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Abstract

We introduce an expansion of the Rishon Model to cover quark generations, (including a previously unnoticed one), provide an explanation for T and V as a topologically convenient moniker representing aspects of phase and polarity within knots (of for example String Theory), and explain particle decay in terms of simple "phase transform" rules. We identify all current particles (with the exception of "Top") including the gluon, the Bosons and the Higgs, purely in terms of the underlying mechanism which topologically can be considered to be Rishons. All this is predicated on the simple assumption that all particles in effect photons phase-locked in a repeating pattern inherently obeying Maxwell's equations, in symbiotic support of their own outwardly-propagating electro-magnetic synchotronic radiation [4], and that Rishons represent a phase "measurement" (real or imaginary) at key strategic points on the photon's path.

Contents

1 Expanded Rishon Model Particles

In the Rishon Model [1] there are two types of particle: T and V. However the original lacks an explanation for generations, as well as a satisfactory analogy as to why T and V should exist. Piotr Zenczykowski provides a mapping to the Standard Model [2] through O(6) phase space using Clifford Algebra. We take a different perspective, that all particles are photons obeying Maxwell's equations and that Rishons are a record of the phase of the photon, in real and imaginary numbers, at key points on the photon's track. *(We note in passing that Clifford Algebra is a generalisation of complex numbers).*

We begin from a base model of a massless synchotronic photon in a phase-locked loop [4]. This being the case, all photons having phase, polarity as well as frequency, T may be considered to be the "real" mathematical part of a photon's polarity and V may be considered to be the imaginary part. From known physics covering photons we therefore already have the mathematical tools necessary to describe the Rishon Model: all that was missing was the identification.

Under current investigation is both String Theory as well as the old model of toroidal "knots" as the basis for elementary particles. A 3,2 toroidal knot would have the required characteristics of having three points at which phases would peak, as well as inherent spin 1/2 [3] [4]. Three peaks give the opportunity to express one each of T and V particles, as well as giving an explanation for "colour" as being - quite literally - three phases (of the same photon). Also useful for visualisation purposes is Sundance Bilson-Thompson's topological Model [7] (note however that Bilson-Thompson begins with the Rishon Model but assigns V a neutral charge with no explanation as to why). Also noteworthy is that toroidal knots come up in String Theory. So the possibility of "Vohu" being imaginary polarity therefore definitely feels like it is along the right lines.

The elementary particles of the Rishon Model are shown in Figure 1:

		T-charge	V-charge	Total Charge
up	T V T	+2/3	+1/3	+1
down	$\bar{V}$ $\bar{T}$ $\bar{V}$	-1/3	-2/3	-1
electron	$\bar{T}$ $\bar{T}$ $\bar{T}$	-1	Ø	-1
neutrino	V V V	Ø	+1	+1

Figure 1: Fundamental Rishon particles and charges

From the perspective of a particle literally being a photon, the sum total of both the T-charge and V-charge of each of the Rishons must be either +1 or -1. Considered thus: three points, 120 degrees apart, on a sine wave must, by definition of a sine wave, exist, period.

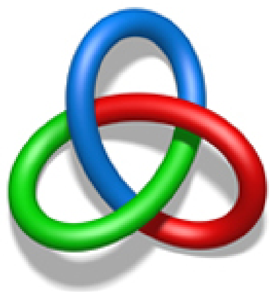

Figure 2: 3,2 (Trefoil) Knot, marked with three phases R, G and B

We see in figure 2 three separate colours: these correspond to the three "opportunities" at which T or V may be expressed. As the polarity is permitted to rotate (from real to imaginary) as the wave progresses on its phase-locked loop, at each of these three places if the polarity is real we have T, and if it is imaginary we have T. The eight permitted patterns (if anti-particles are also included) is therefore defined mathematically by the limited possible polarisation options of the photon. So although it is possible to have TTV, the fact that the three Rishons are circularly linked (last back to first) TTV is effectively equivalent to both VTT and also TVT. We therefore use the convention of placing the differing Rishon in the middle (TVT, VTV).

In effect then, the Rishon Model is (just as in Sundance Bilson-Thompson's braids method [7]) simply a topologically convenient way to visualise particles. As such we explore Rishon generations within this easily visualised manner and note some surprising discoveries along the way.

2 Neutron and Proton

Next is the neutron and proton, shown in Figure 3, where the up and down quarks known to be present in neutrons and protons are expanded into their corresponding Rishon particles:

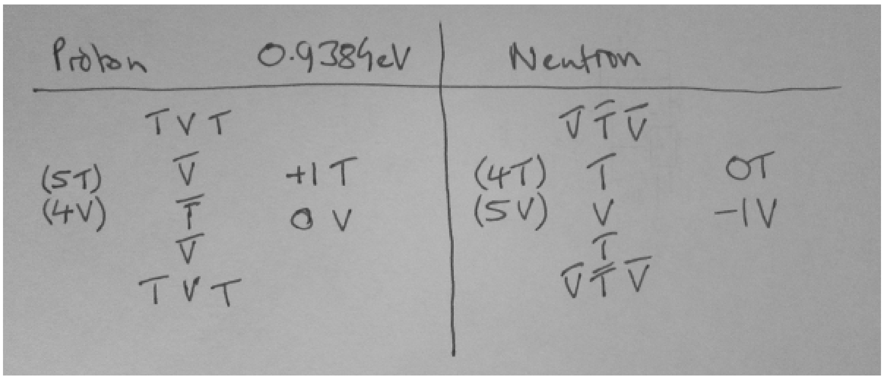

Figure 3: Proton and Neutron Rishon Model structure

The proton has, as expected, a +1T (electrical) charge and the neutron has 0 electrical charge. However: note that whilst the proton has a zero V charge, the neutron has a *negative* (-1) V charge. From this we quite reasonably surmise that the neutrino has a *positive* V charge, on the grounds that the electron has the opposite T charge from a proton.

We lay out the Proton and Neutron in this shape as a way to express spin characteristics. It is believed that this is actually how the larger (composite) particles generate spin. Under investigation for additional possible explanations however are further toroidal knots (in this case the 10,3 pattern).

Observe in the proton how the end $\overline{V}$ particles of the down quark line up with the central V particles of the up quarks at either end. In this way the two up quarks may safely themselves spin, and at the same time the whole "I-shaped" assembly may rotate, thus providing from an external perspective the observed spin characteristics noted of protons in current particle physics models. This arrangement also places a natural explanation for a limit on certain combinations of Rishons.

3 Rishon "I" Frame

If other Rishon particle combinations were placed into an I-shaped frame, applying the same rule that the ends of the middle particle attract the middle of the end particles to create a stable rotating whole, it turns out that there are 16 total possible patterns, shown in Table 1:

udu	(['TVT', '$\overline{VTV}$', 'TVT'])	$t: 1$	$v: 0$	*proton*
udv	(['TVT', '$\overline{VTV}$', 'VVV'])	$t: 1/3$	$v: 2/3$	*anti − bottom*
u$\overline{v}$v	(['TVT', '$\overline{VVV}$', 'VVV'])	$t: 2/3$	$v: 1/3$	*unidentified*
$\overline{u}\overline{d}\overline{u}$	(['$\overline{TVT}$', 'VTV', '$\overline{TVT}$'])	$t: -1$	$v: 0$	*anti − proton*
$\overline{u}\overline{d}\overline{v}$	(['$\overline{TVT}$', 'VTV', '$\overline{VVV}$'])	$t: -1/3$	$v: -2/3$	*bottom*
$\overline{u}v\overline{v}$	(['$\overline{TVT}$', 'VVV', '$\overline{VVV}$'])	$t: -2/3$	$v: -1/3$	*anti − unidentified*
dud	(['$\overline{VTV}$', 'TVT', '$\overline{VTV}$'])	$t: 0$	$v: -1$	*neutron*
du$\overline{e}$	(['$\overline{VTV}$', 'TVT', '$\overline{TTT}$'])	$t: -2/3$	$v: -1/3$	*charm*
de$\overline{e}$	(['$\overline{VTV}$', 'TTT', '$\overline{TTT}$'])	$t: -1/3$	$v: -2/3$	*strange*
$\overline{d}\overline{u}\overline{d}$	(['VTV', '$\overline{TVT}$', 'VTV'])	$t: 0$	$v: 1$	*anti − neutron*
$\overline{d}\overline{u}e$	(['VTV', '$\overline{TVT}$', 'TTT'])	$t: 2/3$	$v: 1/3$	*anti − charm*
$\overline{d}\overline{e}e$	(['VTV', '$\overline{TTT}$', 'TTT'])	$t: 1/3$	$v: 2/3$	*anti − strange*
$\overline{e}e\overline{e}$	(['$\overline{TTT}$', 'TTT', '$\overline{TTT}$'])	$t: -1$	$v: 0$	*muon*
e$\overline{e}$e	(['TTT', '$\overline{TTT}$', 'TTT'])	$t: 1$	$v: 0$	*anti − muon*
v$\overline{v}$v	(['VVV', '$\overline{VVV}$', 'VVV'])	$t: 0$	$v: 1$	*muon neutrino*
$\overline{v}v\overline{v}$	(['$\overline{VVV}$', 'VVV', '$\overline{VVV}$'])	$t: 0$	$v: -1$	*anti muon neutrino*

Table 1: permutations of all legitimate I-Frame Rishon particles

For brevity of this introduction the deduction of the above identification (muon, strange, charm etc.) has been left out. The python program used to generate these 16 patterns followed the rule of having the central Rishon of the two outer triplets be the opposite charge but the same type as the outer of the central triplet.

How we deduce the concept of the I-Frame is an inherent part of the I-Frame and the fact that there are only sixteen possible combinations for the rules as specified. Reality could well be that this is merely a topological representation which happens to fit these rules. What we can say however is that this topological representation allows us intuitively to see that all sixteen particles must have spin $\frac{1}{2}$ as the two end Rishon-groups are permitted to rotate about the centre.

4 Further Extension of the I-Frame structure

The next logical progression up from a 9-particle Rishon (3x3) is a 15 particle frame (5 set of 3). However the number of legitimate (stable) combinations is extremely limited.

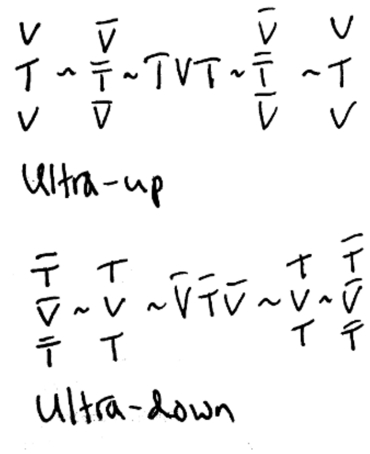

Figure 4: Tentative "ultra-up" and "ultra-down" penta-triplet particles

These two ultra-quarks are effectively a pair of neutral pions rotating about a central quark. The neutral pions therefore give these ultra-quarks zero spin characteristics. Any particle constructed from them would therefore also have zero spin.

The 15-Rishon ultra-quarks have been tentatively identified as the make-up of W, Z and Higgs Bosons. In a similar way to the Muon (as a 3x3 arrangement of T and anti-T particles) the tau is tentatively identified as being a lepton made out of entirely T and anti-T Rishons in a 3x 5x3 arrangement.

Here we have a Higgs+ (T-positive charged variant):

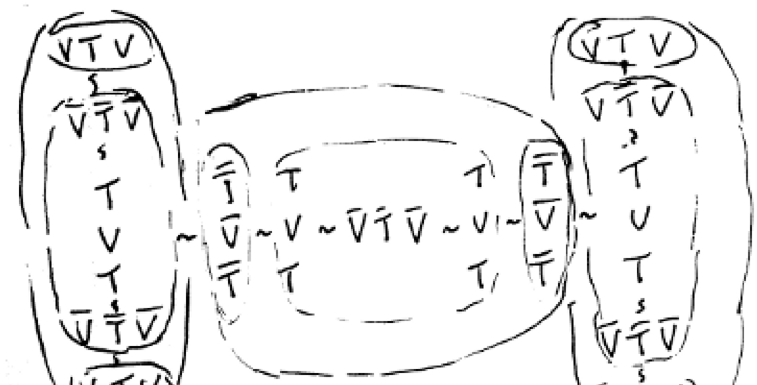

Figure 5: 3-level I-Frame: ultra-quarks in a Higgs aka ultra-heavy proton

Note the central quarks of each of the three ultra-quarks are those of a proton. A Higgs-0 (ultra-heavy neutron) should therefore also exist.

5 W, Z Bosons and the Gluon

Retrospectively, after examining considerable numbers of decay patterns, both the W and Z Bosons and the Gluon were identified. As shown later, the gluon was straightforward enough to identify as being a Pion, making there four different flavours of gluon, covering Pion-0 in both up and down types as well as Pion+ and Pion-. Also shown later is that the difference between a Pion and a gluon is that the gluon is created and destroyed near instantaneously, being both the simultaneous input and output of phase transformations. The Pion on the other hand would be the output of some phase transforms, and unlike its gluon incarnation it would have received enough energy to be self-sustaining until it decayed.

The W and Z Bosons on the other hand took longer to work out. The breakthrough was in the identification of the 5x3 quark pattern. It was then possible to identify the Z Boson as being an ultra-heavy flavour of Pion-0 (meaning that there should correspondingly be two variants of Z Boson), and the W+ Boson was identified as an ultra-heavy flavour of Pion+ and the W- an ultra-heavy Pion-. Here we illustrate a W+ Boson:

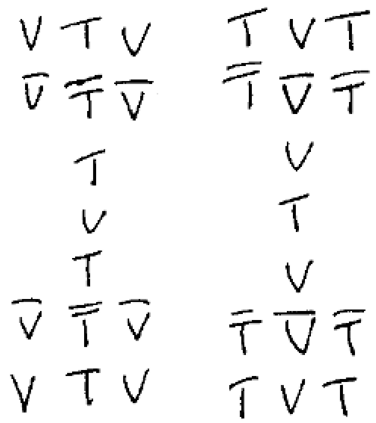

Figure 6: 3-level I-Frame: ultra-quarks in a W Boson arrangement

The W and Z Bosons are fascinating, because they are effectively comprised entirely of pions. We also identify the gluon as being a "virtual pion" which is created and destroyed simultaneously. There are therefore four different types of gluon because there are four different types of pion. The W and Z Bosons, aside from the binding energy, could therefore be effectively considered to be comprised solely from gluons. If it were not for the huge binding energy, the Bosons would also be instantaneously created and destroyed. Coordinating the simultaneous creation and later the simultaneous destruction of (in effect) five sets of pion pairs however is not possible; this gives a "decay" time to the W and Z Bosons.

6 Decay Patterns as Phase Transitions

Firstly, the concept of decay has to be dropped and replaced with the concept of "Phase Transformations". If particles may be viewed as standing wave circular photon patterns (a sine wave with phase and polarity), then particle "decay" of sine waves resulting purely and simply in... more sine waves with new phase and new polarity. Therefore to explain particle decay, we need nothing more than... more T and V particles. Kazuo Koike considers this same concept [5]: we extend it further, from the perspective of conservation of energy being ultimately critical and fundamental.

These are the allowed phase transforms. They must occur in pairs (one $V\overline{T}0$ and one $\overline{V}T0$).

$$
\begin{array}{lccc}
V\overline{T}0 \; -> & & & \\
 & \overline{VTV} & + & VVV \\
\text{or} & \overline{TTT} & + & TVT \\
\text{or} & \overline{TVT} & + & VTV
\end{array}
$$

$$
\begin{array}{lccc}
\overline{V}T0 \; -> & & & \\
 & \overline{VTV} & + & TVT \\
\text{or} & \overline{TVT} & + & TTT \\
\text{or} & \overline{VVV} & + & VTV
\end{array}
$$

In essence, any pair from say the $V\overline{T}0$ group may transform into any other pair from the same group (including to the same original pair). Using the XOR operator (exclusive OR) as a convenient moniker for sine phase differential it can be shown that in one group, two Rishons remain unchanged, whilst the remaining Rishons cancel out to sum total 0 charge in both T and V. Thus at any one time if we take any four Rishons, two from each group, the net charge in both T and V will always be zero.

So the exchanges occuring in pairs result in phase and polarity conservation (if all matter may be considered to be phase-locked concentric standing wave patterns). In diagrammatic form, considered from the perspective of each particle, these are the transformations that can take place:

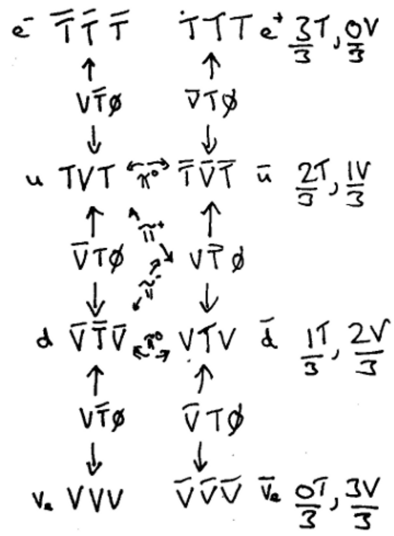

Figure 7: Chart showing the chain of permitted transformations

The only other rule is that the arrows in and out of these phase transforms may be applied in reversed time, in a Feynmann-like trick. Still under investigation (but considered extremely likely) is whether the number of time-reversals on phase transform pairs must also be conserved. i.e. if there are a total of 3 time-reversals on $V\overline{T}0$ transforms within a "decay", there must equally be 3 time-reversals on the $\overline{V}T0$ transforms as well.

The "ultimate time-reversal" on a matched pair of VT0 transforms results in particle creation in groups of four quarks at a time: two pions where the sum total energy (all charges, all phases / colours) always totals zero (including the gamma radiation needed to separate the two pions).

Also of note is that the concept of a "gluon" comes from when a pion's two quarks are simultaneously the input *and output* of a matched pair of VT0 phase transforms. Figure 8 is the simplest example:

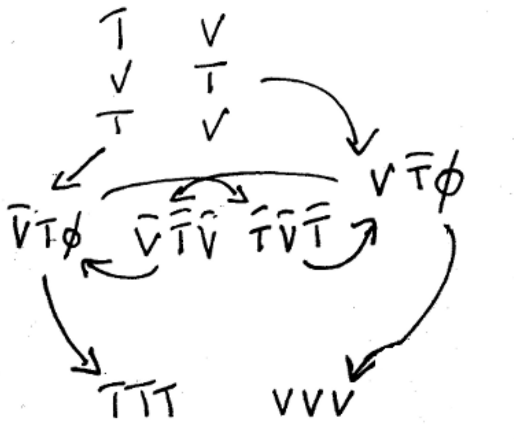

Figure 8: Pion phase-transition to positron (e+) and neutrino (ve)

What is happening is that each of the two quarks of the pion+ (top) undergo phase-transformations into positron and neutrino, but the energy to do so requires a balance. That energy comes from the simultaneous creation and destruction (centre) of a pion-, which acts as the dual simultaneous input and dual simultaneous output of *both* VT0 phase transforms. When a pion is created and then instantaneously destroyed in this fashion as an intermediary aid in phase transforms, the Standard Model gives it the name "gluon".

6.1 B Meson oscillation

Here a method is shown which supports particle oscillation. The concept may be extended to other particles as well.

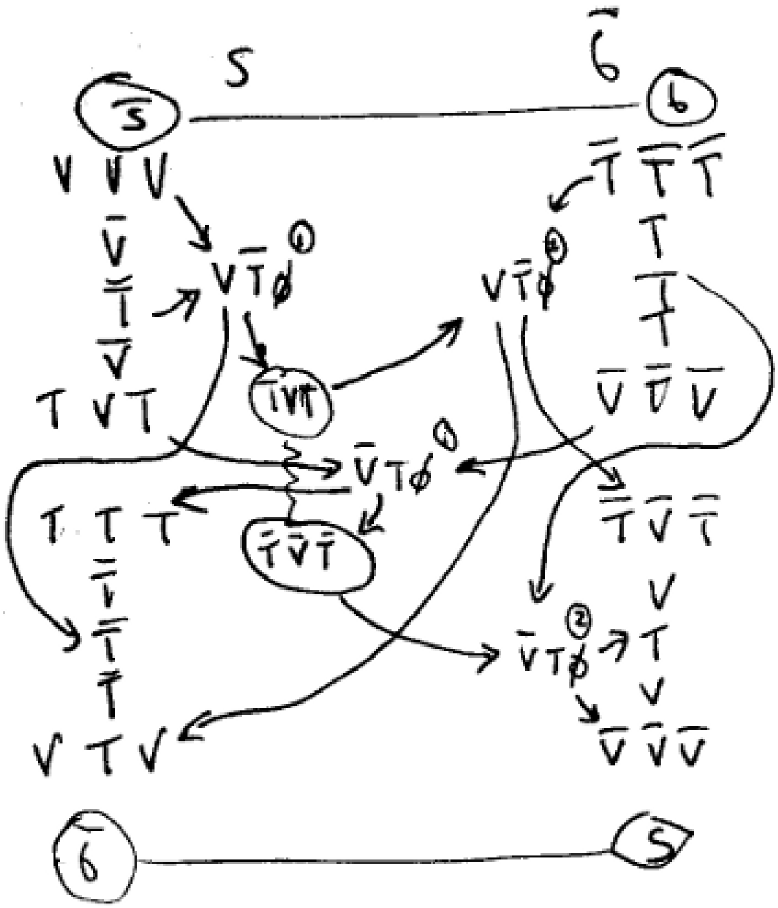

Figure 9: B Meson Oscillation

At the top is an anti-strange and bottom quark. Through the intermediary of a gluon (pion-0 up type) and two pairs of matched VT0 phase transforms the two quarks spontaneously transform into anti-bottom and strange. As there is nothing to prevent the reverse transformation taking place they oscillate continuously.

It is duly noted that gluons are considered in the Standard Model to be the "force" that keeps particles intact. When it is considered that gluons are virtual pions, and that virtual pions (as standing wave patterns themselves) can represent a phase differential between two other standing wave patterns (i.e. particles), the perspective of the gluon as "force carrier" in the Standard Model begins to make more sense.

In the context of B Meson and other oscillations, therefore, we make the observation that the "gluons" needed to keep the quarks together become of sufficient magnitude (or the instability within the structure becomes of sufficient magnitude) such that the simplest way to resolve the instability is for these phase transforms to take place.

6.2 Pion Muon phase transition

This transformation from a pion into a muon and muon neutrino is considered in two phases, for clarity.

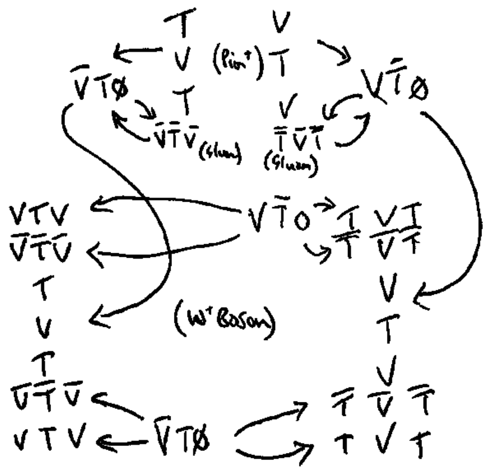

Figure 10: First phase of pion transition: to W Boson

Figure 10 illustrates the transition to W Boson. The initial quarks may not be placed directly into the W Boson: they must undergo phase transforms in order to jump between quark flavour levels.

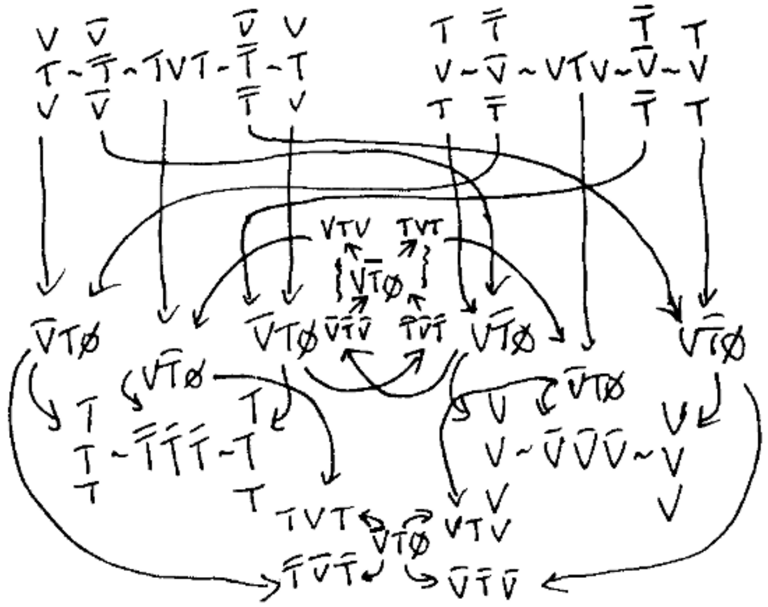

Figure 11: Second phase of pion transition: to Muons

The second phase requires, to give a mathematical balance, some odd tricks (shown in the centre of the diagram). A fully time-reversed VT0 and a transitional VT0 are used. It is cumbersome but successful, representing phase and charge conservation.

6.3 Neutron phase transition

In figure 12 we consider a neutron phase transition into a proton, electron and anti-neutrino:

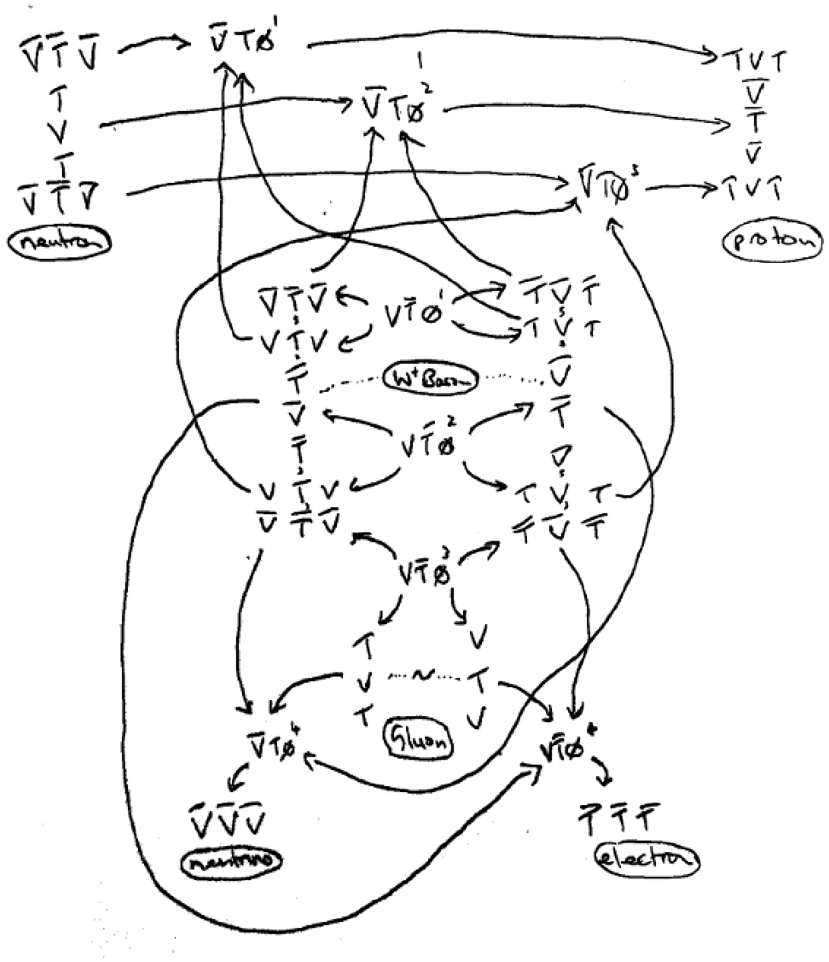

Figure 12: Standard neutron transition to proton, electron and anti-neutrino

There are four matched VT0 phase transforms, conserving phase, charge and polarity. Three are completely time-reversed phase transforms, introducing the majority constituents of the W Boson as well as those of a virtual pion+ (aka gluon). Two matched phase transforms result in the electron and anti-neutrino, whilst the three $\overline{V}T0$ phase transforms that match with the three completely time-reversed phase transforms cater for the transitions necessary for the neutron's constituents to phase-shift into a proton.

Note that there is one critical discrepancy between this model and that of the Standard Model. The Standard Model requires that the T charge be conserved across the intermediate particles. In this model, as it is based on phase transitions, conservation of net charge is enacted by the pairs of phase transforms. The additional simultaneous creation of the gluon is therefore a necessity.

We note also in passing that the muon to muon neutrino phase transform has a near-identical VT0 phase diagram.

7 Discussion

In this brief introduction, covering all potential particle decay patterns ever observed would be both counterproductive and impossible. A set of strategically appropriate examples were therefore selected. Also for brevity we leave out some of the logical deduction behind the identification of the quarks.

7.1 Quarks yet to be identified

We note that as of yet Top is proving annoyingly elusive: there is simply insufficient information to positively identify its makeup or its generation, in terms of Rishons.

Top is odd because its energy signature when considered from the 1st order 5-significant-figure mass approximations outlined in Dr Worsley's work [8], whilst strange, charm, bottom, muon, proton and neutron all clearly fit within a 2nd level family structure, Top fits best in the 3rd level (i.e. at the same level as the Tau, W, Z and Higgs Bosons and the ultra-quarks). However as already mentioned, it is believed that there are not many stable patterns that can be sustained at the 5x3 Rishon Generation Level, making Top's presence at this energy level something of a conundrum due to the lack of other particles - or quarks at this same level - with which to make any clear inference.

There is also the "unidentified" quark to deal with within the 2nd level (3x3 I-Frames). Possible candidates include genuinely previously undiscovered quarks whose existence is only present as oscillations for incredibly short durations, accounting perhaps for some of the odd masses of oscillating particles such as eta0. Perhaps instead when a mathematical framework is fitted to the model outlined here it may be discovered that the unidentified quark is a mathematical impossibility. We can only speculate at this stage.

7.2 Balancing the books

The neutron's phase transition to its "decay" particles presented a unique challenge during its derivation. It and many other transformations such as the muon to muon neutrino, electron and anti-neutrino phase change can only take place if there is also an additional virtual pion (gluon) created which balances the "phase transformation" books. Logically thinking this through, we note that particle decay patterns are deduced by inference, not by being able to actually see the actual particles themselves. Might it not be the case that within experimental error of the huge (91 GeV) energy of W Bosons, the presence of a small instantaneously created and destroyed particle with a near-infinitesimally small lifetime could, perchance, have been overlooked?

There is however a potential way to infer the possible existence of this additional intermediary. Currently below experimental and statistical error levels, more accurate resolution of future experiments may reveal a discrepancy in the originating points of the "decay" particles from the W Boson and of the anti-neutrino and the electron.

7.3 Noteworthy predictions and implications

There are a number of noteworthy predictions and implications from the Expanded Rishon Model. Not least of these is the existence of two flavours of Z Boson (one being an ultra-heavy "up" pion, the other being an ultra-heavy "down" pion), but also that, if the Higgs+ may be identified as being an ultra-heavy proton then an ultra-heavy neutron (Higgs-0) should also exist. In all cases there should also be anti particles of the same. Regarding the Higgs: one interesting thing to note is that the difference between the mass of the neutron and the proton is almost exactly the same as the gap between the two experimentally observed Higgs at 126.0 and 125.3 GeV respectively.

The other strange observation is that it appears to have gone unnoticed that out of seven experiments from 1995 to 2000 to measure the mass of the neutrino using Tritium beta decay, all of them recorded a *negative* mass-squared value. In other words, the mass of the neutrino would appear, from these results, to actually be an imaginary number. Assuming that all seven experimental results were not in fact a systemic error but were actually correct, this would seem to support the hypothesis that Vohu is in fact imaginary (three Vohu Rishons is a neutrino). Almost with regret however it is noted in an informative review of neutrino mass measurement experiments [10] that there were in fact systemic errors.

7.4 Imprinting

One particular question that arises out of particle "decay". If particles truly decay to intermediate W and Z Bosons, why is it that there are different products resulting from the exact same intermediate particles? Surely once a W or Z Boson comes into existence it should decay to exactly the same end products?

We infer from this that there is more going on than it first seems. In the context of particles being massless photons on a phase-locked concentric path conforming to toroidal knot patterns at the epicenter of an outward spiral of their own standing-wave synchotronic radiation, despite the overabundance of adjectives we have a possible glimpse of an answer. Consider when two particles are given sufficient energy to overcome the barrier presented by their standing-wave synchtronic radiation (known in the Standard Model by the names "electrical charge" and "strong force"), the disruption to that outward spiral (which was an integral part of maintaining the photon - aka particle's - pattern) is only partially disrupted.

In other words although the epicentre has been disrupted - resulting in a phase-transformation into intermediate particles such as the W or Z Boson - the immediate surrounding space around the chaos is still "ringing" with (and expecting there to exist) the original particles that created that outward spiral in the first place. In fact what is present within the surrounding space is an "imprint" if you will of the overall charge and spin characteristics, and not so much the actual particle that was originally at the epicentre of the spiral. When it is time for the W or Z Boson to collapse, the surrounding space therefore critically influences the decay, thus giving wildly different end results.

Thus we have a natural explanation as to why conservation of aspects such as "charge" and "leptop number" occur, because these aspects are "imprinted" into the surrounding space in a similar way to that in which water may be imprinted by chemical compounds that have long since been removed from the actual vicinity of the water molecules that originally surrounded them.

7.5 The Fine Structure Constant

Regarding this "imprinting effect", we note that in 2004 Hans de Vries came up with an elegant and exact formula for the fine structure constant [9]. Remarkably this formula is still dead-accurate to current experimental precision. We note however that at high energies, alpha is not considered to be a constant, and within the context of the above discussion we have a potential explanation as to why this is the case.

Consider a photon to be (for want of any other easily-visualisable cue) on a circular track, its wavelength equal to twice the circumference of its track as a means to represent spin 1/2 [3]. As it revolves (twice before returning to its original phase) it creates outward synchotronic spiralling radiation that progresses outwards to infinity at the speed of light. Taking a single line through the epicentre and extending it outwards to infinity, one encounters a series of peaks of that outward radiation that are separated precisely by twice the compton wavelength of the particle.

The accumulation of these outward wave-fronts would, with each revolution, result in a pattern that mathematically becomes triangular numbers, exactly as shown by de Vries. The back-lash of those standing wave patterns would only permit the epicentre to have a radius that was in perfect balance with those spiral standing waves. That ratio would, when enough iterations had passed, settle onto α.

Where it gets more complex is when the radius of the concentric track (or toroidal knot) gets particularly large. In this case, whereas before it would be the outward standing waves that would largely dominate the iterative process that settled onto the value recognised as "α", instead one might find that it is the larger energy of the epicentre, reflected in the much larger radius (lower compton wavelength) that dominates. In this way, that perfect "ratio" drops to around 1/128 by the time energies around 80GeV are achieved. Thus, also, even at the much tinier energies of particles such as the electron, we anticipate the de Vries formula, which effectively represents a particle with absolute zero mass, to begin to deviate from the perfect α at some point after many decimal places.

The reason for raising the de Vries formula in the context of the "imprinting" earlier mentioned thus becomes apparent: the familiar term $1 + \frac{\alpha}{2\pi}$ is part of an infinite mathematical series that provides not just an elegant solution for alpha but its very derivation also hints that the idea of particles being photonic knots with polarity in standing wave patterns at the epicentre of their own synchotronic radiation is worth pursuing.

It is also worth noting that quantum mechanics is, in effect, a mathematical representation that recognises the presence of these very same standing wave patterns radiating out from the centre of every particle.

7.6 Summing up

This discussion began with Rishons T and V, and ends with an explanation for the fine structure constant. In between there were hints of toroidal knots normally seen in String Theory. The Standard Rishon Model, first considered in 1979, was, like the original knot physics ideas, left behind due to insufficient exploration leaving the Generation issue unsolved. The idea that Vohu is complex polarity and Tohu is real polarity is considered to be the key insight that could in future link these different areas together into a consistent and simple theory.

Further work will therefore focus on deriving a mathematical model for the mass and magnetic moment of particles, taking into consideration the possibilities raised in this paper. We believe that the simplicity of de Vries's iterative algorithm may prove vital to such efforts.

8 Conclusion

Here is a cursory summary of the Expanded Rishon Model, covering the following main points:

- Particles are considered to be massless photons on a circular phase-locked track, with radius equal to its compton wavelength. The wavelength of the photon may however be double (or more in the case of more complex particles?) that of the diameter [3].
- We identify the polarity of the standing-wave harmonics of the photon with "T" as real, and "V" as imaginary. Three points on the standing-wave harmonics of a 3,2 toroidal knot give rise to the four elementary particles (eight including anti-particles).
- The "I-Frame" concept (or possibly the 10,3 toroidal knot) gives 16 possible further patterns that give rise to the neutron, proton, charm, strange, bottom and one further as-yet unidentified quark.
- An expanded ("ultra") I-Frame concept comprising 15 Rishons per quark gives rise to the constituent parts of the Tau as well as those of the W, Z and Higgs Bosons.
- Particle "decay" may be envisaged as the"phase and polarity conserving exchange of energy between the photons embedded within their circular phase-locked tracks". Where that is impossible the sum total remaining energy is simply emitted in a straight line instead, as... (unsurprisingly) a photon.
- Pairs of charge and polarity-conserving VT0 phase transforms can be considered as Feynmann Diagrams, resulting in variations that ultimately at the extreme may be used to create particles (usually pions of all four types). or destroy them. Conservation of total Feynmann time-reversals within VT0 phase transforms is considered highly probable (and needs investigation).
- The effect of the synchotronic radiation emanating from a particle's epicentre polarises its surrounding space in an outwardly spiralling standing wave pattern where α is a defining characteristic of the relationship between the epicentre and its own synchotronic radiation.
- The "imprinting" of that synchotronic radiation on the surrounding space in effect "stores" the charge, lepton number and other aspects of the particle, such that "decay" byproducts are overwhelmingly influenced and must conform to those characteristics.

In essence then the Rishon Model falls naturally out of the consideration that matter is comprised purely of massless synchotronic phase-locked standing-wave photons, and that when the polarity is imaginary this gives rise to "Vohu", and when the polarity is real this becomes "Tohu". No other "particles" are needed, not even in "decay", because there is literally and absolutely nothing else present in the universe other than photons, with all that that implies. Ultimately, then, everything is pure energy, but it is phase and polarity that gives rise to particle characteristics, as well as the phenomenon known by the name "decay".

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