, but that further exploration is still underway.
- Low degree of certainty. This category primarily contains working hypotheses, intuitive reasoning and work-in-progress for which no or very little evidence has yet been found (or explored).
- Research, notes and evaluations. Covers key insights and ongoing evidence collation.

It is *particularly* important to note that it is most emphatically **not** the case that the statements (declarations) are made as either fact or "laws", on the basis that to do so is to be "certain", making it pathologically impossible to revise (or rework).

1.0.1 Key equations

$$E_{\hat{x}} = E_{0\hat{x}} e^{-i(kz - \omega t + \psi_{\hat{x}})} \quad (1)$$

$$E_{\hat{x}} = E_{n\hat{x}} e^{-i(kz/2)} e^{-i(-\omega t/2)} e^{-i(\theta/2)} \quad (2)$$

where $-\omega t/2$ is the rotation over time of the elliptical polarization axis, and where the relationship between each of the particle's elliptical polarisation axes may be expressed as:

$$E_{n\hat{x}} = E_{0\hat{x}} e^{-i(\theta)}, \theta = n\tau/12 \quad (3)$$

From Castillo (Spinor) superposition paper:

$$A^2 = A_1^2 + A_2^2 + 2A_1A_2 \cos \frac{1}{2}(\Theta) \cos \frac{1}{2}(X + \Phi) \quad (4)$$

where A is the superposition result $E_{\hat{x}}$, A_1 and A_2 are the two elliptical vectors being superimposed, Θ is the angle about z between the two vectors (including phase delay), X is the starting phase of A_1 (n of equation 3) and Φ is likewise the starting phase of A_2 .

1.0.2 Key diagrams

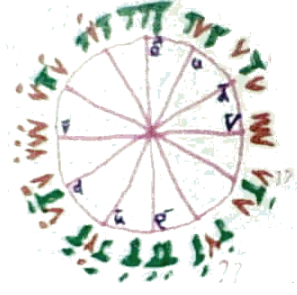


Figure 1: Twelve Rishon positions

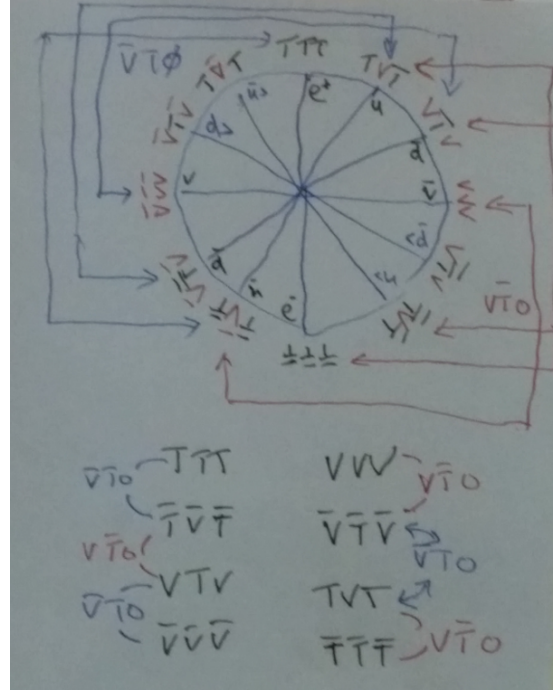


Figure 2: Right-chiral $\overline{VT0}$ Phase Transforms

1.1 High degree of Certainty, Fundamentals

This section's declarations are preceded by the qualifying condition "The working hypothesis which has a large degree of independent corroborative evidence to support is:" which is left out from each statement so that it does not detract from each. As it is such a huge list, the fundamentals are covered first.

1. There is only light. There are only photons. There are no forces other than electro-magnetism (and possibly gravity). Particles are simply elliptical-polarisation of space in a circular mobius arrangement satisfying the group $SU(2)\times U(1)\times U(1)$ that is non-radiating, self-contained, self-protecting, self-stabilising, infinitely-stable and completely frictionless (because they're photons).
2. Rishons do not exist per se but, after summing them up, the total Tohu and Vohu may be used to "map" (as a unit-vector in the complex numberspace with T representing real and V representing imaginary) onto a phase diagram, best represented by a gaussian exponential $\exp(-i\phi\tau)$ where ϕ is integer increments from 0 to 11 (see figure 1 and equation 3). Thus we may never see an individual Rishon but the terminology and insight remains fundamental and mathematically valid when the Rishons are joined together into their triplets as a very important reminder and representation of the phase angle from which they are derived *and their vector*.
3. Hypercolour is a convenient reminder of the "braiding order" of the photons, to represent three key points on the phases that must remain in sync, such that during superimposition the end result is a uniform (unit vector) pattern.
4. Whilst right-chiral up and down are at 1 and 8 'o'clock respectively, left-chiral up and down are at -1 and -8 'o'clock (which map to 11 and 4 'o'clock respectively). Likewise with the left-chiral corresponding anti-particles. Thus we have a natural and complete representation not only for the base quarks and the neutrino and electron as well as all anti-particles but also the handed-ness of all the same, as well.
5. The equations used to express elliptically-polarised mobius light (see equation 1) is a strong fundamental basis for representing Rishon "triplets", that occurs in the field of optics as well as Friedmann-Robertson-Walker spacetime and more recently in Joy Christian's EPR-Bell proof, as $SU(2)\times U(1)\times U(1)$. It is characterised by a double exponential function (Christian's EPR-Bell Equation 81) where the first part contains an angle that is half that of the second (thus creating and representing the mobius characteristics and simultaneously providing a strong mathematical foundation and basis for spin half).
6. Rishons "triplets" - the base 12 particles - superimpose through the application of Jones Calculus to factorise out a common exponential base that is *identical* to the second part of the double-exponential from its constituent triplets corresponding equation(s), leaving a *static* (unchanging) phase angle in the first part that is, through Jones Calculus and thanks to the unique characteristics of gaussian exponentials (including modulo τ arithmetic), tantamount to the *summation* of the vectors in the complex number field... **BUT**...
7. ...again thanks to the unique properties of gaussian exponential mathematics when applied to mobius topology, it is an unfortunate but extremely elegant mathematical coincidence that the summation of the vectors, for all legitimate compound particles, *happens* to coincide with a phase angle on the Rishon phase map of figure 1. This very (unfortunate) elegant mathematical coincidence explains both why there are only 12 valid Rishon Triplet phases, but also why not only all researchers who have explored the Rishon Model have not been able to find a (complete) guage group onto which to map the Rishon Model to date (including the author), but also, as outlined in Joy Christian's paper, why proponents of the Standard Model have missed this crucial insight as well. Everyone is summing the vectors representing "charge" instead of summing the *phase angles* (in a mobius topology): an insight that has misled researchers to explore $SU(3)\times U(2)\times U(1)$ extensively instead of the much simpler and much more elegant $SU(2)\times U(1)\times U(1)$.
8. Maxwell's Equations (or an improved derivation thereof, candidates include the $O(6)$ Clifford-based equations derived by John Williamson) apply as the fundamental underlying basis for both the internals of particles as well as the interaction with all matter and all photons, because particles *really are* just photons. There *really is* nothing in the universe except photons, where it just so happens that some of those photons have managed to get themselves into infinitely frictionlessly mobius-ly-looped elliptically-polarised (and for compound cases, superimposed and phase-harmonic) configurations, representing a perfect positive-feedback (and thus self-stabilising) energy-conserving **non-radiating** counterbalance between the torsional field (Orbital Angular Momentum as the elliptical polarisation axis of each component

rotates on its mobius path), Angular Momentum, and the resultant E.M. field both inside their orbital radius as well as out, obeying nothing more complex than Maxwell's Equations, through and through. The first person in the world to properly explore (and solve) some such configurations to within 10 decimal places of current experimental uncertainty is Dr Randell Mills.

9. The non-radiating condition is **absolutely critical**. Any mathematical equation (for example the Schroedinger Equation unless $v \ll c$) which is attempted to be applied in *any* theory of particle physics that may be demonstrated and proven to be "leaking energy" is **by definition** a completely invalid basis on which to model particles. Particles do not "leak" energy: they remain stable without dissipating. This is an undisputable undeniable fact. Conservation of Energy is an undisputable undeniable fact. Particles simply do not vanish into thin air through dissipation of their internal energy. The Schroedinger Equation in particular is completely invalid to use as the basis for a model of particles because, if particles are photons travelling at the speed of light, $v = c$ and it goes rapidly downhill from there.

1.2 High degree of Certainty: Implications

From the fundamentals of the preceding section, the following (increasingly derivative) logical implications follow. They also are preceded by the same qualifying statement as the preceding section.

1. Through the superposition capacity of the underlying mobius elliptically polarised E.M. field equations, compound particles such as the neutron, proton, pion (including the ρ pion which is a 4-way superposition of up and down quarks), mesons, muon - *literally every single particle including gluons and Bosons* - may simply be represented by the superposition of Rishon Triplets, as long as the end product fits onto one of the major compass points (representing ± 1 electrical or ± 1 magnetic charge). The exception to this observation appears to be Baryons (the pion family) which may be both ± 1 electrical *and* ± 1 magnetic charge, simultaneously.
2. Even the larger quarks (charm, strange, bottom, top) may be demonstrated to be the superposition of Rishon Triplets in different configurations. The configurations currently noted so far include two (pions), three (proton, neutron, charm, strange and bottom), four (ρ pion), five (ultra-quarks - see below - and "top") and "stacked" combinations thereof which *also* conform (so far) to the two and three superposition layouts. Ultimately these then simply represent "harmonics" of the underlying elliptically-polarised phase-coherent photon(s). It really is all rather simple and *does not need* anything more complex to map quite literally every aspect of the entire range of particles.
3. The superconducting electron may also be viewed as being simply a double-harmonic of a "stacked" (phase-coherent) pair of electrons-as-Rishon-Triplets. This explains J Hirsch's observation that a superconducting electron's radius is *larger* than a normal electron, as well as providing a natural explanation for electron "Cooper pairs". It's just an excited state (with spin 0) which is absolutely critical to being able to "run the gauntlet" of alternating N-S / S-N electrons in a superconducting material. The change in mass compared to an independent pair of normal electrons may be attributed to the reduction in torsional energy (the reduced Orbital Angular Momentum - reduced turning rate - of the photon(s) on the mobius "strip". As may be seen in Carl Diether and Joy Christian's paper, torsional energy is proportional to $1/r^6$ where r is the radius of the particle.
4. The superposition results *automatically* in the expansion of the radius of the whole to accommodate and counterbalance the increased energy as contributed by the Torsional, E.M. and rotational energy, in a way that is mathematically equivalent and identical to electron covalence "shells".
5. Electron "shells" are therefore simply a special case where the radius of the electron has quite literally expanded right out to its "shell" orbital radius.
6. From the above, it may be logically concluded that there is **no such thing as a gluon**. There is however such a thing as an "ultra-ultra-ultra-short-lived pion" of varying types (which, through the unfortunate use of the "gluon" nomenclature, have all been completely overlooked), with a lifespan measured in a few multiples of a Compton wavelength, or, that, by a mathematically elegant "fluke", that pion (of whatever type) may be viewed as being the phase-differential between a pair of quarks (of any type whose Rishon phase vectors sum to a total identifying as "pion") or that pion may be viewed as being "continuously and seamlessly created and immediately destroyed within a spectacularly-short timeframe".
7. Also from the above, it may be logically concluded that there is **no such thing as a W, Z or Higgs Boson**. There is however a pair of ultra-quarks, corresponding to a five-way superposition of the

appropriate up and down quarks, with estimated "bare" masses somewhere around the 16.5 GeV mark, from which two different charged particles are made named ultra-pions that are mistakenly given the names "W+" and "W-", as well as two neutrally-charged particles which are both mistakenly named "Z", as well as two leptons ultra-neutron and ultra-proton which, from koide-like mass analysis happen to correspond to the two Higgs candidates at 126.0 and 125.3 GeV respectively.

8. Also from the above, it may be logically concluded that there is **NO SUCH THING** as a "**Weak Force**". However the same may just as emphatically *not* be said of the "Weak Interaction", for which there is a very reasonable explanation that comes down to the way in which the (mistakenly-named) W and Z Bosons are constructed. It really is Maxwell's equations (placed into the context of Special Relativity) all the way down.
9. Also from the above, it follows that there is **no reason to have a "Strong Force"**. The Strong Force may be mathematically derived from the fact that the superposition of the quarks results in phase-cancellation (lessening) of the individual quark's E.M. field (and influence), and thus that Laplace's equation may be easily and effectively be deployed. It *really is* Maxwell's Equations all the way down.
10. Conservation of energy is **absolute** and paramount, giving rise to some rules known in Extended Rishon Model terminology as VT0 "Phase Transforms" (see figure 2). These transformations are *required* to be carried out in simultaneous (opposing) pairs. If not, the end result is (with the obvious exception being the kinetic energy of the particles themselves also has to be conserved) the emission of a gamma photon as the sole exclusive alternative means by which energy may be conserved if the VT0 "matched pair" rule is violated.
11. There is **no such thing** as "Particle Decay". There is however a concept known as "Phase Transformations" where the superposition of what amounts to "pions" (aka "gluons") results in two Rishon Triplets (actually four due to the VT0 transforms requiring to be carried out in matched, sign-opposing pairs) undergoing simultaneous Energy-conserving "phase shifts". The "superpositions" of the Triplets in effect becomes an *actual* (permanent) summation, cancelling out the existence of the two (four) former Triplets and replacing them with two (four) alternatives that happen to differ in their Rishon Phase-diagram angle by exactly one positive and one negative phase-difference of $\tau/12$ between each Triplet-pair, respectively. Any phase-shift beyond that $\tau/12$ boundary appears to be either outright impossible or just plain fantastically improbable.
12. This *also* applies just as well to the left-chiral quarks, but the rules for left-chiral quarks differ solely in that the sign of the Vohu (magnetic, complex/imaginary) portion is *mirror-imaged*. Thus we have a natural and logical explanation as to why left-chiral and right-chiral "decay" may not mix: there does not exist a phase-transformation that can "jump the gap" over such a massive phase differential in one single "decay". Over-simply put: the phase angle of left-chiral up minus the phase angle of say right-chiral down is not $\tau/12$. Therefore left-chiral and right-chiral may not interact in decay. You do one or the other, not both, because they *really are* actual different particles. It's really that simple.
13. Time-reversal (Feynman diagrams) apply to VT0 Phase Diagrams. It is therefore possible for a VT0 Phase Transform to create four matched particles (sum total energy and charge: zero), or for four phase-matched particles to annihilate with little (or no) gamma emission, or for one particle to phase-transform into three and vice-versa, or two to phase-transform into two. All combinations are perfectly valid but a bit of a mind-melt to work with.
14. An incredibly important aspect of the application of Conservation of Energy to the intermediate "decay" particles when a W (or Z) Boson is involved is that, because the W (and Z) Bosons are in effect themselves constructed from five pions which happen to come to a total of *four* separate, distinct and simultaneous (energy-conserving, zero-sum, balanced) matched VT0 phase-transforms, there is a *single pair* of quarks as a discrepancy left over, bringing the total to *twelve* matched up and down quarks and anti-quarks, sum total charge of all twelve quarks being *exactly* zero electrical *and* magnetic charge (thus fulfilling the Law of Conservation of Energy). Summary of the consequences of this rather comprehensive statement: **W and Z Boson creation is ALWAYS matched by a corresponding oppositely-charged pion** noting and stressing that there are *two* different types of Z Boson that correspond *directly* to ultra-flavoured versions of the pion0-uu (up-anti-up) and pion0-dd (down-anti-down).
15. Thus it is **NOT** the case that "Charge is Conserved via the intermediary decay particles". This is a fundamental misunderstanding that stems from the (quite reasonable but) mistaken "vector summation" approach taken throughout the history of development of *all* the particle physics models to date, but

characterised in particular in the current version of the Standard Model by its complete and comprehensive lack of rules that do not - and cannot in their current form - take into account the "magnetic" aspect represented by Vohu.

16. Instead, it is the **surrounding space around the particle** that has a "memory" or "imprint" of the particle's E.M. field, in a completely valid (or perhaps identical) analogous way to that of the "memory effect" of water molecules. The *surrounding space*, being an E.M. field, imposes *directly* onto the chaotic mess of the intermediate particles, forcing them to conform to a configuration that is as close to the original particle(s) as possible. Thus, whilst **charge** is not conserved in the intermediary particles themselves (because charge is instead conserved by and in effect *stored in* the **surrounding space** where and so that the intermediary particles **must** obey first and foremost the Law of Conservation of Energy), characteristics such as *lepton number* and *spin* most definitely *are* (conserved).
17. If a near-match configuration end-result set of byproducts may not be found within a time-frame sufficient for the surrounding space to retain the "memory", particularly in the more complex phase-transform arrangements involving multiple simultaneous *VT0* transformations taking place, it simply all begins to fall apart, resulting in the "branching" (alternative byproducts). In extreme cases it all goes to hell in a handbasket, the elliptical polarisation mobius-loop characteristics are lost, the end result being that a straight-line photon is emitted as a "discrepancy". This aspect of the Standard Model is deemed to be valid, and there is no conflict between the Extended Rishon Model and the Standard Model in regards to particle "decay" byproduct "branching".

1.3 Summary of High degree Certainty statements

This is a huge body of very bold statements and implications, which makes it all the more important to qualify them as *not* being "Laws" or as (yet) fully-corroborated. They are however reasonably corroborated in multiple independent ways, none of which contradict either the statements or the implications, but instead strengthen them and increase the probability of the theory being sound... without actually providing a full formal mathematical proof.

The trail of derivation began with the initial Rishon Model, and was followed up by expansion into the "levels" which were later clarified as being superpositions under an expanded radius. The phase diagram was added recently after a breakthrough insight based on Jones Calculus. That was then followed by learning that $SU(2) \times U(1)$ groups had been explored in-depth in the late 1970s and early 1980s, but that these were abandoned in favour of $SU(3) \times U(1)$.

Joy Christian's insight from his EPR-Bell proof that $SU(2) \times U(1)$ is equivalent to $SU(3)$ but, crucially, respects and formally recognises that critical and fundamental mobius topology which, it is suspected, be the key to unifying the insights of the Extended Rishon Model and the Standard Model as it currently stands, in combination with a recent discovery of a mathematical paper that shows Jones vectors to be directly equivalent to a spinor on a Poincare sphere in $SU(2)$ [12].

The one absolutely crucial overall insight that can be said is that it would appear that there is *no need* for complex groups $SU(2) \times SU(2) \times U(1)$ or $SU(6)$ - it really does appear that anything that fits on top of mobius-looped elliptically-polarised light (such as $SU(2) \times U(1)$ or $SU(2) \times U(1) \times U(1)$) would be perfectly sufficient to describe *all* particles and *all* interactions between particles, given that it would appear that particles are simply superposition of the fundamental 12 "phases", expanding the radius to accommodate the required balance of charge(s), then solved using Laplace's Equation.

It's a long trail that is near-excruciatingly painful to follow in its level of detail (particularly the phase transforms) but is logically consistent... just not yet "formally" complete.

1.4 Medium degree of Certainty

This section's declarations are preceded by the qualifying condition "The working hypothesis which has a reasonable degree of independent corroborative evidence or self-consistency to support is:" which, again, is left out from each statement so that it does not detract from each.

1. The puzzle of the neutrino may potentially be explained by its lack of electrical charge (but presence of magnetic / imaginary charge) allowing it to drop to a fantastically-low radius (with enormous angular momentum as a result). That does **not** prohibit it from being expanded out to a much larger radius if it is incorporated into or interacts with other particles.

2. In phase transforms, the matched pair of gluons (aka ultra-short-lived pions) resonate at the same frequency (wavelength i.e. radius) as the particle from which they originated, so may **not** mix directly with particles of different "families" (different radii). However once they have coalesced into actual pions, they may lose some of their energy or gain it (in the form of momentum or reduction of momentum), reduce (or increase) radius accordingly and thus "jump family levels" so to speak. It would appear however that there *may* result in the creation of particles which have a large (temporary, excited) radius, that is then shrunk and imparts a corresponding velocity as a result. This is a very recent insight so is still under investigation.
3. VT0 Phase Transforms are likely to only involve "single click" (phase shift of only 30 degrees) operations. There *may* be special circumstances where a 60 degree shift occurs but it is highly improbable due to the energy differential being too large.
4. There *may* be some form of flavour-oscillation going on between W Bosons and their corresponding oppositely-charged pion, similar to the bottom-strange dual-oscillation.
5. Whilst the elliptical polarisation mobius characteristics are fairly clear, it's not so clear as to exactly *how many* photons (one, or more, or infinite harmonics) are actually on any one orbital elliptical path within particles. The maths works regardless, but it would be nice to know.

1.5 Low degree of Certainty

This section's declarations are preceded by the qualifying condition "The working hypothesis which has a low degree of independent corroborative evidence or self-consistency to support, but is worth documenting and pursuing further to find out either way is:" which, again, is left out from each statement so that it does not detract from each. One aspect of these statements is: they are ridiculously difficult to prove **or disprove**. Some things however can actually be tested or analysed.

1. Vohu conveys "magnetic field" presence as in accordance with Maxwell's Equations. Both the neutron and the neutrino have "magnetic" presence (charge). Therefore, it may reasonably but tentatively be suggested that *anti-neutrinos orbit neutrons in shells in exactly the same way that electrons orbit protons*. This has huge follow-on implications.
2. If it is reasonable to assume that neutrinos orbit neutrons in shells the anti-neutrinos would do so by "jumping" to a larger radius in *exactly* the same way that electrons also jump (spread) to a larger radius, swapping enormous angular momentum for radius in the process.
3. The age-old perspective of magnetic "flux" would therefore potentially and ironically be correct: anti-neutrinos would "jump" in the direction of the "flux", being the "conveyors" of magnetism. Their ability to jump flavour (energy level) could be an important means of conveying more energy than otherwise anticipated (reducing temperature in the process).
4. The mass of the neutron therefore *might* be mistakenly incorporating a single anti-neutrino in its orbital (single, first) shell.
5. The anti-neutrino's tendency to fluctuate, *if* it is orbiting a neutron, *could* be responsible for the neutron's instability.
6. It *might* be the case that neutrons don't like being "magnetic ions" (in effect magnetic monopoles) so are unstable as a result, trying (unsuccessfully) to "steal" anti-neutrinos from the surrounding space and failing to find the required energy to do so. If they did succeed it would be at the expense of creating a neutrino in the surrounding neighbourhood, which would quickly get very unhappy and destabilise the neutron... this is highly speculative however.
7. A very careful and comprehensive analysis of the properties of all known elements, laying out "shells" according to the number of neutrons instead of number of protons, then paying careful attention to their magnetic properties, *might* show some correlation with the tentatively proposed neutrino "shell" concept. Diamagnetism and other properties in particular. Also, it would be fascinating to see if some of the anomalous "unexplainable" shell positions for electrons correlate in some way with the hypothetical "anti-neutrino" shells.
8. If neutrinos do indeed orbit neutrons in shells then two neutrons which successfully find anti-neutrinos (which, as we know, is incredibly hard to do if they mostly travel at the speed of light), should bond

together, creating neutron-neutron: a fantastically-stable, electrically-neutral, magnetically-neutral, non-reactive, non-interacting compound. Sounds pretty much like "Missing / Dark Matter", doesn't it?

9. Gravity *might* just be a side-effect of electro-magnetism. This isn't exactly a new theory but in light of (pun intended) light being the constituent candidate for the internals of particles it would make sense to re-evaluate that.
10. The 10dp discrepancy on Maxwell's Equations is particularly annoying and tells us that the full story is not yet known.
11. In the modelling of how the photons rotate on the orbital path it was not clear whether the elliptical axis rotated about the Z-axis by the same degree that the photon also travelled, or whether the elliptical axis remained (cartesian-style) in the same plane it originally started from. The significance of either choice is not yet clear and there is insufficient information available to determine which.
12. It *might* be possible that some of the left-chiral and right-chiral up and down quarks have been mis-identified. Left-chiral anti-up at 7 'o'clock *might* actually be Right-chiral anti-up for example but with Left-chiral up *remaining* in its present 1 'o'clock position: it is highly unlikely but cannot be ruled out. The author has a vague recollection dating back to 1986 of trying various combinations and getting into all sorts of trouble before settling on the current working hypothesis seen in figure 1.

2 Expansion on High-certainty Fundamentals statements

2.1 There are only photons

It's simply an application of Occam's Razor. Which is more likely to be true: that there are an overwhelming number of forces with no direct proven and established link to reality, or that matter is self-looped photon(s) in previously unnoticed stable configurations? Dr Randell Mills takes this premise to its logical extreme and builds on the fundamentals of Maxwell's Equations to map pretty much the *entire* set of elements and much of particle physics along the way to in most cases an accuracy of 10dp, only going out to around 7dp when larger elements around the 100 atomic number are involved.

There are a huge number of other papers that likewise explore the concept that matter is simply photons, and there is a huge amount of corroborating evidence to that effect. Qiu-Hong Hu, G Poelz, John Williamson, Ido Kaminer et al, as well as some obscure papers showing a link between optics and spinors, some of which demonstrate the concept that photons may have angular momentum *without also having straight-line momentum at the same time*. Freund's theoretical mobius elliptical polarisation work dating back to 2009 was experimentally confirmed recently in 2015 once materials science caught up to be able to create the required Gaussian Beams.

The only "force" left which may or may not actually be related to (or a side-effect of) electro-magnetism is gravity. Exploration of this is left for later (lower-certainty) sections and is not strictly part of the Extended Rishon Model anyway.

2.2 Rishons do not actually exist but need to be respected

It was a long, long time - thirty one years - before the author realised that Rishons are a sort-of mathematical coincidence, whilst, at the same time, is very important to respect both the phase diagram and the vector (sum or superposition). The initial insight that allowed the author to independently derive the Rishon Model back in 1986 was the question as to why quarks would *only* have non-unit charges. Being immersed in A-Level physics and maths it was natural to surmise that Tohu would represent electrical charge (or the real plane) and that Vohu would represent magnetic charge (the imaginary plane).

What the author did *not* know back in 1986 was all the things about I/Q polarisation of radio waves (photons), that the polarisation and the E.M. field could be represented in the complex numberplane, although the local Ham Radio operators at the school led to some minor exposure to the concept. So all that came later.

After reading Ido Kaminer et al's work in the field of optics, John Williamson's paper, as well as the work of Dr Randell Mills on GUTCP, and the 2015 experimental-based publication and confirmation of Freund's elliptically-polarised "Mobius Light" work dating back to 2008 and before, the idea that the Rishons would map directly to a unit vector being rotated in the complex numberplane *really* should have occurred a lot sooner than it actually did.

So where we have to respect Rishons is that they have *two* relevances: firstly in their sum totals to 1, 0 or -1 (if we wish to be specific that is for Tohu: more accurately i, 0 and -i apply for Vohu), and secondly in them *simultaneously* representing 30 degree multiples away from their respective axis in the real and complex numberplane, respectively. As explained later this is a very important and beautifully elegant mathematical coincidence that comes down to a combination of the trigonometric properties of an equilateral triangle and the additional properties of gaussian exponential operations under a mobius topology.

One fascinating observation discovered recently: the Rishon Phase Map is remarkably similar to a map of Q (Charge) vs "Weak Mixing Angle". Interestingly there are only two clear discrepancies (left-hand up and right-hand down). If we multiply the distance from the Y-axis by two, in both cases the similarity is restored. The only other major discrepancies are the right-hand electron, left-hand positron, and the left hand electron is also a bit further off to the left of the Y-axis than expected. Even the W Bosons are where they might be expected to be, around magnitude root 2 at 45 degrees, representing in effect the cancellation of electrical charge and its replacement with magnetic, or vice-versa. These similarities would be fascinating to explore in-depth, particularly why the layout has more in common with a square than a circle. One possible explanation for that is that the distance from the Y axis must be divided by the electric charge (2/3 in the case of up and 1/3 in the case of down). This would put the mixing angles much closer to unit vectors and restore the circular approximation.

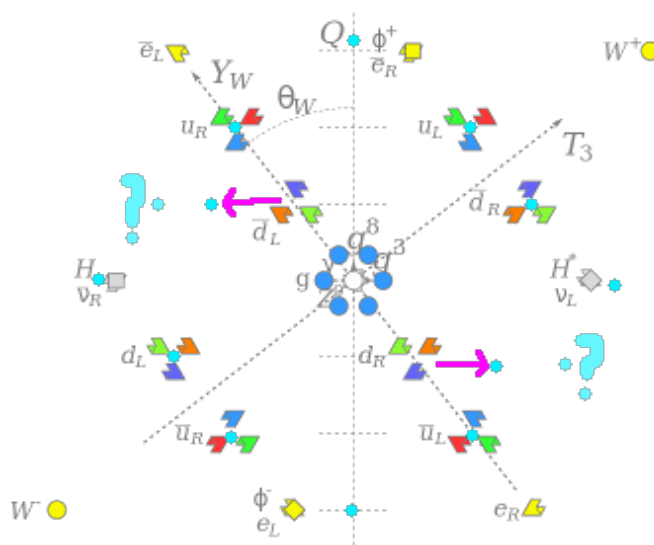


Figure 3: Q (charge) vs "Weak Mixing Angle"

2.3 The reminder of Hypercolour

During the hypercolour analysis an attempt was made to "spin" three quarks (Rishon Triplets) through a 360 revolution, keeping equal-coloured Rishons in close proximity as they rotated. After only 180 degrees it was noted that a naive 2D rotational arrangement simply wasn't going to work: the hypercolour (proximity test) wouldn't match up. That was where the breakthrough insight of the possibility of a mobius configuration came from. With a mobius configuration, the proximity of similarly-coloured Rishons would remain close.

This analysis provided an independent if rather unusual confirmation of the characteristics of elliptically-polarised mobius light as a potential candidate. So whilst, again, it may be concluded that Rishons do not actually exist "per se", there is a constant reminder of our need to respect that which they represent.

2.4 Chirality 'o'clock

The phase map threw up four anomalous (empty) positions that, after a little thought, were clearly the left-chiral quarks. The Rishon "Group" analysis paper covered (using python2) some rotation and other transformations that confirmed the unique nature of the twelve phase positions, as well as (very importantly) confirming the various identities including the fact that the neutrino does not have a "handed-ness" variant (or that they are synonymous).

All of this falls directly out of the mobius topology, so one of the tasks on the TODO list is to gain access (somehow) to the papers that were published as far back as 1978-1985 as related to the $SU(2)\times U(1)$ gauge group... or to find someone to work with to re-derive them, paying special close attention to the mobius characteristic.

2.5 The recurrent theme of Double-gaussian exponentials

The recurrence of the mobius double-gaussian exponentials across the field of optics and in particle physics is really quite high, which really should have been a huge clue all along.

Following a trail of leads provided independently by Professors Qiu-Hong Hu and G Poelz respectively, the first occurrence of "mobius" characteristics (not that the author identified them as such at the time) was in Ido Kaminer's work on non-paraxial gaussian beam superposition solutions. Ido and his team noted that the phase of *all* of the constituent parts rotated by *half* the angle of their curvature, which was interpreted to be a good candidate onto which to map the characteristic of "spin half".

In retrospect, looking right now at the wikipedia page on Jones calculus, section "Axially rotated elements" it is blindingly-obvious that elliptically-polarised circularly-looped light would also display mobius characteristics: it's *right there*: axial rotation by $\theta/2$ is performed by a simple 2D rotation matrix involving θ , **not** $\theta/2$.

Joy Christian's EPR-Bell proof has a critical equation 81 which is the multiplication of two exponentials. It is preceded by a very important and insightful paragraph that helps understand what is going on in a geometric (3 dimensional) sense. The paragraph *following* it allows us to then understand why it is that each of the particles, having initiated from a *different* position on the phase map, are *unique* and thus completely different from each other. Thus we can say that the "Group" for the Extended Rishon Model has been found, and it is $SU(2)\times U(1)$, which is very very fortunate because that's the one that was proposed in 1961, for which Sheldon Lee Glashow, Abdus Salam and Steven Weinberg received the 1978 Nobel Physics prize.

However to be absolutely honest, without detracting in any way from the importance of Group Theory (in particular because of its extreme effectiveness in predicting "branching") it really does appear to be much simpler to follow the application of Maxwell's Equations in the field of optics as a way to comprehend what is going on. The only down-side is: the only person who has successfully solved Maxwell's Equations (from a Classical perspective) for these kinds of elliptical topological configurations involving circular loops of elliptically-polarised light is Dr Randell Mills, and even there, the configurations that he solved are (in essence) restricted to the electron, the neutrino, the proton and the neutron, which was (and is) the primary focus of his life's work.

Within his work there is a cursory exploration of the proton that makes sense as a way to accurately derive the proton (and then the neutron) anomalous magnetic moment, but it is nothing like as bare-bones first principles as the work covering the neutrino and the electron. The reason is: very simple: even Dr Mills has been seduced by the concept of gluons, and he hasn't explored it because he didn't need to as a way to justify the commercial investment in Hydrino production and experimental confirmation.

It is also worthwhile remembering that $U(1)$ is directly represented by a single gaussian exponential, and that there is also a huge recurrence of single exponentials right across the board. It would be foolish to ignore all these hints.

2.6 Rishon Triplets and Jones Calculus

The superposition of the elliptically-polarised mobius light was noted from Dr Randell Mill's work, and was found by accident after trying to make sense of Freund's equations. The following question was asked: if it is reasonable to assume that photons may superimpose without self-destructing (becoming the sum of their superposition as a single entity), where, according to the experiments in "Braided Light" it is indeed perfectly reasonable to make that assumption; if it is further reasonable to assume that, as part of the superposition, the radius would remain the same, the rate of rotation remained the same, the phase separation (rotation about the Z axis if we assume the photons to be orbiting in a circle confined to the XY plane) between them remained constant at all times, and the number of twists (one) as each photon arrangement did so *also* remained the same, then could there be some sort of mathematical magic that allowed the photons (particles) to have their E.M. fields be at right-angles to each other, as well as "sum" to something sensible instead of something mathematically completely bonkers, completely unstable and impossible to fathom, all at the same time?

The answer it turns out was yes, but only under some very special circumstances that happened to *only* apply to Mobius-style gaussian exponential configurations, which also by a complete fluke happened also to map to *exactly* the rules that had previously been derived for the VT0 phase transforms, which was a huge relief as it was a bit of a concern that that might not be the case.

Extending Castillo's work on superposition of Jones vectors as spinors [13] it has been possible to show the conditions under which Rishon Triplets would superimpose (coexist) without unstable constructive or destructive interference. As anticipated the conditions are that, exactly as shown with pieces of paper stacked on top of each other in earlier work to represent "mobius light", the Rishon Triplets "path" (their E.M. fields) must be at right-angles to each other [6]. This is achieved through a phase shift of 180 degrees, which, thanks to the unique properties of elliptically-polarised light, results in the elliptical axis being offset by exactly half that amount: the exact required conditions whilst at the same time providing a symmetric balance between the photons on their orbital circular paths.

This result, which, when reviewed in the context of the Rishon "I-Frame" which was empirically-derived from statistical analysis but otherwise entirely mathematically unjustified, *confirms* the I-Frame's layout, with the interesting discrepancy being that, of the two identical triplets in for example the proton and neutron layouts, one of the (identical) triplets is inverted 180 relative to the other. This was not anticipated and could not have been predicted purely from the "visual" representation used for the past thirty years, and is an important result.

2.7 The elegant and unfortunate mathematical accident

The expression for one particle using equation 3 may be substituted into the other particle's equation 2, then some amazingly simple gaussian exponential refactorisation results in an equation where the second exponent part is identical to that of the two contributing ones which are undergoing the "superposition" to create this new third equation.

The first part of that new third equation has a new "static" term which is the *sum of the two contributing E_0 vectors* plus a term that is twice the difference between the two phases. This is very very important and it is why the Rishon Model's derivation must be respected and not ignored. The "rules" of particles have to respect *both* the phase angle *and* the superposition of the vectors, making it a near-impossibility to satisfy if it wasn't for the unique mathematical properties of gaussian exponentials under a mobius topology. Along the way we also collected an insight as to why there are only 12 fundamental particles (12 "starting" phases), which from an intuitive perspective may be understood as being related to the fact that $2\cos(60) = \sin(60)$, $2\sin(30) = 1$ and so on, so when unit vectors at such angles are summed, they happen to fall onto to 1, -1 or 0 in either the horizontal (complex) or vertical (real) space as well. This simply *does not work* for any angles other than 30 or 60.

In retrospect, when looking at other models involving the original Rishon Model, in fact not only that but when considering pretty much every single model of particle physics that the author has ever encountered, they *all* are based purely on the superposition (sum) of vectors. Charge must *sum* to +1, 0 or -1. I do not know of a *single* other theory of particle physics which maps onto the complex numberplane in some form which requires that *both* the phase has to match *and* the vectors (generated from the exact same map that created the phase) also have to sum to a sensible value that has some logical and direct correlation with some aspect of an actual particle.

2.8 It's Maxwell's Equations and Photons all the way down

To really understand this perspective, it's necessary to comprehensively dive into Dr Randell Mill's work for the months that it will, of necessity, take, to absorb the full implications of a lifetime's work that is published in a whopping 1800 page volume.

Once that's been done to the extent to which the reader can cope without their head unscrewing, John Williamson's paper may also be read, noting in particular that, after providing a model and a solution for the electron in O(6) space involving a special application of Clifford Algebra that "folds" back to 3 dimensions for a fundamental reworking of Maxwell's Equations, he notes in passing that if you change the phase angle of the modelled (electron) by 90 degrees its primary EM "presence" is in the *magnetic* domain.

However, lacking the (unbelievably comprehensive and consistent) analysis carried out by Dr Randell Mills in the 3D space using the "original" Maxwell's Equations, John makes the incorrect assumption that due to its huge mass, this strange particle might be a "W Boson" rather than a neutrino. The difference here is that Dr Randell Mills, in the section in GUTCP on the neutrino, notes that the whilst the neutrino's

angular momentum is absolutely enormous, the radius is tiny. We may logically conclude that whilst John also correctly noted the huge angular momentum, he did not notice (or explore) the greatly-reduced radius, because his model does not have, as a fundamental basis (as do none of the models based on or around the Standard Model) a "nonradiating" condition with which to directly and explicitly work, to derive the boundary conditions needed to solve the particle model's final radius (note that mass equates to radius, and the Millennial Prize for explaining the mass gap is still outstanding). Thus, John's modelling misses the critical importance of the balancing act (Torsion or "Helical Orbital Angular Momentum"), with E.M. field, with angular momentum and so on that Mills applies to simple and spectacular effect.

Whilst the exact mathematical solutions and framework are still being sought by the author, the fact that Dr Randell Mills has been so successful at deriving the electron mass to within 10dp from first principles with *absolutely no reference whatsoever to Quantum Mechanics* is simply an absolutely jaw-dropping mathematical achievement and inspiration. However it is very very unfortunate that Dr Mill's primary focus is hydrinos: he has cut a path through the necessary mathematics, leaving behind an absolutely tantalising trail of breadcrumbs which it is terribly frustrating for the author to not be able to pick up and follow.

Therefore, looking at different directions and avenues simultaneously, the work of Joy Christian and Fred Diether were encountered: two papers which offer some clues and possible mathematical frameworks to explore: Friedmann-Robertson-Walker spacetime, $SU(1) \times U(1) \times U(1)$ groups, Einstein-Cartan-Sciama-Kibble theory of gravity and many more, which give a different perspective from that of the field of optics and the (direct, classical) application of Maxwell's Equations, only to find that it is the same thing just in different words. For example: what comes from optics and is named "Helical Orbital Angular Momentum" is the same thing that ECSK theory names "Torsion".

Thus there are many different candidate approaches to achieve the same end-goal, all of them ultimately based on Maxwell's Equations, due to the fact that Yang-Mills *is* a generalisation of Maxwell's Equations, moving them to the frequency domain (Quantum Mechanics) to do so, but fantastically-complicating the entire mathematical space in the process whilst at the same time draining *all* intelligence resources (and funding) from further exploration in the original (classical) space.

The defining "dividing" point was the "Ring Model" as far back as 1913, when Bohr came out with his model of the atom. Very few people remained focussed on the Ring Model, and it really was not until Dr Randell Mills provided a clear solution for a Special Relativity correction of the radius of particles that are derived from first principles using Maxwell's Equations that anything remotely bearing a resemblance to the "Ring Model" would actually make any sense or be accepted in any way, shape or form today, given the significant advances made in particle physics theory over the past century.

About the only other person the author has encountered who has worked on an alternative theory that mentions a Special Relativity related orbital radius correction is McMahon, although this avenue has not been explored at all: it is mentioned purely in passing.

2.9 The nonradiating condition

It cannot be overemphasised enough how absolutely fundamental and critical the nonradiating condition is. First raised as the basis of the Ring Model, Dr Randell Mills is the only person to provide an explanation that the author can comprehend as to why the Schroedinger Equation breaks down and is, plain and simple, completely wrong. In a special section in his work he goes to some lengths to explain it clearly, noting that there are multiple ways in which the Schroedinger Equation may be demonstrated to be invalid, and presenting formally just the one needed to prove the point.

In discussions with others (anonymous) it was noted however that the Schroedinger Equation seems to hold true when $v \lll c$, just as Newton's Equations of motion (actually probably Euler's Equations which are accidentally attributed to Newton) are only correct for $v \lll c$.

That aside: it's really rather simple. Particles do not just evaporate into thin air. They don't spontaneously explode into a cloud of lethal X-rays. They don't "deflate" over time. The energy within them *remains* within them, and in fact particles actually *actively resist* (reject) any attempts to provide them with extra energy, or "decay" as a result, or in the case of electrons, jump "shells" if the input of energy is too great for their current stable configuration (witness LEDs and solid state physics as a result).

We can therefore quite freely make the following strongly-worded statement: **Any mathematical or theoretical model which blatantly ignores this evidence presented to us is, by definition, categorically and fundamentally fatally flawed.**

In essence: by following the extreme effectiveness to which Dr Mills puts nonradiating to good effect, using

it as a boundary condition to satisfy Maxwell's Equations and derive numbers that are accurate to 10dp of real-world measurements, the importance of the nonradiating condition has been very deeply imprinted into the author's tiny brain. However without having first read G Poelz's work on the nature of the electron, where Poelz also notes the importance of ensuring that synchrotronic radiation not "leak" (his term for the nonradiating condition), that realisation would have taken a bit longer than it really should.

In summary, then: there are at least three separate independent directions from which the importance of nonradiating has been thoroughly explored, in relation to particles: The Ring Model, G Poelz's paper, and Dr Randell Mill's GUTCP. There are likely to be many more, but it is worth noting that the one particle physics theory that does *not* make special mention, emphasis or explicit use in any way of the nonradiating condition is: The Standard Model. A side-effect of this lack of explicit mention is that it is causing people in both the mainstream *and* non-mainstream scientific communities to make mistakes by omission.

3 Expansion on High-certainty Implications statements

3.1 It's all superposition. Nothing special

If we may reasonably assume that superposition is possible (Jones Calculus of mobius-elliptically polarised light showing us how), then there really is no need for anything particularly special. However in order for the particle to not be ripped apart immediately, the superposition vector needs to map to a unit or a zero charge in the electrical and the magnetic field.

The only other rule appears to be that the angle of the E_0 vector (and thus the entire mobius path) of each constituent particle must *also* be on a major compass point relative to all other constituent particles taking part in the superposition. In other words, the mobius strips must be either at right-angles to each other or properly superimposed or directly opposed.

In terms of harmonic oscillation in the context of E.M. fields this rule makes perfect sense: right-angles means that the E.M fields are orthogonal, and thus may co-exist - simple as that. The less stable particles have constituent contributions that superimpose on a 180 or a 0 degree angle.

3.2 Yes even the larger quarks

The larger quarks appear to be the superposition of the base Rishon Triplets to create a superposition vector that is *not* on a major compass point (unit electrical or magnetic charge). Thus it is simply not stable on its own and must further be part of a composite particle.

3.3 And the superconducting electron

The fascinating thing about superconducting electrons is not so much the electrons themselves but the conditions under which they are forced into existence. One such configuration is for the surrounding electrons in their covalent shells to be fixed into alternating spin-up followed by spin-down (N-S, S-N) arrangements in each alternate layer of the lattice of atoms.

Dr Randall Mills puts it rather well in different words:

To conserve the electron's invariant angular momentum of \hbar , flux is linked by each electron in quantized units of the magnetic flux quantum, and the basis of superconductivity is a correlated flow of an ensemble of individual electrons such that no energy is dissipated (i.e. superconductivity arises when the lattice is a band-pass for the magnetic field of an array of magnetic dipoles; therefore, no energy is dissipated with current flow).

In other words, the regular surrounding lattice-arrangement of N-S S-N electrons creates a huge "No Magnetic Entry" sign on the door where the electrical current (the electrons) would normally be jumping from atom-to-atom in the "holes" of the shells. Rather than just "give up", two electrons *team up* (where Dr Mills seems to be implying that the possibility exists for *more* than two).

Here is where the author's perspective differs from Dr Randell Mills. I suspect that the electrons go into a "double-harmonic" waveform i.e. that the two electrons simply superimpose but at 180 degrees to each other. The result is an expanded radius with "spin zero" and other characteristics that allow them to successfully negotiate the zero-magnetic channel.

3.4 Superposition automatically increases the particle radius

This statement comes from a few independent sources. Firstly: J Hirsch's observations on superconducting electrons, which he notes have a larger radius. We surmise that two electrons (aka "Cooper Pairs") simply "team up" i.e. superimpose at 180 degrees, to create that all-important "zero spin" and magnetically-neutral larger-radius particle.

Secondly: we have the very very simple and obvious hint: energy is proportional to radius. If there's more energy (in the form of more photons superimposing), the radius automatically increases to accommodate the increase. This basic assumption is then utilised by Dr Mills to good effect throughout the entirety of his work, providing answers that match to within 10dp for fundamental particles and only beginning to reduce accuracy to around 7dp for huge atoms with atomic number around the 100 mark.

3.5 Electrons in shells are higher-order harmonics, too

Again: it is reasonable to assume that the radius of the electron orbital shell is as large as it is *because* the electron has expanded outwards to such a huge extent that the atoms it orbits are simply *within its field*. This does not make much sense until we view the electron as simply comprising photon(s) in a unique and very special configuration of Maxwell's Equations. Again, Dr Mills puts it best and to good effect.

3.6 There is no such thing as a gluon

Wherever the gluon is mentioned, it's in context of two things: first, an incredibly short life-span and second, two particles are mentioned whose charges and other aspects, when subtracted from each other, **always** come out to be **exactly** those of one of the pions. Logically, therefore: If it looks like a pion, smells like a pion, and has the characteristics of a pion, it's probably a pion.

Take for example the internals of the proton. It's understood that the proton comprises two up quarks and one down quark, where "gluons" hold together the up-to-the-down, the down-to-the-up and the up-to-the-up (followed of course in the Standard Model by then more gluons holding those gluons together, and then those gluons holding those gluons together and so on). However what is the difference between an up and a down quark? It's a pion. What is the difference between an up and an up quark? Another pion. So we could either say "there's a gluon holding the up and the up together"... *or* we could say that "Between the up and the up quark a fantastically-short-lived anti-up/anti-up pion continually exists as a permanent standing-wave "phase-differential" between those two up quarks".

This is a matter of perspective but it is a crucial one that provides a much higher level of discernment into what's actually going on inside of particles. Not least is that the use of the word "gluon" *completely* overlooks and prevents and prohibits the possibility of even *considering* that the *eight* separate and distinct "types" of gluons are simply the eight left and right chiral handedness pions. This would seem to be a really rather glaring oversight on the part of the Standard Model.

3.7 There is no such thing as a W, Z or Higgs Boson

The author freely admits to being pedantic here but with the Bosons being assumed to be a gauge "force", as opposed to being separate particles in their own right, the author is left with very little choice but to give alternative nomenclatures to the particles that fit precisely with the masses of the W, Z and the two Higgs candidates.

It is *suspected* that the original work for which Glashow, Salam and Weinberg were awarded the 1979 Nobel Prize is perfectly correct, with one notable exception: the number of rotations in $SU(2) \times U(1)$ i.e. in effect the number of powers to which the exponential is raised (modulo τ) which of course would *not be noticed* because anything that's on a multiple of τ which is then raised to any arbitrary number of powers is of course zero, in modulo τ arithmetic. So if the W and Z Bosons comprise in effect five superimposed pions, four of which are *entirely neutral*, it would be perfectly reasonable to empirically derive gauge equations that looked absolutely correct but *entirely* missed out the neutral constituent contributions, furthermore coming up with the *right answer* as far as mass and other characteristics were concerned.

Thus, by giving the W, Z and the two Higgs Bosons alternative names (ultra-pions, ultra-proton and ultra-neutron) it helps avoid the confusion caused by several decades of usage that has unfortunately become entrenched as "fact", as taught in Universities, on Wikipedia and standard textbooks.

3.8 There is no such thing as the "Weak Force" (Interaction's okay)

This one's really very simple. If the W, Z and Higgs Bosons may be identified to comprise superimposed quarks, they're not a separate force: they're particles. It's really that straightforward. However what is less straightforward is the Weak "Interaction", which is felt to be completely valid, and down to the nature of the pion, the ultra-pions (W and Z Bosons), shape of the two Higgs Bosons and the startling similarity between the neutron, proton and ultra-quark layouts from which the four Bosons are made.

More than that: if we regard particles as being superpositions of underlying Rishon Triplets (representations of elliptically-polarised light), and that the end-result is a form of "orbital shell" that will project out beyond its radius and could potentially "jump" to a larger radius (with more triplets aka quarks involved in the resultant harmonic arrangement) if encouraged to do so and given enough energy to sustain such an arrangement even for a brief period of time, then it begins to make an intuitive kind of sense that similar-structured particles could, under the right circumstances, flip between arrangements much more easily than those with less similar internal structures (less "resonance" in common, if you will).

Bear in mind that the difference between an up quark and a down quark is only a difference of 1/3 of each of Tohu and Vohu. Bear in mind that the ultra-quark is *five* quarks, in effect being an up (or down) quark with a pair of neutral pions superimposed over the top of it (made from the opposite type of the first quark). Bear in mind that it doesn't actually take very much energy (relative to the actual size of the Bosons) to bring pions into existence. Bear in mind also that VT0 phase transforms (see below) occur in energy-conserving pairs that don't take much energy to make happen. Bear in mind that the universe is viewed as creating "virtual particles" all the time, and that it would not be unreasonable for such "virtual particles" to "team up" so to speak, if the circumstances were right. If the W and Z Bosons are made up in effect of the superposition of a total of *five* pions each, where, when you look at them closely you find that the neutron or the proton is buried *inside* them, and much of our universe is *made* from neutrons and protons, such that the surrounding space would be resonating with an E.M. field that has a near-identical sub-structure to the two Bosons, it's really not hard to see why the W and Z Bosons can pop into existence far easier than their total energy would tend to otherwise support. It's now known for example that protons, when passing in close proximity "feel" each other through the interchange of Bosons.

The only major anomaly here (despite it being the addition of six sets of pions to surround each of the three corresponding quarks in the case of each of ultra-neutron and ultra-proton) is the two Higgs Bosons. The author has yet to successfully manage to use ultra-neutron or ultra-proton in *any* phase-transform diagram as an intermediary, despite its clear (short-term) stability and possibility of existing within the Extended Rishon Model. What *has* been successfully done is to use the W and Z Bosons (caveat: see below) as intermediaries, although it is regularly necessary to deploy well-known Feynmann time-reversal tricks to do so, in particular for the well-known neutron "decay".

3.9 There is no need for a "Strong Force" (Maxwell's is okay)

Straight out of Dr Randell Mill's paper, it is pretty clear that the "Strong Force" simply does not exist, neither does it need to be invented:

The bonding in multi-nucleon nuclei involves the superposition of the quark and gluon functions of the constituent nucleons to form the nuclear version of atomic orbitals wherein the gluons provide the central force and the quarks comprise the two-dimensional current-density surfaces. The nuclear bonding gives rise to spherical shells comprising equipotential minimum-energy surfaces as a linear combination of the nucleons. For example, the deuterium nucleus is a minimum energy superposition of a neutron and a proton. Thus, the deuterium quark/gluon function is a spherical coordinate orbitsphere solution of Laplace's equation

Orbitspheres are defined as being the set of Great Circles that the charge of the particle(s) are uniformly distributed across. Note the mention of Laplace's Equations, as being the the balance-point (zero-charge) sum of a series of electrical potentials. Thus, what is mistakenly believed to be the "Strong Force" is simply the "zero-balance of electrical charge", in a near-identical way to electron orbital shells.

The whole reason why the "Strong Force" was invented is simply because it never occurred to anyone to use plain Maxwell's Equations. That having been said: Dr Randell Mill's work is not absolutely accurate: it's good to around 8 decimal places but there is a discrepancy that tells us that there is more yet here to be explored. Regardless: it is not unreasonable to conclude that if solving Laplace's equation get you to within

8dp of the right answer, complicating matters by pretending there's a separate "force" is easily eliminated with Occam's Razor.

Being kinder to the people without whose fantastic work it would not be even possible to *make* such a strong statement, the "Strong Force" may historically be viewed in the same light as Newton's (Euler's) equation for Kinetic Energy, as being a successful approximation (or substitute) under certain conditions.

3.10 Conservation of energy is Absolute: VT0 Phase Transforms

if there is ever going to be an inviolate "Law" in the Universe, it's that Conservation of Energy is absolute. However, the fascinating thing about such a "Law" is that if two identical opposite-typed particles happen to get created which happen also to travel in equal and opposite directions with equal energy, equal mass and equal (but opposing) velocity, then bizarrely and paradoxically, the "Absolute" Law of Conservation of Energy is preserved!

The reason why comes down to the fact that, if particles are purely photons, then two photons which happen to have the exact opposing waveform with the exact same phase, frequency and magnitude *are* in fact obeying this law because they sum *exactly* to zero. What happens to those two particles (photons) *after* they are created is a different story but here, again, because they are heading in opposite directions they will encounter other parts of the universe and so will encounter and interact with different particles. We can however quite reasonably say that if we knew the *exact* phase, magnitude and frequency of *all* particles and photons in the *entire* universe, their grand total would sum to exactly *zero*. It's an impossible task but a reasonable deduction.

VT0 Phase Transforms (right-chiral transforms are shown in figure 2), are in effect the creation of a pair of equal and opposite matched types of "gluons" (not really: they're matched ultra-short-lived pions) which absolutely and without any doubt or exceptions of any kind obey the Law of Conservation of Energy, summing precisely and exactly to zero sum total energy due to their identical phase, magnitude, frequency but opposing sign, and identical momentum (including angular momentum) but with opposing velocity.

These "gluon pairs" (aka pion pairs) allow two pairs of Rishon Triplets to *simultaneously* undergo a phase-shift to an *alternate* pair of Rishon Triplets that differ solely and exclusively by one thirty degree rotation (one "clock position") each. One pair may phase-shift clockwise whilst the other *must* phase-shift anti-clockwise. But, more than that, if we superimpose the two particles in each pair (summing their Rishon-triplet vectors) in both *before and after the transformation*, there must only be a difference of 1/3 Vohu and 1/3 Tohu between them. It's complicated but makes perfect sense: if you look at any of the pions and take their Rishon-triplet vectors those *also* differ by 1/3 Vohu and 1/3 Tohu. This rule applies to left-chiral as well as right-chiral except that Vohu is mirror-imaged (inverted) - see further below as to why.

Ultimately though it comes down to the conservation of energy. It's very very important to note: the equal and opposite frequency and angular momentum has some very important implications, which the author is slowly beginning to understand enough to be able to explain (in the medium-certainty category). A summary would be that particles have to phase-shift in symmetrical ways, and that the phase-shifts may only occur between particles of similar radius (energy).

3.11 There is no such thing as particle "decay"

This is really simple to understand as a misnomer. If particles transform through phase-shifts, allowing them to jump to higher (or lower) energy orbits because ultimately they're photons all the way through, then there's really no such thing as "decay" at all.

3.12 Left and right chiral "decay" has a logical explanation

If we look at the difference in V and T charges between an up and a down quark of the same chirality, the difference is a simultaneous 1/3 T and 1/3 V vector. If we look at the difference in terms of the pion combinations (aka "gluons" - see below) which in effect the VT0 phase-transforms *represent* the matched transfer of pairs of phase-preserving, charge-summing-to-zero-preserving pions, pions themselves have a simultaneous integer (1,0,-1) Tohu and integer-but-imaginary (i, 0, -i) Vohu charge.

Their application (left-chiral to left-chiral) thus transforms left-chiral particles to left-chiral particles *if and only if* the gluons (pions) involved are *also* left-chiral, and likewise in the right-chiral world. So It's really rather straightforward. Put another way: if you try to take a left-chiral quark and apply a right-chiral VT0 phase-transform to it, the end result is a particle that has either a non-integer V or a non-integer T charge. Put

another very simple way: you simply cannot phase-transform two sets of particles that differ by such a large phase differential. They're at different points around the phase "clock", they're *literally* different particles, and trying to make them "jump" across such a large (and different) energy gap is a clear and blatant violation of the law of Conservation of Energy. *It. Ain't. Gonna. Happen. Period.*

The Standard Model is incapable of recognising or providing a rational explanation for this phenomena. It is treated as a mystery that is actually really very simple when particles are treated as being phase-harmonic elliptically-polarised mobius light.

3.13 Feynmann rules (time-reversal) applies to VT0 Phase Transforms

An important aspect of VT0 Phase Transforms is the application of Feynmann rules. It comes down to the superposition of the elliptically polarised photons being able to "spin off" - de-superimpose - or for a single particle to "flip out" to three more particles that happen to sum (by way of the VT0 Phase Transform rules) to the particle that they were spawned from... it's quite straightforward, very specific, but a bit mind-bending. It helps to remember that VT0 Phase Transforms are in effect a computer-science style "XOR" operation, to start first with the straight 2-to-2 transform and *then* choose the directions of the arrows (any direction is okay because it's XOR operations). It is *critical* to not make the mistake (as done many times in the past by the author) to assume that time-reversal means that one of the *particles* must be inverted to its anti-particle as well. This is a **mistake** that leads to completely erroneous calculations.

We may view the annihilation and creation capability as being simply the universe's "virtual particle soup" creation/destruction heuristics which are outlined by proponents of Quantum Mechanics and thus well-understood. However it's important to appreciate that only the base 12 Rishon Triplets are involved. Compound particles *may* be brought into existence (or wink out of existence) but *only* by way of the 12 phases in intermediary steps (or if VT0 Phase rules are violated, by way of gamma radiation).

Also: one very very important aspect of the annihilation capability is that it critically underscores why (as outlined in the medium-certainty section as it is still under investigation) the radius (aka "level" aka "energy") is an important aspect of VT0 Phase Transforms. If the energy level(s) (i.e. radii) of any of the four particles undergoing the phase transformation are *different*, there's no way that they can superimpose and conserve energy, can they? This is explored more in-depth in an alternative section.

3.14 W and Z Boson creation accompanied by opposite-charged pion

This one is a matter of perspective, but comes down to the absolute prioritisation of the Law of Conservation of Energy. The universe simply will not permit - not even for the purposes of "quantum tunneling" - the creation of energy (or charge). Energy may be *borrowed* from somewhere for the purposes of quantum tunneling, but it cannot be created. Thus, it is flat-out impossible for W and Z Bosons to be created - with charge - from out of nowhere.

Instead, the *constituents* of the W and Z Bosons may be created through VT0 phase transforms in equal and opposing matter-antimatter "virtual particle soup" reactions, where it just so happens that, unfortunately, the number of such VT0 phase transforms happens to have *one* pion (two quarks) spare of identical and equal and opposite charge and type to that of the corresponding W (or Z) Boson aka "ultra-pion" which was simultaneously created.

The word "unfortunately" is used because it is *believed* by the author that the reason why the accompanying pion in any W or Z Boson (aka ultra-pion) "decay" hasn't been spotted is because the size of a W (or Z) Boson is so large relative to that of a pion that, statistically, it's simply not been noticed in the observation of "decay" experiments. Not only that, but due to the empirical data fitting the Standard Model very well, where it has been *assumed* from that empirical data that "charge is conserved", so *nobody is looking*.

With the Standard Model completely overlooking Vohu and its significance (being down to the complex numberplane and its representation of magnetic fields), and in combination with the significance of both phase *and* vector magnitude needing to be respected, without Vohu none of that can even be *deduced*. This is all extremely unfortunate.

3.15 Charge is NOT conserved via intermediary "decay" particles

With the Law of Conservation of Energy being absolute and unbreakable, charge simply cannot be brought into existence without having a direct counter-balancing charge to bring the sum total to zero. This applies in the electrical (Tohu) field *and the magnetic* (Vohu). With the Standard Model failing to recognise the concept

of Vohu, it is a very unfortunate mathematical coincidence that the Standard Model fits the observed data perfectly correctly... whilst at the same time completely missing the possibility that matter might be made of elliptically-polarised photons in mobius circular infinite self-stable loops, with all that that may imply.

Put another way:

- Charge before "decay" is X
- Charge after "decay" is also X
- the difference is therefore **ZERO**
- so why the heck would the "conveyers of energy and transformation" have "charge"?
- if the intermediate particles had any "charge" then that "charge" would be **added** to the result.
- This does not happen... therefore the intermediate particles sum total to *ZERO* charge.
- (Paradoxically) QED.

3.16 Charge is instead conserved ("stored") by the SURROUNDING SPACE

After particles have undergone "decay" into the intermediate particles, the surrounding space is still resonating - still contains an E.M. field imprint - of the particles as they were before the "decay". This "imprint" is what influences the (exact same in many cases) intermediate particles to undergo differing phase-transforms into alternate "decay" byproducts. Thus we may say that it is the "surrounding space" that in effect "stores" the "charge" temporarily, because "charge" is in effect nothing more than a harmonic resonance pattern of E.M. fields.

3.17 "Branching" of "decay" in the Standard Model looks great

The one aspect of the Standard Model which the author considers to be a huge success is that of branching prediction and modelling. There is nothing incompatible between the Standard Model and the Extended Rishon Model in this regard. The only difference of perspective is that the surrounding space is still resonating with the memory (energy, field, frequency etc.) of the particles prior to "decay", which, over time, is clearly going to dissipate / disperse (at the speed of light) and lose cohesion / effectiveness in influencing the intermediary particles.

4 Expansion on Medium-certainty statements

4.1 Neutrino puzzle: interaction expands radius outwards

We may be completely misunderstanding the nature of the neutrino entirely. Almost certainly if, as Dr Randall Mills outlines successfully in GUTCP, its presence is almost entirely in the "magnetic" domain: imagine a radio wave oscillating in the complex (magnetic) field only, but then looped into an elliptically-polarised moebius arrangement: that's quite *literally* the definition of a neutrino.

Now, as noted by Dr Mills, there's virtually nothing to prevent the radius of such an arrangement dropping to a fantastically low value (where mass is directly proportional to radius). However he notes that the orbital angular momentum of a neutrino is disproportionately large (understatement). We surmise, therefore, that the neutrino *can* gain mass... if and *only* if it happens to interact with other matter, expanding its radius outwards in the process. This would go a long way to explaining why neutrinos can be part of a compound quark, as well as being the make-up of the muon-neutrino, and many many other factors that haven't really been properly understood.

Further discussion on this theme, and any follow-up implications, need to be part of the "low" certainty section as by this point they are highly speculative. This particular topic remains here due to Dr Randell Mill's successful derivation of the neutrino mass and angular momentum from first principles. It is however specifically noted that Dr Randell Mills may be incorrect in his assertion that neutrinos *never* interact with matter: we believe that they *may* be able to do so under very specific conditions, but that their nature makes the possibility of "bare" neutrinos achieving such circumstances without assistance just fantastically and ridiculously improbable.

4.2 VT0 Phase Transforms must respect "family" (energy) levels

This is a very recent insight from re-reading the section above that Conservation of Energy is absolute and inviolate. If that is truly the case, then when a particle begins to jump to an alternative radius in order to accommodate the addition of the VT0 phase-transform pions in order to form a W (or Z) Boson, it is clear that some of those VT0 phase-transform pairs will be at levels with small radii (the lower-level particles such as electron, neutrino and so on), whilst others will be at levels with much larger radii (neutron, proton, and beyond that).

It is therefore reasonable to assume that attempts to "match" or "source" VT0 phase transforms from completely different energy levels is flat-out impossi-

ble, as this would violate the law of Conservation of Energy. Put another way: a quark which is part of a large radius particle (a neutron) has far more energy than that of an electron, so how on earth would it be possible to undergo phase-transformation? Clearly it would violate the Law of Conservation of Energy to do so. So let's look at the two "stages" of neutron "decay". At first glance it appears that, indeed, for example, $V\bar{T}0^1$ is violating this rule, by being involved in four particles of differing "levels": the neutrino and pion (aka "gluon") at level one, the neutron at level 2, and the W Boson itself at level 3.

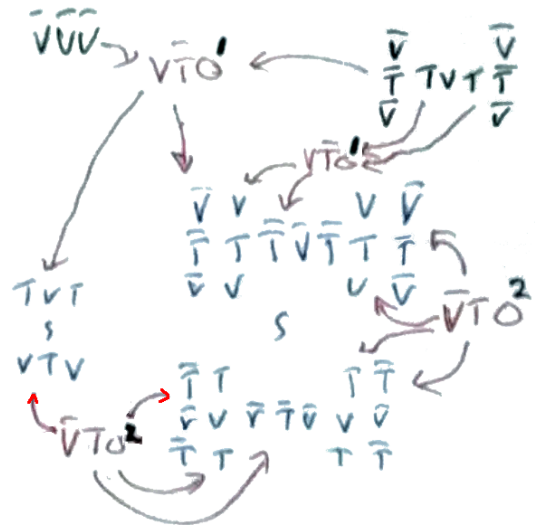


Figure 4: Neutron Stage 1 phase-transformation



Figure 5: Neutron Stage 2 phase-transformation

However we may think this through and solve the discrepancy with some careful thought. Firstly, we note that the neutrino and neutron do not actually decay together into an electron and a proton: this is a Feynmann style diagram involving time-reversal on the neutrino, such that the two figures below show us the neutron phase-transforming into a neutrino, electron and proton, instead. Bear in mind that time-reversal is involved in the two above

diagrams, so it becomes necessary to rewrite these patterns slightly to give a better sense of what's going on.

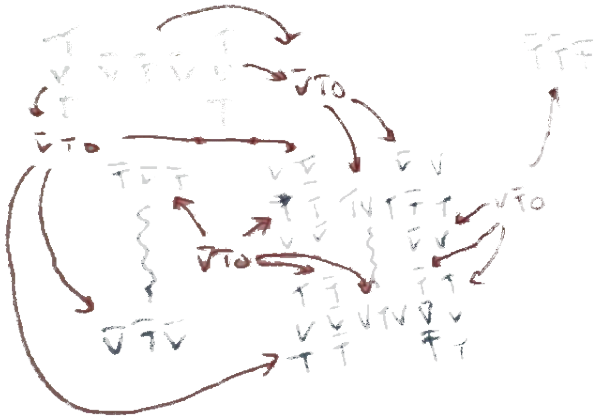


Figure 6: Proton to electron stage 1

The above diagram has a couple of different characteristics from previous ones that have been drawn. Firstly we chose to use a feature of VT0 phase transforms where a single quark results in the triple-production of three others. Bear in mind that it is the *sum total* of the four T/V Rishon vectors that must total $1/3 V$ and $1/3 T$ of the required signs. In Computing terminology it is easiest to think of VT0 phase transforms in terms of XOR operations.

Secondly: the radius of the associated pion is displayed at the same size as that of the W Boson, as a 2D way to represent that it does indeed have the same "level" of energy (same frequency), even temporarily. Thirdly (difficult as it is to do) it is assumed that the electron also has a similarly-large radius, but is about to "collapse" to a smaller one and gain a huge amount of kinetic energy in the process.

Note however that just as with the prior depictions of Stage 1 and Stage 2, we have not yet included the phase-transforms to cover the neutrino and neutron. This is covered below:

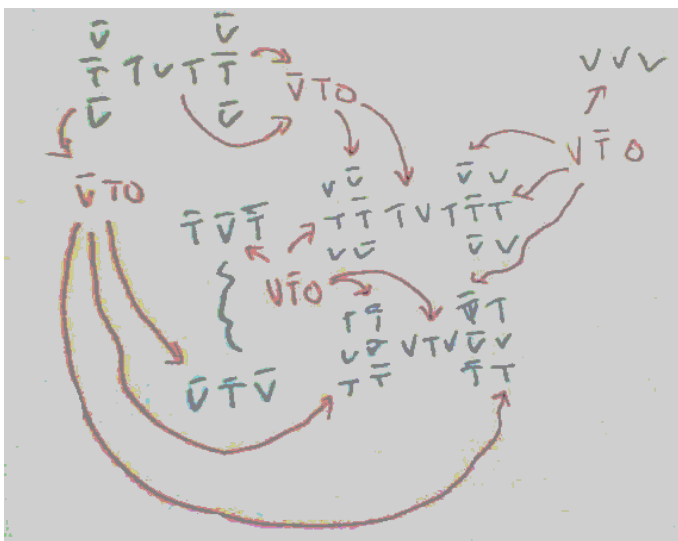


Figure 7: Neutron neutrino stage 2

Here it has been chosen to reverse time so as to

emphasise the ultra-pion and pion's similar initial radius, and to emphasise that, again, the anti-neutrino (as with the electron) is created spontaneously as part of the energy-conservation in the creation of the Boson (ultra-pion), quite likely at the same initial radius *as* the ultra-pion, quickly dropping to a smaller radius with a huge kinetic energy impulse as a result. Also, again, a second triple-quark-creation VT0 phase transform has to be used (if one triple-quark VT0 is used then it must be matched by a second opposite matching type of VT0 phase transform).

So it would appear that there could indeed be a rule where the radius (energy level or "family") of the particles as they undergo phase transformation is very very important. It's not possible in other words to just phase-transform from a lower energy (smaller radius) to a higher one (larger radius), nor a higher one to a lower. Only same-level energys may carry out phase-transforms, where it is then *permitted* for the end result to "shed" some of that radius (energy) in the form of straight-line Kinetic Energy.

This goes a long long way towards explaining why the W and Z Bosons (aka ultra-pions) are involved in particle "decay" at all. They're a form of energy-balance "opportunity" so to speak. Everything has to jump to the larger radius in order to have the opportunity to reorganise.

4.3 VT0 Phase Transforms may only cause a 30 degree "jump"

On the phase map (figure 1) the VT0 phase transforms are shown in three pairs, each of which are separated by thirty degrees ($\tau/12$). In earlier explorations (derivation) of Phase Transforms it was not explicitly spelled out that it is quite likely that only a single 30 degree "jump" may be performed, swapping one "click to the left" around the phase map with a corresponding "click to the right". It would be natural and logical to expect that *two* clicks (a 60 degree phase-shift) would require too much energy. Analysing that can actually be done mathematically, by comparing the energy differential between particles of different phase offsets.

As noted previously it is not *entirely* ruled out but is not considered to be highly likely, either, particularly when it seems that the use of a pion to phase-jump a single "click" is much easier and requires less energy (even for compound particles when a "Boson" is involved). It's also worth pointing out that the VT0 Phase Transform map has triple-Tohu (electron and anti-) and triple-Vohu (neutrino and anti-) isolated by up and down (and anti-) quarks. It's *required* to go via the intermediary pions to get to the unit-charge (stable, main compass-point) particles.

4.4 W Boson (and associated pion) oscillation

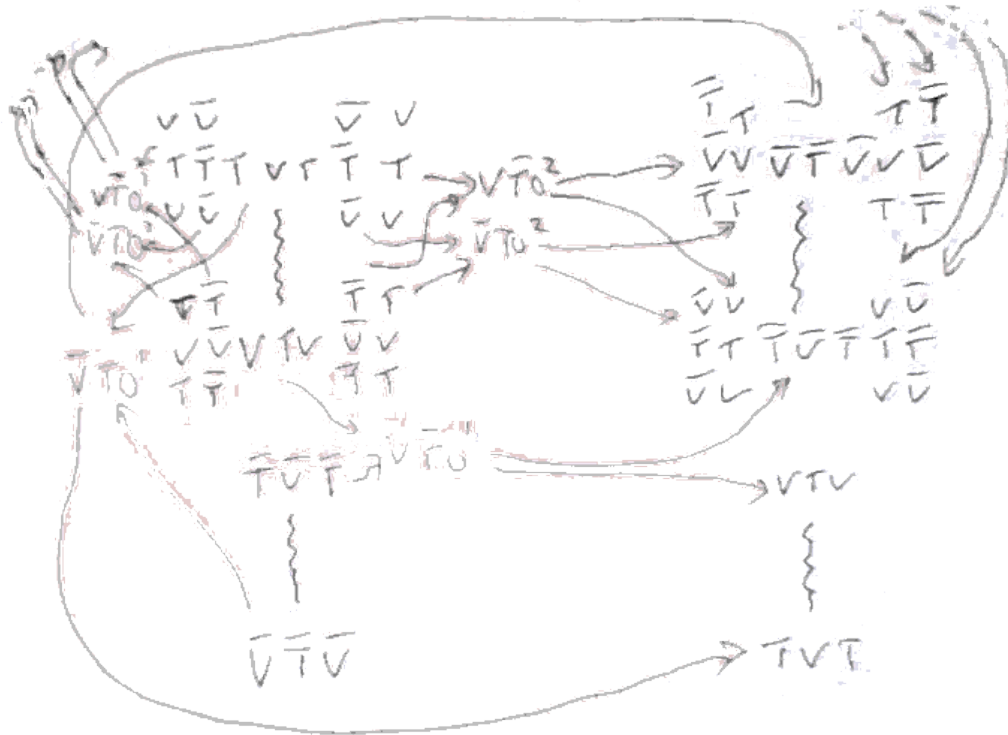


Figure 8: W Boson and associated pion oscillation

Efforts to pin down the neutron "decay" have been irksome to say the least. One of the strange things however is that in making mistakes and using W^+ instead of W^- (with corresponding oppositely-charge pion) the end result was exactly the same. This led to an investigation to see if it was possible for oscillation to occur between a W^+ and π^- to a W^- and π^+ and the answer is a definite *yes*. This would tend to tentatively support a rather intriguing (concerning) hypothesis that the observed experimental mass of the W Boson may actually *incorporate* the associated oscillating pion, although before going that far when there is no evidence yet noted to support it, a full investigation of alternative "decay" patterns involving W "Bosons" is going to be needed. The potential for oscillation however does explain quite a lot.

4.5 One photon or many?

This is a bit of a conundrum. Dr Mills uses the word "photon" in his work, but if you speak to anyone in the field of optics, elliptically-polarised light requires a gaussian beam, aka photons *plural*. There is however the possibility that a single photon, by virtue of it being on a mobius loop, is in effect multiplying up to *become* a gaussian beam all by itself!

What is definitely not known however is whether in fact there are multiple photons of ever-increasing harmonic wavelength, or whether there are multiple twists (three, five, seven) so that the double-exponential characteristics are still obeyed but the entire superposition results in more "point-like" behaviour. If this were the case it would explain why Quantum Mechanics has been successful in describing particles (up to a point, pun intended) as such harmonic patterns would be best described by moving them to the frequency domain (aka QM).

Regardless: at the fundamental level, the mobius elliptically-polarised mathematical "rules" fit precisely and cleanly - it's just that there's no information available at this point to *precisely* determine whether it's one photon or many, self-gaussianising (if one) or harmonic pattern (to infinity) or multi-photon self-gaussianising. Interestingly none of that affects the mathematical results or effectiveness of, for example, Dr Randell Mill's approach and solutions. The base assumptions "elliptical polarisation" and the consequences thereof, considering and assuming "spherical field patterns", circular orbital paths, uniform charge distribution and nonradiating condition seem to be perfectly sufficient and successful, up to a point.

5 Expansion on Low-certainty statements

It is critical to bear in mind that these are extremely low-certainty hypotheses. They're highly speculative, have no corroboration, have no equivalent in *any* other particle physics theory, and as such and for that reason alone are worthwhile exploring as "outliers" that would, if correct, help corroborate the rest of the Expanded Rishon Model.

5.1 Anti-neutrinos in orbital shells around neutrons?

The entire concept of anti-neutrinos orbiting neutrons is in the quite reasonable expectation that if the neutron and anti-neutrino have an E.M. field that is predominantly magnetically-aligned (as opposed to electrically aligned because their E.M. field is rotated at 90 degrees into the complex plane) they're going to attract... i.e. undergo magnetic attraction. Thus without going into huge mathematical detail it is reasonable to assume that the anti-neutrinos would go into "orbital shells" as a direct equivalent of electrons around protons.

5.2 Doing so by swapping large angular momentum for radius (mass)

In reading Dr Randell Mill's first-principles theoretical derivation of the neutrino, which is accurate to current experimental data, it is understood that a "free" neutrino has in effect a "collapsed" (tiny) radius, and thus an extremely small mass, but that it correspondingly has a fantastically-large angular momentum. This would explain why a *free* neutrino does not interact well (if at all) with matter: it's too small, too light, and too "dense" in effect.

Where the author's perspective *differs* from that of Dr Randell Mills is that the author surmises that, exactly as outlined conceptually to good effect by Dr Mills on the electron's capacity to "expand" its radius, even outwards to be larger than the protons that it orbits (aka "shells"), the neutrino can reasonably be expected to do *exactly the same thing*. In the process, it would *gain* mass, and, also, its angular momentum would correspondingly reduce to more sane levels. There is no reason that can be perceived as to why, due to the symmetry of the electron and neutrino (except for the 90 degree rotation of its elliptically-polarised constituents aka "photon(s)"), the "excited" neutrino in orbit around a neutron would not be *exactly* the same mass / energy (give-or-take a bit) as an electron in a similar corresponding "shell" position when an electron is orbiting a proton.

5.3 Magnetic "flux" is back in vogue!

Says it all: ironically, anti-neutrinos would be "jumping" between shells in a direct analogous way to electrons... except in the *direction* of the magnetic "flux", instead of at right-angles to it as with an electron. Anti-neutrinos (or the "holes") would be *literally* the magnetic field lines, aka "flux". On discussing this concept with others, their objection is that it is *electrons* that convey electro-magnetism, solely and exclusively, such that there would be "no need" for a "magnetic flux". There was no real answer to that until Dr Randell Mills worked out the equations for the neutrino from first principles based on Maxwell's Equations, showing that the E.M. elliptically-polarised mobius field of a neutrino's internal photon(s) is(are) primarily magnetic (complex numberplane), being rotated by exactly 90 degrees compared to that of an electron.

5.4 Neutron mass *might* be incorporating the neutrino

This one is particularly controversial and probably completely wrong. The reason is down to the chances that a neutron would capture (or have) an anti-neutrino in its orbital shell position in the first place, due to a "bare" neutrino having dropped to such a tiny radius that the probability of it interacting *at all* is so ridiculously small. However it may be the case that the neutron, being unhappy with its magnetic "ionised" state, brings an anti-neutrino into existence (with the mass being so small this may actually be possible).

However it cannot be ruled out that the neutron's mass actually incorporates the anti-neutrino. If we may (reasonably) assume that to be true, and (reasonably) assume that the amount of energy that a neutrino would gain (swapping angular momentum for radius aka mass) was equal and near-identical give-or-take to an electron, then we could confirm that by taking the difference in energy between a proton and a Helium ion, subtracting that from the mass of a neutron, subtracting also the mass of a bare electron, and seeing what the discrepancy is. Turns out that the discrepancy is *really close* to that of a bare neutrino. So despite being extremely unlikely and probably completely wrong, the possibility still cannot be ruled out ad-hoc.

5.5 Anti-neutrino fluctuation could be why neutrons are unstable

If a neutron *does* have an anti-neutrino in an orbital-magnetic shell, we surmise that for a neutron "ion" (in effect) there would be nothing to prevent or prohibit that anti-neutrino from undergoing flavour-level fluctuations. This could potentially interfere with the neutron's stability, to have its surrounding anti-neutrino jumping not just shell but flavour *in* that shell, causing huge problems in the process.

We surmise also that when a neutron bonds with proton(s) their anti-neutrinos have significant electrical matter surrounding them, forcing them to enter much more stable orbits and behaviour patterns, calming the neutron down in the process.

5.6 Neutron magnetic "ionisation" might create anti-neutrino

This is highly speculative, but given the low mass of a neutrino might actually work. It could be the case that neutrons simply don't like being magnetic monopoles, such that the low mass of a neutrino is a low enough barrier for a neutrino-anti-neutrino pair to be called into existence, and the anti-neutrino filling the neutron's first orbital shell pretty much instantly. The resultant neutrino, which would fly off in the opposite direction, would be extremely hard to detect as its radius would drop instantly to the lower "ground" energy state. This would go a long way towards explaining why the neutron is "magnetically neutral". But it is worthwhile bearing in mind that this would still be in effect a magnetic equivalent of a free radical (single shell position filled with one spare) which would help explain its instability when isolated, as well as the increased mass compared to a proton.

5.7 Comprehensive periodic table analysis needed

Confirmation from empirical observation of whether anti-neutrinos do in fact orbit neutrons in exactly the same way that electrons orbit protons boils down to a simple application of the exact same rules by which the electron shells are calculated, followed by a comprehensive analysis of the elements and their properties (particularly magnetic properties) as correlated against the "expected" anti-neutrino shell covalence bonds. For example diamagnetism would be expected to have something strange such as a neutrino shell that is nearly full and has one missing, or one extra, or something to that effect that can be really quite easily assessed, given how well electron shells are currently understood.

5.8 neutron-neutron as an ultra-stable compound: "Missing" matter?

This is very simple logical deduction. If neutrons bind to neutrons just as two hydrogen atoms bind together (except with neutrinos in covalent bonds) the end product would be electrically neutral, magnetically neutral, chemically inert, highly stable, highly non-reactive, near-impossible to interact with using E.M. fields... how on earth would it even be detected, or its existence confirmed **or denied**? It would seem rather unfortunately to fit, very well, the category known as "Dark Matter".

About the only possible way that it could potentially be detected would be to work out some conditions under which it could be brought into existence, clear the area of all E.M. influenceable particles by applying an ionising field, and then to explore the area with back-scattering techniques to see if there's anything unexpected still there. The problem is: creating the neutron-neutron compound in the first place. We surmise that the only circumstances occurring in nature where the neutron-neutron compound would be created would be where neutrons are in close proximity to an over-abundant source of anti-neutrinos. Funnily enough a star would qualify as fitting those exact circumstances.

5.9 Gravity as a side-effect of electro-magnetism?

This is again pure speculation but worth recording. Noting that matter is in effect made of waves, and knowing that the superposition of two waves of equal frequency is a third wave with a phase shifted to in between the two sources, and knowing that photons "radiate" and knowing that the radiation decreases in inverse-square proportional to distance, we surmise that gravity may simply be a side-effect of electro-magnetism *if and only if* all matter happens to be resonating as "waves" i.e. photons. Given that we base the entire Extended Rishon Model on the premise that light *is* what is inside all particles, the hypothesis that gravity is simply the result of the outward propagation and superposition of E.M. fields is not unreasonable... just not part of the main focus of this study.

5.10 Incomplete Maxwell's Equations

In talking to a friend I learned the little-known history of Maxwell's Equations. The original documents contained so much that the publisher demanded that Maxwell "trim them down". The original manuscripts have since been forgotten or at least not considered in mainstream science, leaving many to attempt to "improve" on the originals. From the fact that Dr Randell Mills is *almost* correct (to 10dp) we may surmise that something is amiss. However it may equally be some other factor, which leaves this speculation in the "low probability" category.

6 Research

This section contains a list of people and specific topics worth paying attention to for either very specific skill-sets, areas that they have investigated, parts of a solution or mathematical work that they've done. Also included are specific topics or links worth investigating.

6.1 G.F. Torres del Castillo and I. Rubalcava-Garcia

Name of paper: *The Jones vector as a spinor and its representation on the Poincare sphere*. Key insight: maps Pauli Matrices and SU(2)xU(1) onto Jones Calculus. Incredibly important as it links "lack of reality and assumption of mathematical basis only from QM in Standard Model where things like Heisenberg's Uncertainty Principle *actively* discourage people from thinking about the actual internals of particles" to "actual reality, actual real existence, actual photons" and provides a firm basis for not only the Extended Rishon Model but also the Standard Model as well.

Additional paper by Castillo, "Spinor representation of an electromagnetic plane wave" also incredibly valuable. In particular this paper mentions **great circles and tangents** where great circles are used to extreme effect in Dr Randell Mill's work. Also, the following statement is believed to be a **full** justification of the entire approach taken with the whole superposition and stability of Rishon triplets:

Equation (33) shows that there is no constructive or destructive interference between the waves if and only if $\alpha^\dagger\beta$ is equal to zero or is pure imaginary.

These are *exactly* the conditions outlined and required for superposition of triplets aka quarks / base leptons! Quarks superimpose on an imaginary (90 degree) basis, the muons are the extreme case where triple sets of electrons or neutrinos superimpose... it's all right there! very exciting. Duly noted: that equation is likely to cover the cases for the muons but, importantly, as it says "no constructive or destructive interference" it's *not* covering the quarks. Will reach out to Castillo to see if he's worked on anything related to $\tau/12$.

6.2 Carl Brannen, Spin Path Integrals and Generations

This article, which Carl developed whilst studying the Rishon Model, may prove to be extremely valuable in deriving mass equations that take into account the newly-discovered "5th generation" of quarks (5 superimpositions), aka ultra-quarks. Also to be explored: the ρ pions which are suspected to be 4th generation (4 superpositions). Noted is the use of the words "Pauli Matrix" which occurs in the paper on spinors in poincare space being equivalent to Jones Calculus. Noted also is the huge recurring theme of $\exp(-i \text{ angle})$ and noted in particular is the recurrence of $\pi/12$ which is down, it is believed, to the $\theta/2$ from the mobius topology which divides the rotation angle by half, thus resulting in $\pi/12$ as opposed to $\tau/12$.

6.3 Dr Randell Mills

Absolutely incredible, light-years ahead of everybody else, resulting sadly in a high level of disbelief right across the board. It's almost as if people are angry that they weren't the ones to come up with the idea, that because it's not based in Quantum Mechanics it must automatically be false and total nonsense. This bizarre attitude has been observed in both mainstream *and* non-mainstream scientific communities, the latter should know better than to be so closed-minded outright blatantly judgemental. I'm generally displeased and angry to witness such closed-mindedness.

That aside, Dr Mills' work is so ridiculously accurate, comprehensive, down to first principles and clearly consistent that it is extremely hard to dismiss out-of-hand... *if* it is properly analysed and read thoroughly. (Without thorough reading it is *extremely easy* to be judgemental and miss something crucial that allows a

false conclusion to be reached). The main problem there, being: out of necessity, it's a whopping 1800-page document.

That is not to say that it is complete. Also it's missing certain things such as the higher quark families and more. Basically Dr Mills cut a swathe of mathematical problems down so that it would be possible to justify research investment in hydrinos, leaving behind a whole set of tantalising clues and areas that really really *really* need to be properly investigated.

6.4 John Williamson

John's work is extraordinarily valuable but nowhere near complete. He creates a reworking of Maxwell's Equations in 6D then maps (folds) down to 3D, solving some of the discrepancies in Maxwell's Equations as a result. The author noted an amazing article on tensors and Clifford Algebra which describes how Maxwell's key equations can be expressed as a *single* equation in Clifford Algebra! Clearly there's something going on, there.

6.5 Isaac Freund

This was a lead from the experimental work in 2015 on confirming mobius light elliptical polarisation. Isaac's theoretical work was responsible for the insight that mobius light really might actually be a candidate for the Extended Rishon Model. This was the first time that the Wikipedia page on Jones Calculus was explored as a way to understand how elliptically-polarised light might successfully superimpose, and under what conditions. The trivial case (same or opposing phase, same frequency) was obvious: the non-trivial case much less so.

6.6 Takahiro Nishiyama, Koichi Shimoda, Toshio Kawai and Kiyoji Uehara

Four people have been known to explore standing-wave solutions of Maxwell's Equations and other aspects involving superposition and so on. One fascinating aspect that comes out of this work is that it appears that light may possess orbital angular momentum *without* simultaneously possessing momentum along its direction of travel, which is fantastically weird and very very important at the same time. Nishiyama's paper: <http://dx.doi.org/10.1016/j.wavemoti.2014.11.011>

6.7 Andrew Worsley

Andrew is an M.D. who, armed with nothing more than persistence, a 20-button non-scientific calculator, logical reasoning and a desire to find simple answers, derived equations for the masses of particles to within at least 6 decimal places. That's *all* particles, at *all* generations and families - a staggering achievement given how he doesn't reference any formal mathematical textbooks or mainstream references *at all*: it's purely from first principles and uses the speed of light as the (almost exclusive) sole constant for the entire body of work.

One key aspect of his work which may require someone in cosmology to verify is that he derives (in a completely rational and consistent way) a loop between the units of time, length and mass. In other words: if we have something which is expressed in terms of mass it may be *converted* to (and is directly equivalent to) units of time times length... or something along those lines. It's an extremely novel idea which makes a lot of sense, which is used consistently and very very carefully. The idea of units being equivalent is so extraordinary that Andrew goes to *huge* lengths to make absolutely sure that he gets units correct throughout his work, using it as a careful cross-reference check in each and every single equation.

The closest known equivalent to his work is to describe it as "Koide-like" except the Koide formula is quite simple and can be covered in a few pages, whereas Andrew's work required an entire book to describe, it's that comprehensive and back to first principles. Andrew is currently spending a lot of time trying to get those extra few digits of accuracy.

6.8 Ido Kaminer

Seems to be at the centre of some fascinating investigations into nonparaxial gaussian beam superposition, particularly for medical uses in creating "optical tweezers". His work was the very first in which the author became aware that light could superimpose in self-consistent ways that resulted in curvature but, crucially, meant that *all* components would curve consistently at the *same* speed, same amount, and all change phase by exactly the same amount such that they would *continue* to curve as a self-supported coherent group. What was particularly fascinating to note was the fact that as the coherent array curved through an angle x the

phase of all components rotated by exactly $x/2$. This was interpreted to be the conditions for spin half and later turned out to be the "mobius" characteristic. Kaminer et al spent some time exploring if it was possible to get light to curve round so that it came back to its starting point, and the team that he worked with succeeded in this endeavour.

6.9 Hans de Vries

Came up with an empirical formula for alpha in 2004 which is undeniably accurate, and looks startlingly similar to the standard way in which the electron magnetic moment is expressed as a recursive iterative infinite sum, with the key difference being that the power is a triangular number in the alpha variant instead of a straight incrementing sequence. His formula's importance has been seriously, seriously underestimated by the mainstream scientific community. Blatant censorship on sci.physics.research is routinely carried out whenever attempts to discuss it are made.

Additionally he appears to have been extremely prolific in 2004 on physicsforums.com <https://www.physicsforums.com/threads/the-lepton-masses-from-g-pi-e.46055/page-3#post-382642>

6.10 Jay Yablon

Jay is one smart cookie whose work is comprehensive, thorough, and easy to follow. Most papers leave out the explanations and assume significant mathematical or other knowledge, leaving out really rather important and critical information that makes it incredibly hard to understand, follow or replicate the work. Jay's work is undeniably the complete opposite of that, so that even someone with no background in the required mathematics actually stands a reasonable chance of following along.

Jay's work is significant in many regards, notably for his work on Baryons as Yang-Mills monopoles, where he deploys a strategy based on "gaussian ansatz" (most likely not realising the significant c.f. Carl Brannen's work) which, funnily enough, provides accurate mass estimates to within $1e-10$ of experimental data. Recently his paper on time dilation and contraction takes the de Vries formula seriously, because of a highly-significant mathematical similarity in a recursive relation. This led to speculation that the fine structure constant is an infinite recursive series of Special Relativity corrections to the radius of particles... but this has yet to be proved unfortunately.

Summary: Jay's work is worth paying attention to.

6.11 Manfred Schmid and Pavel Kroupa

In a paper "The Spheronic Toy Universe: How Special Relativity may be Visualised to Emerge from a Wave-Nature of Matter", Schmid and Kroupa take the well-known "spherical standing wave" solutions for sound waves and drop them into a Special Relativity framework, then logically and mathematically deduce their similarity to particles including showing de Broglie phase waves, contraction and a speed limit.

Thus they show that it's logically possible for particles to *be* spherical standing-waves, which, according to all the other research, is stacking up in a rather large way to confirm the underlying hypothesis.

6.12 Introduction to QCD and Standard Model

Equation 1.7 looks remarkably like the equation for a pion as well as a quark, from the context and perspective of the ERM. Difference being that the quark would have the *opposite* colour of the same gluon, because the "gluon" represents the phase-transform of one quark *into* another quark.

6.13 Light captured as particle and wave

Investigate / assess:

<http://www.nbcnews.com/science/science-news/physics-first-light-captured-both-particle-wave-n315936>

7 Recurring Patterns and keywords

From a reverse-engineering "black-box" perspective, keywords are just as important as the people investigating them. This section therefore records various phrases that have been used in connection with the ongoing research, explains why they are important (as far as is possible) and their currently assessed level of importance.

7.1 gaussian beams

7.2 gaussian exponential

7.3 Jones Vectors, Jones Calculus, Jones Matrices

7.4 Poincare Sphere

7.5 $SU(2)\times U(1)$

7.6 Mobius Elliptically-polarised light

7.7 Koide Formulae

8 Discussion

The thing that is poignantly unfortunate at this stage of development of the Extended Rishon Model is that the author's lack of mathematical formal background and training is sufficiently comprehensive as to be unable to provide the required detailed formal mathematical proofs that would easily satisfy peer-reviewed scientific journals.

Instead, the author has chosen to pursue a breadth-first overwhelmingly comprehensive "corroboration technique" based on their expertise in reverse-engineering ("black-box" knowledge derivation), using techniques that are formally recognised under the nomenclature of "Demster-Shafer" theory as well as the field known formally as "Epistemology".

Over time however the intent is to fill the gaps by sheer bloody-minded persistence, as, despite the lack of formal mathematical training, the author feels that after thirty years of following an intuitive trail which has not had a single piece of contradictory evidence found or presented, there is definitely something to this Model that continues to make it worthwhile pursuing until it is complete.

This document therefore represents a "statement of ongoing work" in an equivalent format to a Wiki but more appropriate to the format of a scientific paper, and will, despite publication, unlike a normal scientific paper but instead more like a Wiki, be under constant revision indefinitely.

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