Contact: lkcl@lkcl.net

Abstract

This document is in effect a journal of the past thirty years of exploring particle physics, with a special focus on the electron. With the exception of this abstract, a first person dialog has been unusually chosen after discovering that it can be more effective in communicating certain logical reasoning chains of thought. The story begins in 1986 with the rediscovery of the Rishon Model, later expanded in 2012, followed by an exploration of possible meaning as to why the four Rishons would exist at all, and why they would exist as triplets: what possible physical underlying mechanism would give us "Rishons"? The following hypothesis is therefore put forward:

All evidence explored so far supports the hypothesis that all particles are made of phased-array photons in a tight and infinitely-cyclic recurring loop, in a self-contained ***non-radiating*** *E.M field that obeys nothing more than Maxwell's Equations (applied from first principles), with the addition that particles that are not nonradiating are going to be unstable to some degree (i.e. will undergo "decay"). Rishons themselves are* ***not actual particles per se*** *but simply represent the phase* ***and braiding order*** *of the constituent photons.*

A number of researchers have explored parts of this field, but have not pulled all of the pieces together.

Contents

1 Deriving the Rishon Model, 1986 **2**

2 Extending the Rishon Model, 2012 **2**

3 Research Phase **3**
- 3.1 Qiu-Hong Hu and G Poelz . . . 4
- 3.2 Dr Mills . . . 4
- 3.3 Ido Kaminer . . . 6
- 3.4 J G Williamson . . . 6
- 3.5 Cross-analysis of research to date . . . 6

4 Why does the Extended Rishon Model have an I-Frame and a Dumbell-frame? **7**
- 4.1 First Level Rishon Pattern (3) . . . 8
- 4.2 Second Level Rishon Pattern (9) . . . 10
- 4.3 Third Level Rishon Pattern (15) . . . 11
- 4.4 Possible Fourth Level (27) . . . 12
- 4.5 Summary of Layouts . . . 12

5 Why is it so important to acknowledge the existence of Vohu? **13**

6 What actual arrangements of photons would be inside an Electron? **14**

7 Summary and Conclusion **16**

1 Deriving the Rishon Model, 1986

My first introduction to particle physics was a fascinating hardcover book, bought by the Physics Department at Stonyhurst College. I loved the beautiful curves of the bubbles from ionisation caused by particle decay, and I was hooked.

In examining the quark model it made no sense to me that up and down quarks would have one-third or two-thirds charges unless the fundamental unit of charge was itself a one-third quantity. Bear in mind that the fractional Quantum Hall Effect experiments [20] had not yet been done. It also paradoxically made no sense that particles would have only fractional charges, i.e. if anything called a "particle" had a 1/3 or 2/3 charge, then that would be indicative (at least to me) that there was actually a full set of three, where the ones that weren't electrically-charged must be something-else charged, instead (aged 16 I seemed to have a penchant for symmetry). Furthermore, after reading historical records which explained magnetism as "flux", the idea occurred to me that maybe there was a type of particle which could transmit "magnetism" - obviously in concert with "electricity" because any theory which denies reality is going to fall flat on its face. Regardless of the logical reasoning being correct or incorrect at this phase, it led to the hypothesis that there were actually two different types of matter: T (for Tohu or "form") and V (for Vohu or "void"). Thus, quite by accident I had rediscovered the Rishon Model [1].

I spent many months mapping out the particles that had been discovered by experimental physicists up to that point: later when I revisited this topic I would find that many of them were wrong (and the concept of "decay" I had *completely* wrong), but I at least mapped out the electron, positron, neutrino, anti-neutrino, up and down quarks, proton, neutron and the pion. There simply wasn't sufficient information available at the time to deduce any further particles, and the original Rishon Model also was never extended beyond the first generation particles, nor provided a satisfactory explanation as to why T and V should exist at all. It was also impossible at this time to construct the constituent parts of the W and Z Bosons, thus also impossible to either get the "decay" model correct or to even work out what "decay" actually was.

One observation that was different from Haim Harari's original model [1]: the sign of V in all particles and equations was *inverted* when comparing my research and deductions to that of Harari's. This turned out to be crucial later.

In 1991 after graduating from Imperial College with a BEng (Hons) in Theory of Computing I took up a job with Atari and, there I made a phone call to a renowned scientist at CERN, explaining my interest in particle physics. She was very kind: asked me if I knew what a "Jacobean Matrix" was (which I did not) and from my answer she recommended that I pursue a degree in the required mathematics and physics. I thanked her for her advice and, because I had already just finished one degree at Imperial College, did not pursue the Rishon Model further until 2012.

2 Extending the Rishon Model, 2012

I believe it was the reputed discovery of the Higgs Boson that caused me to return to extend the Rishon Model [3], as I simply did not believe that the (two) particles which had been discovered were the Higgs Boson. In the intervening years a huge wealth of particles had been discovered, which, from the larger dataset, allowed me to refine and extend the model up to the third generation with a greater degree of confidence. With no

formal mathematical background beyond A-Level Maths I was unable to provide formal proofs, but I was able to do statistical and ratio analysis of mass values, and worked with Andrew Worsley [9] to make refinements and "educated guesses".

With the additional particles, in hindsight I was able to conclude that both Haim Harari's "Dynamic Rishons" extension [2], as well as the work of Paul Finkler, "Extension of the Rishon Model", must be incorrect: that there is some form of recursion at work, a rule even at the first generation level that is applied to form the larger generations, which is lacking mention or exploration in both preceding mentioned papers.

It was however at this point that I realised that Rishons must represent "phases", and that particle "decay" is simply a "phase transform" (where later I would encounter Piotr's Zenczykowski's work [4] which mentions "quantum phase space" using Clifford Algebra). Piotr, also very very interestingly, inverts the sign of Vohu on mapping it to phase space.

Also, that the E.M. field left behind by a particle as it "decays" is in effect an "imprint" on the surrounding space, into which the new particle(s) have to "fit". The concept of particle "decay" actually being a "phase transformation" is not a new one: it was just new to me, but in combination with the "imprinting" idea allowed me to replace *all* the Standard Model's rules of particle decay with some incredibly simple albeit utterly excruciatingly mind-numbing bit-level zero-sum bit-level "phase transforms". This realisation - the "phase" part of the transforms - would later lead me to the field of optics (experimental and theoretical) to look for answers.

It's worth emphasising that the process of deriving the phase transformations (aka particle "decay") are truly mind-numbingly excruciatingly laborious and boring. It took eight months to deduce the transform for the neutron into proton, electron and neutrino, with each diagrammatic experiment taking *two hours* to write out by hand and complete. Whilst the electron and neutrino are first-generation (three particles), and the neutron and proton are second (nine particles because the three quarks also contain three particles), the W and Z Bosons are a whopping *thirty* separate T and V particles. But that was not all: although the rules are very simple they did not add up: it was only when the total number of Rishons was balanced to thirty six (sum total of all T- and T+ particles being zero, and sum total of all V- and V+ particles also to zero) that the "decay" made sense. The missing particle: one extra gluon, where it had already been deduced that all gluons are ultra-short-lived pions.

With the addition of the extra gluon (aka ultra-short-lived "pion"), the extra six T and V particles brought the sum total of the intermediate "decay" particles to a **zero** balance when all charges of each separate type T and V are added up. This insight *completely* changes the nature of "decay" into that of a "phase transformation". No "lepton number conservation" or other complex rules turned out to be needed.

However despite these insights, I still had no inkling of what was actually inside the particles. I did however now have some clues: phases were clearly important, as was EM fields. I stopped developing the Extended Rishon Model and began to do some research.

3 Research Phase

Using a series of google internet searches I evaluated and read dozens of papers. Those which expanded the Standard Model I scanned in a cursory fashion: they were simply too complex but also seemed to be missing something very very crucial: a simple, rational explanation for what's *actually* inside particles. The explanations that said that statisti-

cally particles contain the sum of *all* potential probabilistic Feynmann-diagram-derivable states seemed to be to be more a mathematical theory trying to fit reality, rather than the other way round, even though the insight itself clearly works and provides answers. With pretty much every mainstream scientist pursuing the Standard Model, I therefore began to read more "fringe" papers that contained alternative ideas, quickly filtering out the ones that made no rational sense, made approximations, contained no formal complete logical proofs or did not read as plain English in the abstract and conclusion.

Paying at first particular attention to anyone who referenced the Rishon Model I quickly discovered the work of Piotr Zenczykowski [4] and of the wonderfully-named Sundance O. Bilson-Thompson [8]. Piotr Zenczykowski provides a mapping to the Standard Model [4] through O(6) phase space using Clifford Algebra. If this particularly lengthy exploration proves fruitful Piotr's work will be an invaluable aid to map it back onto the Standard Model.

Sundance O. Bilson-Thompson's work is particularly novel in that it takes a topological ("braid") approach to particles. The keyword here "braids" proves to be relevant later when an article was seen that describes phased-array photons ("braids"), where the order of the "braiding" is noted by the experimental physicists as being *really* important [14]. More on this later. We do note however that Sundance *removes* the sign on the V (Vohu) particle in his work, thus losing critical information which prevents direct application (mapping) of his work to photon phases.

Again however both of these authors do not provide *actual* explanations or offer any insight or opinion as to what particles are *actually* made of. I therefore continued researching, and, at different times encountered the work of Professor Qiu-Hong Hu [5], G Poelz [6], Hans de Vries [10], Jay Yablon [16], Dr Randall Mills [11] and Ido Kaminer [12] [13] as the primary material. During the writing of this paper, J G Williamson's work was encountered, and is definitely worth covering but will also need to be revisited again in future work [24].

3.1 Qiu-Hong Hu and G Poelz

Qiu-Hong Hu's paper is a clearly-readable step-by-step logical analysis of the electron, which has a key insight that mass is simply a result of the curvature of particles. If it curves, it has mass. If it doesn't curve, it is massless: it's that simple. It was only later that I encountered papers from the field of optics which showed *experimentally* that light really can be slowed down (travel slower than... the speed of... light...) [15] if and *only* if it is on a curved path. Again: more on this later.

G Poelz's paper was too complex for me to fully understand at the time, but I could feel that it was along the right lines. The key insight that I missed at the time was because the paper does not emphasise strongly enough the absolutely critical insight that the synchotronic E.M field re-absorption means that it is both *self-contained* and *non-radiating*. Again, there is no mention of what's actually inside the electron, but the fact that he uses Maxwell's equations is a big clue.

3.2 Dr Mills

I encountered Dr Randall Mill's work quite recently. It wasn't the hydrino parts of his work that captivated me: it was the stunning simplicity of his derivation of the electron g-factor. Again, applying Kolmogorov complexity to the formula that he derived, it simply cannot be dismissed out-of-hand. That there is clear and logically consistent

theory and mathematics behind the formula gives us pause for thought as to why his formula 1 is not more widely known.

$$1 + \frac{\alpha}{2\pi} + \frac{2}{3}\alpha^2\left(\frac{\alpha}{2\pi}\right) - \frac{4}{3}\left(\frac{\alpha}{2\pi}\right)^2 \tag{1}$$

Using the de Vries value for α [10] this incredibly simple formula evaluates to within 2.9e-10 of the current experimentally measured and theoretically-confirmed value for the electron magnetic moment, and with the current CODATA value for α [23] it is around 1e-8. From a lot of reverse-engineering experience I can conclude from this that Dr Mills is definitely along the right lines, but that he has missed out an important additional factor. Jay Yablon's work [16] gives us some hints as to what those additional factors might be. From equation (3.11) Jay lists *eight* separate factors, which are the result of the multiplication of three separate terms all of the form $(1 + x)$.

We surmise therefore that Dr Mills has missed out some of the terms that comprise the *combined* influences. Using numerical analysis (repetitive guess-work basically!) I was able to work out that the missing factor which brings Dr Mill's equation to within current CODATA experimental uncertainty for g/2 is:

$$\left(\frac{\alpha^2}{\pi}\right)^2 \tag{2}$$

or if we want to get technical and use the same sort of formulation as Dr Mills in order to make emphasis of the $\alpha/2\pi$:

$$4\alpha^2\left(\frac{\alpha}{2\pi}\right)^2 \tag{3}$$

The derivation of this missing factor was to take the discrepancy (2.86e-10 or thereabouts) and to keep arbitrarily and intuitively multiplying, dividing, squaring and so on by factors such as π, α, e and so on, giving high priority to the factors used in Dr Mill's original equation, until it reached as close to 1.0 with as few terms (reduced Kolmogorov Complexity) as possible. Each number so discovered was back-substituted into Dr Mill's equation as a 5th term: once the uncertainty dropped below that of the CODATA value I stopped searching - simple as that.

It's an art rather than a science to use this technique: the use of M. Rob's RIES [22] whilst it is on the face of it ideally suited to this task has proven ineffective in the past, due simply to brute force not being as effective for low Kolmorogov Complexity equation searches as intuition: RIES *can* be told to restrict the factors used in its search space but it still comes up with some pretty weird answers that are counter-productive. Regardless of the method used it is very very important to emphasise: *we have absolutely no theoretical basis for the missing factor derived in this fashion: it is provided as-is and we simply note the striking similarity to the other terms in the equation and leave it at that.*

Even without this missing factor, I concluded that it would be an extreme disservice to science to disregard Dr Mill's work, and so began to pay close attention to the derivation of the formula. Dr Mills describes 1 as follows:

> Eq. (I.90) derived in the Electron g Factor section gives the total energy of the flip transition, which is the sum of the energy of reorientation of the magnetic moment (1st term), the magnetic energy (2nd term), the electric energy (3rd term), and the dissipated energy of a fluxon treading the orbitsphere (4th term), respectively.

All of these are easily understandable with the exception of the fourth, which may be understood, possibly, to be the same thing as G. Poelz's "synchotronic radiation field". We surmise that Dr Mills has missed out at least a 5th term, starting with something (learning from Yablon, here) such as "the influence of the magnetic energy on the fluxon in the orbitsphere".

3.3 Ido Kaminer

Ido seems to be working on some absolutely fascinating projects involving optics. Some of that research involves the development of optical tweezers that can actually bend around solid objects so that surgeons can manipulate objects without invasive procedures. His team was involved in working out the solutions for coherent X-Ray beams to be able to actually curve (bend). What they managed to do was to find solutions which *remained* self-coherent and in phase. To emphasise that clearly, because it is very very important to understand: as the coherent phased-array beam bent, *all* components of that phased-array *remained* in phase, *bent and moved forward by exactly the same amounts* such that they would continue to move together on the exact same path. Their description is not exactly like that: it actually says that the beam is coherent at specific locations, recombining regularly (and importantly predictably, as far as the medical and other practical applications of their research are concerned).

A side-effect of their experiments and mathematical equations was - fascinatingly - that the coherent phased-array beams, as they bent through say 60 degrees, the phase of all components would *rotate through half that amount*. Forgetting for a moment that this is photons that we are talking about: we could in fact be describing the *exact* conditions for an electron's spin half!

Later on, Ido collaborated with a team to work out if it was possible to make coherent phased-array beams so tightly curved that they came *back to their original starting point* but not only that returning to the *exact same starting conditions*, in effect repeating the exact same pattern of behaviour indefinitely [12]. It would seem that they succeeded in coming up with such mathematical solutions.

3.4 J G Williamson

This work has only just recently been encountered and already it looks extremely exciting. Williamson is developing exactly the kind of theory involving Maxwell's equations that treats the photon as the prime and sole constituent of particles. Upper and lower bounds are given for an explanation of the elementary charge.

3.5 Cross-analysis of research to date

It is especially noteworthy that both G. Poelz and Dr Mills go back to first principles on Maxwell's Equations and that both reference Bessel functions. Key differences are that Dr Mill's equations have exact solutions whereas Professor Poelz provides upper and lower bounds. Also particularly noteworthy is that instead of using Quantum Mechanics, Dr Mills uses Hankel Transforms (three dimensional Fourier solutions) to solve otherwise intractable problems.

When I did a comparison of the solutions offered by the Standard Model to the electron magnetic moment, one thing struck me: Dr Mills has managed to separate out the different contributing factors (reorientation, electrical, magnetic, and what he calls "dissipated energy of a fluxon treading the orbitsphere"), whereas the Standard Model

simply lumps all of these factors into a single massive partial-differential equation which *has no mathematical means to solve it.* Only through the use of supercomputers and some serious guess-work is it possible to obtain the coefficients of the Standard Model equations for g/2, but beyond providing those coefficients there simply does not exist any actual connection that I can determine between them and any kind of real-world objects. By complete contrast, each of the four simple terms in Mill's equation has an actual real-world contribution and explanation.

Also of note: even though Dr Mill's formula for g/2 is accurate to within the order of 1e-10, he still does not actually offer an explanation for what an electron is actually made of! He also, perpelexingly, takes α as being a "universal constant", similar to the speed of light and π.

Jay Yablon's paper as well as Dr Mill's work are unusual in that they both separate out distinct parts for electro-magnetic effects, with Jay taking the "combined" influence of each part on each other part and Dr Mills not taking such combined influences into account. It is interesting to me to note that much of physics is the process by which equations are simplified, losing potentially critical information in the process but gaining a step towards fuller understanding at the same time. Jay's work is a reminder, at least to me, to always come back and revisit familiar equations in light of new insights.

In respect of this, it is with some sadness that I learned whilst writing this paper that the Wikipedia page on nonradiating conditions [17] makes mention of the idea of a "nonradiating model of the electron" as being extremely promising around 1910, but that it was *abandoned* when the Bohr Model was proposed, and has seen very little exploration or focus since. Papers such as those by Leigh Page [18] remain behind locked paywalls in obscurity. Hopefully however, more recent work for example by Davidson on nonradiating Maxwell's Equations will get a little more attention [19].

Williamson's work has 6-dimensional hints that mirror those of Zenczykowski's "phase space". I wonder if Vohu is simply the photon being folded into different dimensions than the three that are explored by Williamson in his paper [24]. Also, whilst Williamson's work is clearly still under development, and Mill's work is far more mature, Mills sticks firmly to three dimensions (and standard Maxwell's equations in three dimensions), evidence of which is shown in his proposing "Great Circles", whereas Williamson mentions that by moving to 6 dimensions the photon within may move on a toroidal path but is *mapped* to a sphere back in three dimensions, and at the same time Williamson makes it very very clear that there is some "extra factors" which standard Maxwell's equations miss out - exactly as we surmise above that Dr Mills has missed.

In essence: all of the research material, when combined, points towards Maxwell's Equations (as applied from first principles) as offering us a potential path towards a solution. However, none of the material found (including my own) actually yet provides the full picture: only glimpses and hints. And if we are talking about Maxwell's Equations, and massless particles, and bending of light in circles, we're probably talking about photons being the constituent parts of all particles. To whit:

> If it walks like a photon, and quacks like a photon, it's probably a photon.

4 Why does the Extended Rishon Model have an I-Frame and a Dumbell-frame?

When I approached a noteworthy physicist to ask for his opinion on the Extended Rishon Model, he very kindly responded and asked a really rather pertinent question: what is

the reason why you draw the Rishons out in a straight line in the first level, an I-Frame at the second and a "Dumbell" at the third? Actually he just simply asked, "What's the reason for the layouts of Rishons? What's their connection to physical reality of particles?" Honestly, at the time I had absolutely no idea and simply couldn't provide an adequate answer!

In light of the combination of the more complete map of the first and second level of the particles (the first level having been completed back in 1986, the second filled with the exception of one as yet potentially unidentified quark in 2014), and the link between Bilson-Thompson's work [8] and that of the "Braided Light" team [14] we can tentatively offer a potential answer.

The first thing that I feel it is very important to acknowledge: the "sea of virtual particles" of the Standard Model, whilst mathematically correct and valid to the point where it provides extremely useful insights, also at the same time rather unfortunately rejects any possibility that, if particles are genuinely made up of photons, the constituents might actually have position, phase, velocity and angular momentum i.e. be actually concrete and real. Ido Kaminer's work, The Ring Model [21] and Dr Mill's work [11] - being based on Maxwell's equations and thus *requiring* position, phase, velocity and angular momentum, tend to support this, Dr Mill's work in particular as it gives theoretical values for g/2, the mass of the electron and hundreds of other particles to wihin 10 decimal places (decreasing to six for the heavier atoms).

We therefore assume - for now - that there really is a genuine and actual geometric layout of some kind within particles, but because of my limitations in the mathematical field needed to complete the proofs, the layouts are to a certain degree *topological*, captivating as much information as possible, within the limitations of two dimensions. So far it seems to be enough.

4.1 First Level Rishon Pattern (3)

The first level is filled with four particles (plus anti-particles): electron, neutrino, up and down quarks. If we view the three Rishons spots as corresponding directly to the phase-ordering of braided light, we quickly appreciate that with two types of "particles" and three available "slots", the total number of distinct permutations (actual real particles) is eight. This sounds puzzling at first until we realise that if we take all possible permutations of the four Rishons in the three slots, T with anti-T or V with anti-V in the same triplet would "represent" two anti-Rishons in such close proximity that the particle could not possibly represent a stable pattern, if we consider Rishons to be E.M. phases of photons. Also, we note that some patterns, if we consider the triplets to be a circular loop, are in effect equivalent:

$$\begin{pmatrix} T \\ \overline{V} \\ T \end{pmatrix} \begin{pmatrix} T \\ T \\ \overline{V} \end{pmatrix} \begin{pmatrix} \overline{V} \\ T \\ T \end{pmatrix} \tag{4}$$

Despite the potential for loss of information, we assume that all three of these representations, due to the circular nature of the triplets, to be logically equivalent representations of the exact same particle, choosing to place the Rishon that is different in the *centre*. Haim Harari deals with the potential loss of information of this technique by applying a "colour" (R, G, B) to each Rishon. First attempts to replicate this technique into the Extended Rishon Model proved to be so fantastically overwhelmingly complex

(particularly when faced with diagrams containing over a hundred separate Rishons) that a deliberate decision was made to leave that exercise for another time.

What I feel can be said about colour is that is definitely going to be applied to each Rishon (just as Haim Harari did, as does Zenczykowsi in the phase-space model), and I feel that it will definitely be a representation of a circular "something" (in computer science terminology: a circular buffer). Possible explanations of layouts are discussed later (Kepler triple planetary arrangements, trefoils, etc.)

After all's said and done, turns out that there's only eight possible combinations out of the original potential permutation of 64. Also, we observe the following pattern from the eight combinations, which becomes particularly relevant later:

> *If we treat Tohu and anti-Vohu as numerical 1/3, and anti-Tohu and Vohu as numerical -1/3, the sum total of all three Rishons equals either 1 or -1.*

So of those eight possible particles: one (plus anti-particle) we know to be non-radiating (electron), we *assume* despite its constant fluctuation that the neutrino (and anti-particle) are equally non-radiating. Logically, by deduction: the fact that the up and down quarks are not observed as stable particles in their own right, we may reasonably assume that this could potentially be because they are **radiating**.

This hypothesis starts to make more sense when we explore the second level (and also analyse the pion). A pion is two quarks back-to-back, which we know to be reasonably long-lived but not fully stable. In Extended Rishon Model notation I place the two quarks side-by-side as if they were two vectors:

$$\begin{pmatrix} T \\ \overline{V} \\ T \end{pmatrix} \begin{pmatrix} \overline{T} \\ V \\ \overline{T} \end{pmatrix} \tag{5}$$

What I assume here is that the V Rishons are attracting in some way, and the T Rishons are spinning about their corresponding first-level V partners. This supposition makes *no sense* until it occurred to me that the particle **might be emitting E.M radiation parallel and directly along its central axis of rotation**.

However before progressing any further it is worth mentioning that the "Toroidal Ring Model" of particle physics [21] *might* also be a match for the I-Frame Topology (and the "rules" or "patterns" that it represents, the key area to explore being the possibility that if the 3-Rishon particles are in fact "rings" then they would "lock" one inside the other (in phase) in some fashion. This yet to be explored, well beyond the scope of this document and a digression from which we return.

The pion representation above therefore corresponds to an arrangemeent where the two quarks *emit* and *reabsorb* E.M. radiation in a phase-locked equilibrium along their central axis of rotation. Given that we assume that T and V *are* representative of phase angles of photons (T being real and V being imaginary), the attraction of the V and anti-V Rishons begins to make actual sense to me.

Where the pion really initially doesn't quite make a lot of sense to me is the charged pions, $\pi+$ and $\pi-$. Here is a $\pi+$:

$$\begin{pmatrix} T \\ \overline{V} \\ T \end{pmatrix} \begin{pmatrix} \overline{V} \\ T \\ \overline{V} \end{pmatrix} \tag{6}$$

Basically here we have an up quark and an anti-down which is positively electrically charged (T*3) and Vohu negatively charged (-V*3). This double-charging is a fascinating and unique property of pions, the significance of which has been completely overlooked: it means in effect that pions exist simultaneously in the realms covered by both the electron *and* the neutrino.

Regardless of this fascinating digression: how these two would *ever* stick together is a complete mystery, until you look more closely: both the up quark and the anti-down quark comprise only the two Rishons T and $\overline{V}$. Thus, logically, we surmise that if those two Rishons (or photon phases) can co-exist in close proximity within each triplet, we can surmise that there should also exist some conditions where two triplets (quarks in this case) that have the same makeup might make up a temporary particle. Beyond that observation I have no other clue as to the possible interaction of these two quarks when it comes to Maxwell's Equations, but note in passing that any solutions will definitely need to take the weirdness of the pion family into account.

4.2 Second Level Rishon Pattern (9)

Moving to the I-Frame arrangement, we now have 512 possible permutations (8 particles, 3 positions). However, we know that particles do not exist and have never yet been discovered that have +3 electrical charge, or 1 and 1/3 electrical charge, or anything basically other than between 1 and -1 in 1/3 increments, which immediately eliminates a vast number of the potential combinations. The same rule that applies at the first level also applies at the second:

> *If we treat Tohu and anti-Vohu as numerical 1/3, and anti-Tohu and Vohu as numerical -1/3, the sum total of all nine Rishons equals either 1 or -1.*

So we note that seven of the eight possible combinations (plus anti-particles) were logically deduced: Proton, Neutron, Muon, Muon-Neutrino, Charm, Strange and Bottom (*Top is too massive and fits better, according to Worsley's mass-ratio analysis technique, into an entirely different category*). We therefore deduce that there are sixteen possible "places" for particles comprising the (eight) first-level Rishon Triplets. An example is the proton:

$$\begin{pmatrix} T \\ \overline{V} \\ T \end{pmatrix} (V\overline{T}V) \begin{pmatrix} T \\ \overline{V} \\ T \end{pmatrix} \tag{7}$$

When that central quark is laid out in a vertical fashion to match that of its two neighbours, I noted intuitively that information was lost. However, when analysing all eight (plus trivially anti-) particles, in noting that in over thirty years of research no particle has **ever** been discovered with a mass that would put it into this same "second level" group which has for example an up quark, a neutrino and an electron when mapped to its constituent Rishons, the remaining eight (plus anti-) particles had a secret pattern.

That pattern turned out to be that:

- The middle triplet was symmetrical, due simply to the first level symmetry: all 3-Rishon particles are symmetrical about their central Rishon.
- The two outer triplets were always identical
- The middle Rishon of the outer triplets was always the **exact** equal type and opposite sign as the outer Rishons of the middle triplet.

So, for example in the above equation for the proton 7 the V and anti-V Rishons *line up*. It turns out that this "pattern" which I arbitrarily named an "I-Frame" holds for all sixteen possible combinations of particles (fourteen identified, two as-yet unidentified) at this second level *(Also, as noted right at the beginning of this document: this pattern would not work without that inversion of the V Rishon sign, when we look at Haim Harari's original model).*

Now, without a proper formal mathematical analysis it's impossible to say at this point whether the middle particle in its "horizontal" arrangement is somehow *actually* laid out horizontally: if Dr Mill's and G Poelz's work is extended to quarks for example, and we pre-suppose that all particles including the up and down quarks are in synchotronic circular or "Great Sphere" arrangements, radiating perpendicular to the axis of rotation makes no immediate sense. All we can say at this point is: analysis of the available data leaves us with this "Topological" representation of an underlying pattern that I cannot ignore, which is best laid out in its most elegant (and easy-to-verify when performing manual checks) form: an I-Frame. At least we know that one of the I-Frame patterns is self-sustainingly stable: the proton, whilst the neutron has an above-average half-life and *becomes* stable when part of a nucleus.

What we surmise, at the very least, is that there may be some similar "braiding" style boundary condition that, in combination with the radiating and non-radiating conditions expected of the eight first-level arrangements within the I-Frame, helps in the search for Maxwell equations solutions. We expect the proton arrangement to be non-radiating, the neutron to be *nearly* non-radiating, and the remaining six (plus anti) arrangements to be radiating. Perhaps it will turn out that the last remaining arrangement (as-yet unidentified quark) is so unstable or emits so much radiation that it cannot exist for durations long enough for it to be detected. Perhaps it will turn out to be of a form that is instantly morphable to an alternative pattern (such as that of the particles which are their own anti-particle): we just don't know and there is simply not enough information or evidence to make any deductions with any confidence at this stage.

4.3 Third Level Rishon Pattern (15)

The "dumbell" arrangement - a 5-triplet pattern - is fascinating and noteworthy because it is an extension of the I-Frame to in effect add two pions left and right of a central triplet. It therefore takes on corresponding aspects of the I-Frame and the pion. The particles so far observed to date that fit the 5-triplet "dumbell" pattern are *zero spin*. Also, fascinatingly, despite there potentially being 8^5 or 32768 permutations, the combined effect of the pion-applicable rules for the left and right pairs, along-side those of the I-Frame, as well as the "sum of T and inverted V must come to either 1 or -1" rules restrict the combinations that fit the 5-triplet pattern to just *four* possible combinations, which I named ultra-quarks. These four combinations turn out to be the constituent quarks of the W and Z Bosons (and anti-bosons), which themselves are simply second-level ultra-pions comprising thirty Rishons each.

The point is, then (to answer the original question): that there is some indication, topologically at least, to support the layouts proposed at the three levels to provide a clear visual (verifiable) representation of the patterns that have been observed at each level, to date. The patterns also provide us with a means to predict both additional quarks (unidentified second-level quark and the ultra-quarks of the W, Z and both particles currently identified as "Higgs" kind as being an ultra-neutron and ultra-proton), as well as, when it comes to phase-transforms, predict the involvement of an as-yet-

unnoticed gluon (aka ultra-short-lived pion) whenever a W or Z Boson is involved in particle "decay".

I remember clearly being told over twenty years ago that an important part of any new theory is that it must either be more elegant (simpler) than a pre-existing theory (yet just as useful), or that it must make some prediction which can later be confirmed. The Extended Rishon Model makes at least three such predictions.

Furthermore, there exists circumstantial evidence in the field of optics (Light Braiding, Non-paraxial phased-array circular photon arrangements) that tentatively hint that the Extended Rishon Model is still "in the running". As yet I simply haven't encountered anything that contradicts the logical chain of deduction made so far: far from that being the case, the more research that I do I find supporting evidence or evidence that helps refine the model further.

It is however extremely frustrating to not have the mathematical ability, time or expertise to carry out the necessary formal Maxwell based analysis that would put this model on a firm footing.

4.4 Possible Fourth Level (27)

There's only one possible quark which, through cross-referenced mass ratio analysis techniques [9] places it potentially into a separate category: the top quark. There simply aren't any other particles or quarks yet discoveredd which could fit this category, as the energies involved in past experiments are below the threshold of generating particles which contain fourth-level quarks... with the weird anomalous potential exception of top.

It's all a bit of a mystery to me and the only thing that I can do is wait patiently for the upgraded LHC to announce newly-discovered particles that don't fit any current experimental results. It may however need an upgrade even beyond the reach of the currrent LHC.

What we *can* say even now is that the 27-Rishon Frame will simply a repetition of the rules discovered from the second level (9 Rishons). There should again be eight (plus anti-) slots.

4.5 Summary of Layouts

So to recap, as that was quite a lot:

- Application of Maxwell's equations *requires* actual position etc. and that photons within the particles be real as opposed to part of a virtual sea.
- Rishon "Frames" assumed to be semi-topological, representative of interim information until such time as Maxwell's equation solutions are found.
- First level (triplet) most likely a circular ring, meaning that the (photon) braiding order is also circular.
- Central (different) Rishon placed in middle of triplet purely for convenience
- Circular braiding order plus "sum total" rule restricts triplet permutations to just eight.
- Pions are weird but logical on close examination.
- $\pi+$ and $pi-$ very special: part-electron, part-neutrino.

- Second (9) and Fourth (27) levels still has the same "sum total" rule.
- In the Second level the middle Rishon's triplet appears to match up with the middle of the left and right triplets, in opposite sign but same type.
- Colour (R, G, B) is assumed to represent the phase order of each Rishon within triplets, in some way. This needs investigation in a separate paper.

5 Why is it so important to acknowledge the existence of Vohu?

This is quite a tough but important question. Vohu represents (or correlates with) the complex phase of the photon(s) within the particles (if we may assume this to be true for the purposes of answering this question). To ignore Vohu is in effect to cut off 50 percent of all information from which decisions and logical inference can be made. The neutrino is *entirely* comprised of Vohu Rishons - i.e. its "presence" if you will is almost entirely in the complex numberplane, which goes a long way towards explaining why the neutrino has been so elusive for such a long time.

Whereas during "decay" (aka "phase transitions") the Standard Model can only utilise the electrical charge to make logical inferences and deductions as to what the "rules" are of particle "decay", the Rishon Model has *both* Tohu *and* Vohu to make logical deductions. When the Standard Model says that a particle is "neutral", the Rishon Model can say that it is "Tohu Neutral and Vohu Positive".

This distinction is *really* important! With half the information missing it is extremely easy to come up with empirical rules that miss out critical underlying phenomena.

With half the information missing, of course the empirically-derived rules of Standard Model "decay" conclude that "charge" has to be conserved in the intermediary particles (W+ Boson). The Standard Model has no means by which to even recognise or record that the Z Boson is Vohu charged! Or that there are two separate and distinct Z Bosons: one Vohu-positive and the other Vohu negative!

It is very hard to describe how I feel about this situation. There are so many people in the particle physics community working *really* hard, doing an absolutely amazing job to increase the sum of knowledge of humanity, and yet by pure chance on the trail of scientific discovery of the past two centuries *potentially half of the nature of matter is not even acknowledged.*

With the empirical rule having been established that "electrical charge must be conserved", nobody is looking for that extra gluon (aka ultra-short-lived pion) that is deduced, from the Rishon Model, to be the counter-balance to the W (or Z) Boson that always, always brings the sum total charge of the intermediate "decay" particles to *zero.*

It may even be the case (and it is incredibly hard to prove or disprove) that Vohu is involved in orbital "shells" just as Tohu is clearly involved in orbital "shells" (electrons around atoms). It may even be the case that thanks to Vohu charge, *neutrinos actually orbit neutrons and even form covalent bonds.* Thus, just as two protons bond together to create a Hydrogen-Hydrogen compound, with two orbital electrons to bond them together, we would expect *two neutrons to bond together to create an as-yet-undiscovered compound, with two orbital neutrinos creating a covalent bond between them.*

The problem with such a compound - Neutron-Neutron - is that it would be electrically neutral, magnetically neutral, extremely stable and non-reactive, as well as completely chemically inert. Chances of detection (and thus proof or disproof of its ex-

istence): astronomically low. To my mind, that sounds an awful lot like the perfect description of "Dark matter".

Yet, frustratingly, with the Standard Model *not recognising the existence of Vohu*, there is quite literally no handle on the concept that neutrons could have neutrinos orbiting them in shells in a direct analogous way that we understand electrons to orbit protons.

These are just some of the examples of the discrepancies - yawning gaps would be a better word - between the Standard Model and the Extended Rishon Model, which inspire me to keep looking for ways to complete the formal mathematical proofs that would make it worthwhile to bring the Extended Rishon Model to the attention of the wider, formal scientific community. Sadly we no longer operate in the climate of scientific enquiry of the 1800s and 1900s where there were far fewer contributors and everybody knew everybody. Theories are now simply too complex and there is too much extraenous noise. I recognise this very well... but I don't have to like it.... but I do have to apologise for feeling it is quite so necessary to vent my frustration in this (public) fashion.

6 What actual arrangements of photons would be inside an Electron?

This is the million-dollar question. With all the research and deductions made, I *still don't know* because I lack sufficient expertise or time to tackle the Maxwell Equations solutions. I can however make some educated guesses as to what form the arrangements would take. Bear in mind that both the "braided" clue(s) as well as the Poelz, Mills and Sundance clues all have to be taken into account. Bear in mind that we are talking about a first-level Rishon arrangement here (triple Rishon only):

- In early versions I believed (around 2012) that there was only one photon, and that it "popped up" through extra dimensional expansion, in three different places (each of the three points of the Rishon triplet sub-structure). There's no evidence to support or disprove this, but it is generally unwise to dismiss ideas out-of-hand until there is clear statistical empirical or theoretical evidence to do so.
- My favourite form would be a triple Kepler-like planetary-style arrangement: equidistantly-spaced, 120 degree phase difference (in the case of the electron: differing phase and ordering for other particles), except using Maxwell's Equations to work out the E.M field effects instead of using gravitational attraction.
- Following Ido Kaminer's lead we would have a single starting point source for all "phases" (again, 120 degrees makes sense) but that each Rishon-aka-photon would be a *phased-array* group of photons, so arranged to interact not only with themselves but also with the other two "Rishons", as well as their own non-radiating field (a la Mills and Yablon). It's... complicated, to say the least.
- A combination of both: phased-arrays of Kepler-like triple equidistantly-spaced *groups* of photons to represent each Rishon, where the phase-differential and braid-ordering once again reflects the Rishon first-level patterns (eight total).
- A 3-node harmonic arrangement aka "trefoil knot" which happens, quite obviously, to have three points at which the phase of the photon would reach a specific angle (representative of Tohu if it is real and Vohu if it is imaginary).

The nice thing about the Kepler-like arrangement: in the case of the electron, the E.M fields of the two opposing Rishons-aka-photons-or-arrays would combine to cancel out into the *exact* opposite phase, direction (and presumably required magnitude) to cause that third photon (or group) to bend inwards on a circular path. The symmetrical nature would mean that this condition applied to all three photons, thus resulting in *all three* photons continuing on their circular paths, forever. Within the limit of my mathematical ability I can at least calculate that by the time the third photon has gone round 120 degrees of the Great Circle (Mills) or Torus (Poelz) it will (according to Ido Kaminer's research) have rotated in phase by half that amount. The combined radiating E.M. field of the other two should reach it at *exactly* 60 degrees as well! Which is pretty elegant and awesome at the same time... as long as it's possible to ignore relativistic effects in some fashion (i.e. assume that the field does not curve in perspective to the observer, like when you are in a cyclic fairground attraction and try to throw a ball to someone on the opposite side. For the "trick" of phase-combining to work, the fields from the two other photons have to keep sync and not arrive at the third at different times. Solutions if that turns out not to be the case are completely beyond me, I am happy to admit).

The trefoil knot arrangement would only seem make sense in the context for example of either Zenczykowski's 6-dimensional phase-space [4] or J G Williamson's 6-dimensional model [24]. The latter we assume that if the single-loop (similar to Qiu-Hong Hu's helix) is stable within Williamson's theory that the trefoil would equally be as stable, and that it would even demonstrate the same spin-half characteristic, by inverting sign on every other traversal of the trefoil's path. What however isn't immediately clear is how Vohu would be represented: we anticipate that a careful study of both Piotr and Williamson's papers might suggest some answers.

That's really about it. It seems safest to first at least investigate planar possibilities (Great Circles as Mills calls them), to follow up the Toroidal Ring Model topology next, and finally to consider alternatives as yet to be determined.

7 Summary and Conclusion

I started out deriving the Rishon Model from scratch, inverting the sign of Vohu to match that initial 8 (plus anti-) slots within the I-Frame. Later expanded the Rishon Model to a third level with the introduction of ultra-quarks to cover the W, Z and the two (incorrectly-named) Higgs particles around the 126GeV level, which I named ultra-proton and ultra-neutron, respectively.

I also always wondered, even thirty years ago, if Tohu was related to electrical and Vohu to magnetism: I still have not given up on this entirely (for reasons beyond the scope of this document), but now much favour the concept I encountered after reading C.D. Yang's work [7], namely that Tohu must be "real" and Vohu must correspond to "imaginary", which, in combination with Poelz and Hong's work, brought me confirmation by a different path of those first hints that particles might simply be made of photons. Only after encountering Mill's work did the absolutely critical necessity of the nonradiating condition make any sense, and for the first time on re-reading Poelz's paper I spotted (and understood) his use of the phrase "re-absorption", interpreting it to be the same thing as the nonradiating condition used by Mills.

In reaching out to various renowned physicists to ask them if photons could curve, their response was shocking in its denial and intensity: absolutely not. I wish that I had, at the time, access to the Research papers, and the experimentally-observed peer-reviewed papers that clearly show otherwise. Sadly I get the impression that if I had pointed them at those papers they would simply not have responded at all to my honourably-intentioned genuine and respectful enquiries.

Instead, then, from the clues of both Poelz and Qiu-Hong Hu (massless condition) I explored the field of optics and encountered Ido Kaminer's work, which confirmed the possibility of photons being able to travel in circular phased-arrays, thus providing support for the underlying theory of the Ring Model and Dr Mill's work.

More recently, Williamson's work, whilst experimental and still under development, looks very exciting as it is one of the first papers I've encountered that makes sense, fits with the other research, and actually provides support for the idea of photons within particles, moving to six dimensions to do so.

In essence, there really doesn't appear to be anything contradictory to the hypothesis that it is simple photons at the epicentre of particles, obeying Maxwell's Equations in a simple classical form in an as-yet unsolved fashion. Yet, I hope that at least this document provides not only a justification for the Extended Rishon Model (due to it being representative of the braid-order and phase-arrangements of photon triplets and other arrangements at other levels), but also that the combined hints and clues are sufficient and clear enough for a mathematician or computer scientist to actually spend the time exploring this underestimated area in search of solutions. Or, at least, proofs sufficient to show me undeniably that I am wrong, so that I can at last stop wondering. Either way I would be most grateful.

References

[1] Harari, H. (1979). *A Schematic Model of Quarks and Leptons"*, Physics Letters B 86 (1): 83–86. Bibcode:1979PhLB...86...83H. doi:10.1016/0370-2693(79)90626-9.

[2] Haim Harari, Nathan Seiberg, *A dynamical theory for the rishon model*, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/12/598/12598150.pdf doi:10.1016/0370-2693(81)90012-5, Physics Letters B Volume 98, Issue 4, 15 January 1981, Pages 269-273.

[3] Luke Kenneth Casson Leighton, *An introduction to the Extended Rishon Model*, http://vixra.org/abs/1403.0016, vixra:1403.0016, 03 March 2014.

[4] Piotr Zenczykowski (2008), *The Harari-Shupe preon model and nonrelativistic quantum phase space*, arXiv:hep-th/0803.0223

[5] Dr Qiu-Hong Hu, *The nature of the electron.*, arXiv:physics/0512265, `http://arxiv.org/abs/physics/0512265`, 2005.

[6] G Poelz, *On the Wave Character of the Electron* arXiv:physics/1206.0620v13.

[7] Ciann-Dong Yang, Complex Mechanics, Progress in Nonlinear Science Volume 1, ISSN 2077-8139, 2010.

[8] Bilson-Thompson, Sundance (2005). *"A topological model of composite preons"*, arXiv:hep-ph/0503213

[9] Dr Andrew Worsley, A Chronicle of Modern Physics, Book 2, *Flying on the Wings of Genius.* 2006.

[10] Hans de Vries, *An exact formula for the Electro Magnetic coupling constant.* http://chip-architect.com/news/2004_10_04_The_Electro_Magnetic_coupling_constant.html October 4, 2004.

[11] Dr Randell L Mills, *The Grand Unified Theory of Classical Physics*, http://brilliantlightpower.com/book-download-and-streaming/, September 2016 Edition.

[12] Rivka Bekenstein, Jonathan Nemirovsky, Ido Kaminer and Mordechai Segev, *Shape-Preserving Accelerating Electromagnetic Wavepackets in Curved Space*, arXiv:physics/1310.6153.

[13] Rivka Bekenstein, Jonathan Nemirovsky, Ido Kaminer and Mordechai Segev, *Nondiffracting Accelerating Wave Packets of Maxwell's Equations*, http://phys.org/news/2012-04-physicists-maxwells-equations-self-bending.html, doi:10.1103/PhysRevLett.108.163901, 6 April 2012.

[14] Thomas Iadecola, Thomas Schuster, and Claudio Chamon, *Non-Abelian Braiding of Light*, http://phys.org/news/2016-08-physicists-method-braiding.html, DOI:10.1103/PhysRevLett.117.073901, arXiv:1509.05408, 10 August 2016

[15] Daniel Giovannini1, Jacquiline Romero1, Václav Potoček1, Gergely Ferenczi, Fiona Speirits1, Stephen M. Barnett1, Daniele Faccio, Miles J. Padgett, *Spatially structured photons that travel in free space slower than the speed of light*, http://phys.org/news/2015-01-physicists-air.html, DOI:10.1126/science.aaa3035, 10 August 2016

[16] Jay R Yablon, *Electromagnetic Time Dilation and Contraction, and a Geometrodynamic Foundation of Classical and Quantum Electrodynamics*, http://vixra.org/abs/1609.0387, vixra:1609.0387, 26 September 2016.

[17] Wikipedia, *Nonradiation condition*, https://en.m.wikipedia.org/wiki/Nonradiation_condition.

[18] Leigh Page, *A Generalization of Electrodynamics with Applications to the Structure of the Electron and to Non-Radiating Orbits*,

http://journals.aps.org/pr/abstract/10.1103/PhysRev.18.292,
DOI:https://doi.org/10.1103/PhysRev.18.292, 1 April 1921.

[19] Mark P Davidson, *Quantum wave equations and non-radiating electromagnetic sources*, https://arxiv.org/pdf/quant-ph/0606245.

[20] Suzanne Viefers, *Quantum Hall physics in rotating Bose-Einstein condensates*, https://arxiv.org/pdf/0801.4856v1.pdf, arxiv:0801.4856 13 February 2013.

[21] Wikipedia, http://en.wikipedia.org/wiki/Toroidal_ring_model.

[22] M Rob's RIES, http://mrob.com/pub/ries/

[23] Peter J. Mohr, David B. Newell, Barry N. Taylor, *CODATA Recommended Values of the Fundamental Physical Constants: 2014*, arxiv:1507.07956, July 30, 2015.

[24] J.G.Williamson, *On the nature of the photon and the electron*, DOI:10.1117/12.2188259, September 15.