THE CABIBBO MIXING ANGLE AND OTHER PARTICLE PHYSICS PARADOXES SOLVED BY APPLYING THE TDVP MULTIDIMENSIONAL SPIN MODEL

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Abstract [d]:

We have applied well-defined physics, well substantiated empirical data (including well defined constants such as the Bohr radius (radius of the hydrogen atom), speed of light, Planck's constant, rest mass of the electron, its radius and charge, the Coulomb constant and π) and added well-defined equations and principles (such as the Lorentz correction, the principle of conservation of angular momentum, kinetic energy equation, De Broglie's wave equation, Coulomb's equation, the centrifugal force equation, the wave length of a rotating body and calculations of magnetic moment). We have applied these to electron rotation and its inherent spin utilizing the basic concepts of a unified space-time-consciousness theory of finite reality from the Neppe-Close Triadic Dimensional distinction Vortical Paradigm (TDVP) including applying two new mathematical techniques that we have developed as part of this TDVP model, namely dimensional extrapolation across rotating dimensions, and the principles of the calculus of distinctions. These applications allow us to produce a detailed mathematical derivation of the mixing angle of elementary particle fermions, exemplified by the Cabibbo angle in quarks with the empirical calculation already being found to be 13.04 degrees±0.05.

We test two related hypotheses by deriving the Cabibbo mixing angle mathematically.
1. The derivation can be derived <u>only</u> from a nine-dimensional mathematical spin model.
2. The derivation supports a component of the broader Triadic Dimensional Distinction Vortical Paradigm (TDVP) hypothesis, namely that the finite reality consists of a 9 dimensional vortical (spinning) model.

There are three parts to this paper.

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[d] The footnotes in this paper usually describe more technical information directed towards mathematicians and physicists, or contain aside comments sometimes, very obvious, and bacis and so excluded from the text.

- *Part 1 discusses essential elements of the Neppe-Close TDVP model. This is critical because the postulated 9-Dimensional finite spin model derived directly from the proposed concepts in TDVP. Therefore this paper validates this finite component of TDVP.*
- *Part 2 discusses what is known about the mixing angle of fermions. The Cabibbo mixing angle is an empirically derived angle in Theoretical Physics, and it cannot be derived from the prevalent current Standard Model of Particle Physics. This complex area has been greatly neglected because of progress apparently was not made applying this Standard Model. Its actual empirically derived value has subsequently perplexed scientists for 50 years. However, apparently, no-one has previously tested a 9-D spin hypothesis before.*
- *Part 3 derives mathematically the Cabibbo mixing angle in fermions. We show how only a 9-dimensional vortical (spin) model produces a legitimate derivation. Hence both the Standard Model of Particle Physics involving 4-dimensions and the various String Theories (none of which involve 9-dimensional spin) fail.*

We derive the mixing angle at 13.032 degrees. This finding can <u>only</u> be derived by applying the dynamic rotation of elementary particles as nine-dimensional objects (applied to 5 significant figures). This value is falsified using any other dimensional model including the Standard Model of Particle Physics and the various String Theory models (which also would require rotational models not folding). This result can easily be replicated by applying the relatively simple mathematics used, to the dynamic rotation of elementary particles as nine-dimensional objects. This value is falsified using any other dimensional model.

This result supports the hypothesis that the Cabibbo angle could be the result of the fields, waves and particles of modern physics. However, we, as sentient beings, may be able to distinguish only part of this finite reality, reflecting only our four-dimensional subjective experience. These, nevertheless, could reflect part of the feasibility of the larger 9-dimensional spin (vortical) unified finite reality of the essential substrates. Consequently, some dimensions may be hidden from us in our restricted 3S-1t subjective reality. Though the TDVP postulate that finite reality is in 9 vortical dimensions is supported, this derivation does not amplify the nature of any of the specific dimensional substrates namely those of Space, Time and a postulated "Consciousness".
We propose that the essential substance of finite reality manifests as various dimensionally related mixtures of matter, energy and consciousness in 9 finite dimensions even though we may only be experiencing three of space and a moment of time.

As additional extra findings inessential to the Cabibbo derivation, we establish that electrons appear not to be perfectly spherical because if they were that would violate the principles of relativity. Our findings furthermore extend weak universality; and postulate electron clouds are distributed in a double Bell normal curve.
This mathematical derivation supports other significant implications for the future of

appreciating our reality:

1. *the potential to apply higher dimensional realities for future research;*
2. *several TDVP constructs including dimensionometry, 3S-1t reality being relative and not absolute, concepts of orthogonality at higher dimensions, the application of the calculus of distinctions, and the application of LFAF (lower dimensional feasibility, absent falsification).*
3. *the pertinence of spin, the application of relativity corrections in electrons, and the conservation of angular momentum;*
4. *the derivation of the same approximate Cabibbo mixing angle linked with electron spin (as well as quarks), and the broadening of Cabibbo's concept of "weak universality" by hypothesizing that all discrete phenomena result from specific dimensional extensions of the same elementary pattern inherent in the multi-dimensional substrate of reality.*
5. *the finding of electron shape not being uniformly spherical as otherwise certain calculated velocities in our analysis would exceed the velocity of light (important, but inessential to the Cabibbo derivation.)*

These findings because of their breadth could generate several novel ideas for testing and application.

In this paper we motivate the idea that reality may be more complex than what we as sentient beings experience as 3S-1t, strongly suggesting that the Triadic Dimensional-Distinction Vortical Paradigm of Neppe and Close (TDVP) postulate that finite reality consists of a 9 dimensional spin reality, with some of the dimensions being hidden may be correct. This we do through demonstrating that a strange angle size, the Cabibbo mixing angle in fermions cannot be derived through our Standard Model of Physics but it can be derived by applying the 9 dimensional finite vortical (spin) model proposed by TDVP.

To conceptualize this, three steps are necessary, all likely unfamiliar even to experts in the area.

- First, we briefly discuss TDVP. Because this is a new model, not many know about it in

sufficient detail so that we need to give an overview. Particularly important in the context of this paper is appreciating the concept of finite multiple dimensions associated with communicating through these dimensions by vortical rotation.

- Second, we briefly discuss the Cabibbo mixing angle. This aspect of particle physics is esoteric enough that almost no space is devoted to it in textbooks of Theoretical Physics, and there is very little solid literature examining its derivation.
- Third, we discuss in some detail the mathematics. The math is actually easy and can be replicated even by non-experts. But it does require appreciation of the new mathematical techniques that have been developed by the authors, namely Dimensional Extrapolation and Calculus of Distinctions particularly.

Importantly, these three areas are so linked that they overlap greatly. Consequently, it is artificial to completely separate the discussions into these three compartments. They dynamically interface, with the mathematics being the thread through all three. However, the first part of this paper involving background and literature in these areas, separates from the second part, involving the hypotheses, methodology and discussion.

STAGE 1: UNDERSTANDING TDVP

TDVP, the Triadic Dimensional-Distinction Vortical Paradigm is a metaparadigmatic model developed equally by Drs. Vernon Neppe and Edward Close. TDVP applies several major related areas:
- *Triadic* Space, Time and broader 'Consciousness' tethered together
- *Dimensions* of extent involving mathematical *distinctions*
- *Vortices* interfacing across dimensions (indivension)
- *Paradigm* (Metaparadigm /Theory of Everything) across the sciences and mathematics with unification of the infinite and finite resulting in the philosophical model of Unified Monism.

In TDVP, all of space, time and "consciousness" (S, T and C) are tethered together. They are fundamentally inseparably attached together at one or more roots.
TDVP is based on the available broader empirical data of all the sciences (physical, biological, consciousness and psychological), validated partly by mathematical theorems, applying LFAF for scientific validation, and applied to philosophy (as "Unified Monism").
The key features are STC tethering, 9 finite dimensions with 10th plus transfinite dimensions and then a continuous Infinity. All these dimensions are spinning—they are vortices as there is always movement and curvature (mathematically relative to a specific dimensional clustering —domains— there may be no movement (=0 transiently). In this paper we provide a derivation that proves one component of TDVP, namely 9 D spin.

Theory of Everything (TOE) and metaparadigm:

TDVP is sometimes called a "*Theory of Everything" (TOE)*: A TOE is a commonly applied but ambiguous term for a complete explanatory model of reality conforming to the laws of nature. TOEs should seamlessly reconcile with all the major theoretical models and authoritative sources of all the sciences and mathematics, but should not be construed as reflecting omniscience, instead implying application of principles. TOEs are sometimes regarded as primarily philosophical, yet the original, limited meaning was in Physics. We dislike the ambiguity, because its use can be misinterpreted. Nevertheless, applying objective, peer-reviewed metric comparisons to 24 "TOEs", TDVP scores far the highest with a perfect score (39/39).

We've proposed the term *Metaparadigm.* This is the broadest paradigm impacting all sciences, mathematics and philosophy.
A *Paradigm* is a model of reality constituting a specific worldview underlying the theories and methodology of a particular scientific subject.
 A *Paradigm Shift* is a paradigm that transforms thinking in a discipline. Clearly, the TDVP model involves a paradigm shift.

We report some basic principles, many derived from TDVP, to assist with the Theoretical Background Principles to Deriving the Mixing Angle. This background gives insight into our thinking and application of principles, sometimes new, such as dimensional extrapolation, dimensions, calculus of distinctions and indivension. [1; 2] Importantly, even if any of these points are refuted, this does not refute the mathematical calculation that follows behind deriving the fermion mixing angle (such as Cabibbo angle): This is derived from a 9 dimensional spin reality. But the principles underlying TDVP allow insights into our thinking relating to how mixing angles are established and justified.

Calculus of Distinctions:

TDVP is a consciousness-based model that applies a system of logic. This is called the Calculus of Distinctions [3-6] as it deals with distinctions. Distinctions are the basis of all conceptualizations, perceptions, observations, measurements, and knowledge, and the calculus of distinctions is logically prior to enumeration and equivalence, the basis of all conventional mathematics. Because of this, the calculus of dimensional distinctions is a powerful tool used to evaluate and extend all mathematical procedures.
Distinctions may be drawn in any number of dimensions. Dimensions are only measured using these variables of *extent*. This is often an error made in conceptualization by others where the term dimensions is used loosely. This makes an enormous difference mathematically and in science. Dimensions are different from analyses of the *content* and also of the *impacts* that influences of consciousness, mass or energy may have.

Distinctions include all dimensions, and therefore we talk of
of an n-dimensional distinction are measured in units of content, and units of content per unit
of extent express the strength or density of the distinction.

Tethering:

The concept of tethering, while important in TDVP, is relevant again in the appreciation of the
consequences of a 9D spin finite reality some of which is hidden. Tethering is not even like
traveling at light speed-- it is not a wave: the communication is instantaneous. Effectively, there
is "immediate" relative non-local communication at every level: It is there--tethering does not
need to move through space, time or meaning or "physically link". S, T and C always remain
linked, across, between and within all dimensions. The tether might be either tight (with many
roots or source) or loose (more subtly connected). Even when loose, the linkage always exists,
as even any ostensible separation still exhibits communication of all of the STC components.
Tethering involves multidimensional relative STC communications that are just there.
Therefore when one speaks of 9 finite dimensions they become a unit, and our 3S-1t reality is
just our experiential subjective reality with the rest hidden.

Dimensional extrapolation:

Dimensional extrapolation is a mathematical technique. This allows us to combine what
is normally thought of as a geometric procedure with the mathematical logic of the calculus of
distinctions to determine the mathematical nature of multi-dimensional domains.
(Dimensional Extrapolation (DE) allows determination of the mathematical nature of multi-
dimensional domains. A unitary vector, defined in a one-dimensional domain is rotated about
its origin and projected into the two-dimensional domain. Maintaining the same origin, this
process is repeated until the fourth dimension is reached, where the unitary projection domain,
in order to reach a point outside of the 3-S domain must be represented by an imaginary
number, consistent with Minkowski's representation of time as the fourth dimension [7]. All
points located in the 4-D, 5-D and 6-D domains are found to be congruent with the field of real
and imaginary numbers. Continuing in this way, we find that the number field of domains 7, 8
and 9 require complex number representation. DE is therefore an iterative logical operation
based on the natural correlation between number fields and multi-dimensional domains of
extent. Dimensionometric mathematical invariances existing between dimensional domains are
identified, first in one-, two- and three-dimensional domains; and then, using these invariances,
the natural correlations between number fields and spatial domains extrapolated, into domains
of more and more dimensions. The 4-D domain is the most fundamental where the points are
either real or imaginary in time. DE requires that the complex numbers of variables of 3C
extrapolate elements of both space and time with the consciousness as, mathematically,

complex numbers include both real numbers (Space) and imaginary numbers (Time). The application of DE involves executing multiple rotations and projections from dimension to dimension. However, when we examine our 9 dimensional spin model, we take into account that there is no rotation to the first dimension, only a projection from 0-D to 1-D: This is different from all other dimensions as 0 is a point and just projecting. [4; 5]

Indivension and vortices:

In the *finite* reality, TDVP has postulated 9 separate dimensions. But these are linked and communication across and between dimensions involves curved movements, "spin". This is where the term "vortical" and "vortices" fits into the TDVP model. Vortices are the most ubiquitous shape in the universe and we postulate allow for the content of communication across dimensions.
Indivension is a new term used across dimensions. In the 3S-1t context, indivension describes the limited or partial view of reality afforded sentient beings through their physical senses and extensions of them within 3S-1t.
Indivension involves the process in which vortices communicate by content across and between dimensions.

The finite and the infinite:

TDVP does not only postulate 9 finite spinning dimensions. This is the easiest aspect to conceptualize. (TDVP also proposes 10th plus (transfinite) dimensions and that all of reality is unified with finite discrete contained in the continuous infinite:
10th plus dimension: A postulated 10th transfinite series of dimensions, predominantly containing C-substrate qualities, with or without S and T substrates (though still linked to S and T by tethering across dimensions).
Finite: Limited extent in space, time or consciousness: discrete, discontinuous, countable set of values subreality. *Infinite*: (TDVP) Limitless, unbounded, continuous, without end subreality in Space, Time and Consciousness (C-) Substrates. *Interfaces with finite* and though largely unknown, it obeys the laws of nature.
STC: Space, time and "consciousness": specifically, S, T and C-substrates (S, T and C).
Substrate: The source of all *distinctions of extent and content*: STC refers to a Space substrate, a Time substrate and a special kind of substrate of "Consciousness" (C-substrate).
- *Space:* (S) Volumetric extent including the dimensions of height, depth, and width (reflects three variables of extent with an interval metric) within which physical reality manifests.
- *Time:* (T) Duration of *finite* moments perceived together as past, present and future and an *infinitely* continuous substrate. In finite reality, this encompasses three proposed dimensions of extent encompassing all lower-dimensional realities and events and necessarily moving through space and consciousness.

The term "Consciousness":

The everyday use of the concept of "consciousness" has varied. Consciousness has traditionally been the most difficult of all terms to describe and its everyday use has varied. We use the generic term "C-" to communicate the broad range of Consciousness, as a *Unit*: a unified, general term across the infinite and finite. In TDVP, we apply our new EPIC classification: C- involves four key phenomenologically different classifications: the "EPIC" components — Existential C-, Paradigmatic C-, Information-meaning C- , Cybernetic C-. Yet each component can be applied to every description of C-.

1. *E: Existential distinctions* of C-: These involve three important subjective interpretations. (*C-substrate* dimensions tethered with Space and Time and measured ordinally by degree — extent of Consciousness: C-matrix content (what is in the container?) and paralleled with mass and energy (Content Consciousness), C-interface in which the Consciousness process impacts and influences the content and extent: This is Impact Consciousness.
2. *P: Paradigmatic levels* of C-. There is a gradation. Everything has Qualit Consciousness as this is meaning at the most basic quantum level; the endpoint expression of all living (animate) beings is Neurobiological/ Neurological Consciousness; psychological factors involve humans and animals (disputably partly separate from the neurological; Higher Consciousness involves, e.g., creative, transcendent and altered *states*, and traits of mystics, disputably outside the brain. Together, we refer to all these as "*Paradigmatic Consciousness*" and they can be applied broadly across all the sciences, plus mathematically and philosophically.
3. *I: Information* converted to *meaning*: General information repositories may at its extreme be infinite, and covers meaning as a direct targeted expression of meaningful information, applied in any of these models.
4. *C: Cybernetic* consciousness communications: This provides a mechanistic input, central and output model, again applicable to any of these models. It's very important in regular communication, and likely psi and disputably theologically. Physical equivalents would be force (e.g. natural earthquakes, or machines impacting).

This *EPIC Classification* integrates these four non-exclusive conceptualizations. They are always linked: e.g., Consciousness Impacts its Extent and Content, and can be objectified at the Qualit (quantum with meaning), Neurobiological, Psychological and Higher Consciousness levels; consciousness mechanistically has input, receptor and output; and the targeted meaningful information is applicable for every consciousness component.

A basic consciousness (Qualit) <u>level</u> always exists in *everything* inanimate or animate as everything contains the *most fundamental discrete finite physical meaning* linked in extent with space and time, and in content with mass and energy. All living beings have awareness and responsiveness in the nervous system—*neurobiological consciousness*. This is always linked with *psychological consciousness*. A "Higher Consciousness", disputably outside the brain or

body, may occur in *states* like dreams, meditation, or creativity, or may occur as a *trait* in, for example, mystics or near-death descriptions. In TDVP, consciousness always exists as a *meaningful* unit underlying every aspect of reality. Existentially, consciousness impacts and influences the extent and content of events and objects (mass and energy also can influence these).

3S-1t:

Our conventional scientific reality (what, we, as living sentient beings experience)—3 dimensions of space (length, breadth, height) (3S) and 1 moment in time (1t) (the "present"), 1T is 1 broader time dimension with past, present and future; D is non-specific for dimensions; 3D = 3 dimensions; 9 dimensions are abbreviated 9D or 9-D.

3S-1t reflects our conventional scientific reality. This is what, we, as living sentient beings experience—3 dimensions of space (length, breadth, height) (3S) and 1 moment in time (1t) (the "present"), 1T is 1 broader time dimension with past, present and future; D is non-specific for dimensions; 3D = 3 dimensions; 9 dimensions are abbreviated 9D or 9-D. We therefore discuss 9 dimensions *relative to our own 3S-1t experience. This is an important distinction, mathematically justifiable in the Calculus of Distinctions. It allows us to discuss real integers of dimensions, and half-spin based on our real number experiences, as opposed to applying a number system of real (spatial), imaginary (time) and complex numbers (consciousness).*

Our current experience: LFAF:

Lower-Dimensional Feasibility, Absent Falsification (Philosophy of Science approach to proof) (LFAF) is the basis for including logically feasible concepts in hypotheses that may not be falsifiable in 3S-1t. This is applicable at all dimensional levels. LFAF is an important Philosophy of Science approach which we have developed by necessity in the TDVP model. This allows applying proofs, with the basis for including logically feasible concepts in hypotheses that may not be falsifiable in 3S-1t, yet appears feasible. This is applicable at all dimensional levels. It is not specifically applicable in the Cabibbo derivation below but is applicable in the numerous hypotheses and speculations that may follow.)

STAGE 2: CABIBBO ANGLE THEORY.

We provide what we believe to be a remarkable mathematical derivation: We demonstrate how the fermion mixing angle (such as the Cabibbo angle) can be derived from a 9-dimensional spin model preliminarily strongly demonstrating the feasibility of TDVP [8]. The reason for this 13.04 degree value of the mixing angle has mystified scientists for 50 years and cannot be derived from the standard model of particle physics that applies 3S-1t and is falsified using any other dimensional model.

The posited 9-D model:

Based on the solid justifications of the TDVP model[9, 10] thus far, we have hypothesized that the objects of reality are, or can be under certain *finite* conditions, nine-dimensional: We postulate that elementary particles should be regarded as nine-dimensional objects and that a nine-dimensional object will require an additional 180 degrees of rotation, in effect, an additional ½ unit of angular momentum to return to the same quantum state with respect to the 3S-1t reference frame of observation. Certain elementary particles are said to have an intrinsic "spin" of ½.[11] Transitions from one spin ½ particle to another in a particle accelerator may result in changes in size, mass and spin velocity but, in keeping with the universal law of conservation of mass and energy, angular momentum will always be conserved.[12]. Because of the limitations of our physical senses, and their physical extensions (such as microscopes, telescopes and infrared cameras) we are normally only aware of restricted 3S-1t portions of the vortical forms originating in the space, time and consciousness (STC) substrates. The dimensions of reality can be explored mathematically by dimensional extrapolation.

Current particle physics:

Particle physics is metaphorically based on reality being made up of building blocks in much the same way a house is made up of bricks, planks, nails and mortar. That this view is incorrect was shown with the resolution of the Einstein-Bohr debate[13, 14] over the nature of reality. This was resolved by Bell's inequality[15, 16], the Aspect experiment[17] and subsequent more and more refined experiments which clearly prove that the fields, waves and particles identified in the experiments of modern physics are created or selected from a broader range of possibilities, by the conscious choices of experimental observation and measurement.[15, 16, 18, 19] We could even argue that the "atom-smashers", e.g., the cyclotron, or the Large Hadron Collider (LHC) actually *create some of* the particles they seek to study as they last infinitesimal moments in time. Particle physicists with a purely materialistic orientation may not easily be able to integrate the results of the Einstein-Bohr debate into their thinking.[13, 14] Applying the implications of the resolution of the Einstein – Bohr debate[13, 14], we have posited that the structure of perceived reality, appearing in the 3S-1t sub-domain of 9-D reality, consists of patterns brought out of the potential of the Space, Time and Consciousness substrates[1, 9, 20, 21] by observation and measurement.[13, 22, 23] These patterns include the dynamic vortical forms of elementary particles and their combinations making up the atoms of the elements of the periodic table.

Pertinent rotation physics:

Certain elementary particles like electrons and quarks exhibit an intrinsic spin of ½. We apply two principles:

- Max Planck's discovery [24-26] that matter and energy occur only in multiples of basic units or quanta, and
- elementary phenomena do not exhibit specific physical characteristics like mass, size and spin until they register as observed or measured phenomena [17; 27; 28].

Angular momentum

Upon being brought into manifestation as an object in 3S-1t by observation and measurement, an elementary particle will be spinning in one plane, where it will have a specific angular momentum, depending upon its mass, radius and spin velocity. The plane of rotation is determined by the experimental set-up for observation. In particle accelerators, it will always be perpendicular to the direction of the magnetic field that accelerates the particle [12; 29]; and the quantum state of the particle with respect to the reference frame of measurement will be the same after one complete rotation, or after any integral number of complete rotations. [11]

In this discussion, we focus on this simplest atom, the Hydrogen atom. This consists of four elementary particles: An electron circling a nucleus which contains two up quarks and a down quark.[e] There are, therefore, four distinctions drawn in the Hydrogen atom from the substrate of reality: three quarks and an electron. Per the Copenhagen interpretation [14; 16-18; 26] they have no separate discrete existence until observed and measured. [30; 31]

The pertinence of the hydrogen atom

The Hydrogen atom is the simplest stable atom (atomic number of 1) reflecting the combination of quarks at the most fundamental level, with 1 electron, and 1 proton made from two up quarks and a down quark.

The Cabibbo mixing angle

In 1963, Italian physicist Nicola Cabibbo, introduced the concept of a particle "mixing angle" to help explain what was perceived as the weak interaction of elementary particles [32]. This was later called the Cabibbo angle (θC). Cabibbo explained 2 related but somewhat contradictory concepts, namely the idea that:

1. elementary particles (quanta) are separate finite objects, each with its own unique mass, size and angular momentum, that exist independent of observation or measurement. This is basic to classical physics (including relativity).
2. these quanta may change (or decay) from one to another, depending upon their orientation as they combine to form more complex particles, under the influence of the so-called "weak force". This stems from quantum mechanical experiments that suggest that the potential "substance" of reality may manifest as matter or energy (particle, wave or field) depending upon how we choose to observe it.

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[e] Based on the current knowledge of quantum mechanics at this time, fermions should have the same mixing angle calculation because they exhibit the same half-spin properties. The electron, like the quark, is a fermion.

Both of these particle physics ideas ignore the role of "consciousness" suggested by quantum experimental results.

Cabibbo noticed patterns in the way elementary particles in an accelerator decayed from one type to another. He explained this by *"weak universality"* noting similarity in the weak interaction between different elementary particles. Weak universality means that all elementary particles, including electrons and quarks, transition from one to another under certain conditions. With the identification of three generations of quarks [33; 34], called up/down, charmed/strange and top/bottom, this has been said to explain related observations:

1. The transitions between up and down quarks ($u \leftrightarrow d$), between electrons and electron neutrinos ($e \leftrightarrow v_e$), and between muons and muon neutrinos ($\mu \leftrightarrow v_\mu$) have similar probabilities of occurrence.
2. The transitions with change in strangeness ($\Delta S = 1$) have occurrence probabilities equal to 1/4 of those with no change in strangeness ($\Delta S = 0$).

This proposes a similarity between different generations of particles in the weak interaction coupling strength of any of the up-type quarks to all the down-type quarks [35].

The Cabibbo angle was the first version of the so-called "Cabibbo–Kobayashi–Maskawa" (CKM) matrix for quarks. The Cabibbo angle was derived using vector analysis and empirical measurements of the probability of occurrences of elementary fermion particles, including quarks and electrons.[f] In this paper, we broaden the concept of weak universality to hypothesize that all discrete phenomena result from specific dimensional extensions of the same elementary pattern inherent in the multi-dimensional substrate of reality.

Based on repeatable experimental data, this analysis yielded θC = 13.04±0.05° [35], [32]. *The specific values of the mixing angles are not predicted by the standard model.* They have only been determined experimentally. [g]Prior to our derivation, there had been no generally accepted theory that explains why the measured values are what they are.

From the time of Cabibbo, in 1963, there has been a debate amongst physicists why this particular angle was formed because it could not be derived from the standard model. The

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[f] The basis of trigonometry is, of course, the Pythagorean theorem, and we have applied Pythagorean principles across multiple dimensions, not just 3 dimensional matrices, in TDVP. This may seem obvious but multidimensonal geometry, what we're calling "Dimensionometry" still incorporates critical Pythagorean derivations. This is in part because orthogonality relative to specific dimensional parameters is a key concept.
[g] As an aside, there are 2*2 matrices in the Cabibbo mixing angle, and three generations of quarks are coupled together in the complex matrix 3*3 quark CKM matrix. [Quark *mixing angles* are represented by rotation angles = $N(N-1)/2$]. It is an interesting observation that fundamental finite dimensions where such a 9-dimensional spin model specifically is required and seems to work.)

Cabibbo angle has mystified both theoretical and experimental physicists for 50 years, [h] for example, "At this time, there is no generally accepted theory that explains why the measured values are what they are" and "the specific values of the angles are *not* a prediction of the Standard Model." [32; 34-37]

When Cabibbo first derived the matrix for the mixing angle of fermions, the third generation of quarks were unknown, so the matrix was a 2x2 square matrix describing the rotation (by the Cabibbo angle) from the Eigenstate of one quark to the Eigenstate of another. [i] The Cabibbo angle is the angle of rotation between the Eigenstate vectors of, for example, an up quark and a down quark.

There is no "CP-violating complex phase" in the Cabibbo 2 x 2 square matrix. [j] The currently best known values for the Cabibbo angle "mixing" angle is $\theta_{12} = 13.04\pm0.05°$ (Cabibbo angle location in Wolfenstein matrix). [k]

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[h]   Historically, Cabibbo knew of Gell-Mann and later Zweig's work, which was an effort to explain the charge, parity and angular momentum of hadrons like protons and neutrons in terms of three smaller particles. Gell-Mann and Zweig's work, and Cabibbo's mathematical description of the interaction of these three more elementary particles in the form of a two-by-two matrix were purely theoretical. Cabibbo knew of Gell-Mann and later Zweig's work, which was an effort to explain the charge, parity and angular momentum of hadrons like protons and neutrons in terms of three smaller particles. Gell-Mann and Zweig's work, and Cabibbo's mathematical description of the interaction of these three more elementary particles in the form of a two-by-two matrix were purely theoretical. These elementary particles did not have a name at that point. It really wasn't until 1968 that experimental evidence appeared in data from the Stanford linear accelerator [38] to support the idea that protons were composed of three smaller components. (Incidentally, Richard Feynman originally called these particles "partons" though "quarks" won out.) [11].

[i] An Eigenstate of a particle is represented by a vector describing a definite position and a definite angular momentum. This is why the rotational matrix for two quarks is a 2x2 matrix. But quantum mechanical theory says that a particle does not have specific angular momentum and position until it is observed and measured. It has only probability distributions described by the Schrödinger wave equation [39; 40] or Heisenberg's probability matrix [41]. So the Cabibbo angle is the angle between the vectors describing the probable Eigenstates of two different elementary particles.

[j] The term "two by two" comes from the algebraic description in two equations of two parameters, *position and momentum*, which according to the Heisenberg uncertainty principle necessarily involves uncertainty [41]. The Eigenstate function describes it as a fixed 2 x 2 matrix. It is a 2 x 2 matrix containing two simultaneous equations describing the position and momentum of the up and down quark. With the Cabibbo angle, we are still referring to 2 particles and the angle between the eigenstates of 2 particles. The 2 x 2 Cabibbo matrix is therefore a sub-set of the 3 x 3 CKM matrix that describes the weak force for all three generations of quarks. We can extract several 2 by 2 matrices out of the 3 by 3. The probability and the shift in *position and momentum* represents 2 by 2 in the context of the fermion mixing angle.

[k] The other components of the matrix (3*3) involve the Standard Model case ($N = 3$), where there are three mixing angles and one CP-violating complex phase. The CP ("change parity") violation has been observed in experimental data, but is puzzling: It might possibly imply a time reversal and/ or the effects of the extra dimensions that are being ignored in the Standard Model. This is part of a broader "Maki–Nakagawa–Sakata" matrix and actually affects the behavior of all leptons, not just neutrinos [42].

When we refer, here, to the " Fermion Mixing Angle" [1] (which has been exemplified by the Cabibbo data on quarks), we imply *the mixing angle for all fermions, including electrons*.[44] We have chosen to analyze electrons as representative of half-spin fermions because they *should have* the same mixing angle as other (half-spin) fermions, namely the Cabibbo angle (as also exemplified by quarks) [m]. Indeed, the derivation is testable by calculation, and we proceed to do this calculation [n]: The "should have" of the preceding sentence thus becomes "part of our hypothesis".

In this paper, we will show how the Cabibbo mixing angle can be derived from our consciousness-based theory that we call the Triadic Dimensional distinction Vortical Paradigm (TDVP).

Highlights of the Cabibbo literature:

The literature on the Cabibbo angle is limited. Of about 200 articles with elements of

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[1] A fermion is any particle that has an odd half-integer (like 1/2, 3/2, and so forth) spin. Quarks and leptons, as well as most composite particles, like protons and neutrons, are fermions. We are restricting our discussion of mixing angles to particles with half (½) spin. These include leptons and quarks, not necessarily Baryons where the spin is more variable (so 3/2 or 5/2). A lepton is an elementary particle which does not undergo strong interactions, but is subject to the Pauli exclusion principle. [43] The best known of all leptons is the electron. Electrons govern nearly all of chemistry because they are found in atoms and are directly tied to all chemical properties. This is why we analyze electrons here.)

[m] Consequently, we have referred in this paper to "mixing angle", such as the Cabibbo angle or to the "fermion mixing angle". There is no reason to doubt that this mixing angle is the same namely as the original 13. 04 ±0. 05 degrees, which is based on empirical data and then trigonometrically derived. When we refer to Cabibbo's actual work we will talk specifically about the Cabibbo angle, although our custom has been to generalize "fermion mixing angle" to Cabibbo angle.

[n] Fermions obey the Pauli Exclusion Principle. [43] The Austrian physicist Wolfgang Pauli in 1925 elucidated the Pauli exclusion principle. This is an important quantum mechanical principle: No two identical fermions (particles with half-integer spin) may occupy the same quantum state simultaneously. This means that the total wave function for two identical fermions is anti-symmetric with respect to exchange of the particles.

There are other "mixing" angles as well. For the standard parameters, examples are $\theta_{13} = 0. 201 \pm 0. 011°$ [neutrinos], $\theta_{23} = 2. 38 \pm 0. 06°$, and $\delta_{13} = 1. 20 \pm 0. 08$ rad but these are not based on the fermion (e. g. Cabibbo type) matrix. However, the mass Eigenstate 2 x 2 square matrix refers to the analysis of the mixing angle more usually known as the "Cabibbo angle": if we are generalizing to other fermions such as electrons, in our terminology, we more correctly refer to it as "such as the Cabibbo type mixing angle" or "Cabibbo matrix" if we want to emphasize the role of the mass Eigenstate 2 x 2 matrix.

The general consensus amongst quantum physicists today is that electrons and quarks are true elementary particles with no smaller subdivisions and no known internal structure. Electrons and quarks, when subjected to observation and measurement, appear to be very different objects, with different sizes, mass and total angular momentum. However, these elementary particles behave as if they were virtual symmetrical point-like objects in collider experiments, and always have multiples of one-half spin. This means they are going to exhibit the same rotational "mixing" angle. Their measurements are artifacts of the limitations of the experimental setup, and they are oriented to the frame of reference chosen by the observer. [28; 45]).

derivation, there are none that demonstrate the Cabibbo angle of 13.04±0.05 degrees. Most of the literature is indirect discussing the CP contradictions [46], or how to justify the 2*2 matrix and the 3*3, or the links with the broader CKM matrices[47]; or applying other particles; none deal with dimensions per se though there are clues. For example, another Dr Close (FE Close) [48] points out the discrepancies in the Standard Model, the vector model links other angles like the Weinberg [49]

There are few books of theoretical physics that even discuss this. One such is Martin's and even then only briefly. [34] Martin points out how the Cabibbo mixing calculations can incorporate suppressed delays participating in the weak interactions via linear combinations applying the lepton quark asymmetry to doublets allowing new vertices to be generated. Applying the 13.04 value allow the previously forbidden decays with a suppressed sine squared (theta C) factor of about 0.05. [34]

Historically in 1971, 7 fundamental fermions were known: 4 leptons v_e, e^-, v_μ and μ^- of the 4 leptons (with electrons and neutrinos), and the three quarks (up, down, strange) *u, d, s.* [34] To complete this symmetry Glashow et al proposed the fourth charm quark, *c,* to solve problems with neutral currents [50] and the first "charmonium" states in 1974, making the measured weak couplings consistent with predictions of lepton-quark symmetry and quark mixing. There are now 6 leptons (tau as well) and 6 quarks top and bottom. The complication now is possible mixing between all three lower quarks (*d, s, b)* and this leads to the CKM matrix but for the first two generations, the changes induced by the more complex mixing of the third generation are very small but the reason for the CP violation in 3*3 matrices. [34]

The literature on the Cabibbo angle delineates the difficulties. Duret points out the Cabibbo apparent violation of the Standard Model and realized the pertinence of Lagrangian mathematics.[51, 52] Donoghue links up the quark-lepton landscape and raises up other dimensions[53]. Morisi relates the mixing angles to supersymmetry.[54] Azuelos recognizes the vanishing Cabibbo angle[55]. Palmer points out the need for Hamiltonian applications and the complexity of the whole area [56]

The closest derivation comes is an anonymous blogger (whom we discovered post-hoc) who cites [57] and using similar mathematics comes close to calculating the Cabibbo angle. However, the blogger does not take into account two critical features: 9 dimensional spin with eight rotations, and the Lorentz correction. Moreover, they derived a unit angle 1.47884 which is close but incorrect as a consequence—they claim 13.52 degrees. Based on our derivation below, more correctly uncorrected using and incorrect *9 calculation it would be 13.31—an approximation but not in range—and if we applied our 9D spin correction to what they call the "fictitious universe" (because of the ostensible puzzlement this causes) it would be 11.83 degrees (way off). Similarly, they have the slightly incorrect figure for the Weinberg mixing angle (28.75 degrees) where the Weinberg range is 28.8 to 30 degrees. Fritzch has also similarly tried to derive it as well as Yang but such derivation requires Lorentz corrections and realization of 9 spin. There are other attempts as well but none succeed as they do not apply a 9D spin derivation with appropriate corrections like Lorentz [47; 49; 58; 59].

Importantly, there are applications of the Cabibbo angle to any kinds of fermions, not only quarks. For example, even neutrino's and their links to astrophysics, as the solar mixing

angle have a complimentarity relation of quarks and leptons and also exhibit maximally the Cabibbo angle.[60]

STAGE 3: THE MATHEMATICAL DERIVATION: THEORETICAL BASES AND HYPOTHESIS

1. The mixing angle of the electron of the hydrogen atom is approximately 13.04 degrees.
2. The hypothesis is that the fermion mixing angle is the result of the dynamic rotation of elementary particles as nine-dimensional objects.
3. We furthermore propose that the Cabibbo type mixing angle, as described by the Cabibbo matrix composed of experimentally determined probability amplitudes, is actually the result of the vortical motion of the four nine-dimensional elementary particles that make up the Hydrogen atom as they are made manifest from the substrates by observation and measurement. We propose that this can be reflected in calculations pertaining to electron motion and spin.
4. Applying the successful practical applications of the TDVP model [1; 6; 10; 61-64], we hypothesize that the objects of reality are, or can under certain conditions be, nine-dimensional.

The test of this hypothesis is, if indeed,

   a. the calculation using the 9 dimensional spin model will produce the 13.04 ± 0.05 degree figure;
   b. this figure cannot be calculated using a model with any other number of dimensions.

The mixing angle calculated from 9 dimensions

We perform the calculations presented below based on the mathematical physics necessary to test this hypothesis. The implications of such a solution reflect an underlying extraordinarily important finding because a nine-dimensional vortical finite reality would radically change our worldview.

We report here for the first time that the Fermion Mixing Angle can be derived mathematically from TDVP theory, while it cannot be derived from the Standard Model of Particle Physics. The constants we have utilized in our calculation are well-known. They are accurately determined historically to five or more significant figures. They are logically justified as appropriate for utilization in the derivation of the fluctuating mixing angles that ultimately achieve stability at approximately 13.04 degrees, i.e. the Cabibbo mixing angle. What is new, however, is that we derive the Cabibbo mixing type angle by applying dimensional extrapolation to our 9-dimensional TDVP spin model.

The Cabibbo Mixing Angle mathematics
Overview perspective

Close [65] had applied our mathematical technique of dimensional extrapolation to our 9 dimensional (vortical) model of finite reality taking into account key, pertinent well-recognized measures, calculated to at least five significant figures.

The principle of the conservation of angular momentum allowed calculation of the spinning velocity of a free electron stripped from a Hydrogen atom. With this approach, the velocity, v_e, calculated as 2.9974 x10^8 m/sec is a large fraction of the speed of light, requiring applying the relativistic correction by of the Lorentz contraction, Ɏ. We, therefore applied the Lorentz contraction equation formula, $\ell = \ell_o \sqrt{1 - v^2/c^2}$, as the relativistic adjustment to observation and measurement in the mathematical dimensionometry of 3S-1t. Application of the Lorentz contraction equation factor accounts for the shortening of the rotational circumference difference for each 90 degree rotation as seen from 3S-1t. From N=0 to N=1, there is nothing to rotate because there are no degrees of freedom in zero dimensions. Consequently, in 9-D spin realities, there are only 8 rotations not 9. Applying the Lorentz contraction equation, the contraction for each dimensional rotation is calculated to be a factor of 0.0181006 for each 90-degree rotation, or 1.629 degrees.[o] Consequently, this is multiplied by 8, yielding 13.032 degrees, in agreement with what was originally derived experimentally for the Cabibbo angle (13.04±0.05 degrees). Importantly, any other number of dimensions fail: When the calculations are done for other dimensional models the results do not approximate the Cabibbo angle. They are far outside the range of measurement error. This motivates acceptance of our nine dimensional model. *This is not post-hoc*: We postulated a nine dimensional and vortical model well prior to this calculation (in *RBC 1st Edition* in November 2011). [16]

Other justifying principles

- The angle for each rotation is required to be 90 degrees.[p]
- The use of the Bohr radius (of the Hydrogen atom) is justified because we are using the *measured* value not the expected value. The Bohr radius is a finite value brought out of the range of possible values by actual observation and measurement.[q] The calculation ultimately reflects the *observation* of electrons from the *relative* standpoint of 3S-1t even though existing in 9 dimensions.
- We use radians as a measure of angles where appropriate, to facilitate the calculation of the Cabibbo / Fermion mixing angles.[r]

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[o] 0. 0181006 x 90 = 1. 6290.

[p] This is because, while rotation *of any angle* out of a spinning plane results in a projection into another plane, when content is involved (e.g., a spinning elementary particle), rotation of any less or any more than 90 degrees leads to destructive instability—it is disruptive and wobbly. Thus, for an n-dimensional elementary particle to exist as a stable physical object in 3S-1t, say an electron, each of the n dimensions must be orthogonal to all of the other dimensions. Applying the Copenhagen interpretation of physics, the plane involved becomes pertinent only when observed and measured. Importantly, with substantial content, each dimension must become orthogonal to every other dimension because, as soon as there is *content*, there is conservation of angular momentum in 3S- 1t. This, necessarily, requires orthogonal rotation to avoid instability. Any other orientation leads to dissolution of the vortical form in 3S-1t.

[q] r_o = the "Bohr radius" of the Hydrogen atom = 5. 2917x10^{-11}meter. The Bohr radius is justified because we are using the *measured* value not the expected value. The Bohr radius is a finite value derived out of the range of possible values by actual observation and measurement. The "Bohr atom" is non-relativistic.

[r] The "radian" is the natural standard unit of angular measure, used in many areas of mathematics. [66] The radian is the angle of an arc created by wrapping the radius of a circle around its circumference. The radian describes the

- We apply the conservation of the angular momentum of an electron stripped from a Hydrogen atom.[s]
- We represent the calculations mathematically to five significant decimal places.
- We account for a charged particle spin creating a magnetic moment.
- Mathematically, this model continues to obey the interval-ratio scale, the orthogonality rules, and the real number rules as the calculation is relative to the 3S-1t domain. This is even though at the higher finite dimensionalities, imaginary and complex numbers are involved. There is an interval connection of dimensionality extent, but not of the ordinal elements of substance content. Where applicable, the Lorentz contraction is applied. Moreover, whereas we have proposed that ordinal elements are conceptually pertinent going beyond the fourth dimension (time) [1; 9], these only exist as measures of substance of essence. It is appropriate to analyze this data based on interval measures as this data is relative to our current dimensional domain of our experience, namely 3S-1t.)

The calculated result for the Cabibbo like mixing angle
We calculate the Cabibbo-like mixing angle is 13.032 degrees. This is derived from a 9 dimensional vortical model. The exact mathematics is presented in detail below.

This paper then broadly outlines these results reflecting our finite nine-dimensional model which is pertinent and has mathematico-physical justification.[t]

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plane angle subtended by a circular arc as the length of the arc divided by the radius of the arc: it, therefore, represents the ratio of a subtended arc, divided by the radius of a circle. This defines the relationship between the sine and cosine in both derivative and integral identities in calculus: An angle's measurement in radians is numerically equal to the length of a corresponding arc of a unit circle. The magnitude in radians of one complete revolution (360 degrees) is the length of the entire circumference divided by the radius, or $2\pi r /r$, or 2π. Therefore 2π radians is equal to 360 degrees, meaning that one radian is equal to $180/\pi$ degrees equal to 57. 29577 degrees reflecting a semi-circle and a right angle (90 degrees) is $90/\pi$ is 28.648.

[s] The conservation of the angular momentum of an electron stripped from a Hydrogen atom is represented mathematically by $r_e m_e v_e = r_o m_o v_o = h/2\pi$, where r_e is the Lorentz radius of the electron, r_o is the radius of the Bohr atom, m_e is the mass of the free electron, m_o is the mass of the electron in orbit around the H atom, v_e is the spin velocity of the free electron, v_o is the velocity of the electron in orbit around the H atom, $h/2\pi$ is the constant converting the angular momentum of the electron to a quantized unit of angular momentum, and $m_e = m_o/\alpha$ (where α is the fine-structure constant). We assume that the force stripping the electron from the H atom is exactly equal to the kinetic energy of the electron, calculated to be $E = \frac{1}{2} m_o v_o^2 = 2. 18$ joules or 13. 6 Ev, also called the energy of ionization of Hydrogen.

[t] The preliminary calculations yielding 13.032 degrees have been based on the conservation of angular momentum adjusted for relativistic effects and dimensional extrapolation. Given that it is the spin angular momentum coupled with the intrinsic spin of the free electron that produces the mixing angle called the "Cabibbo angle", there are three more elements to consider:

Quantum uncertainty must be considered (the Heisenberg Uncertainty Principle [HUP]) [41] The rotation matrix of experimental data from which the Cabibbo angle is calculated, is a probability matrix: The values of the individual numbers of the array are averages of many observations. This is, of course, something that must be accounted for in any calculation in Quantum Physics. The angular momentum of the electron in orbit around the nucleus of the

DETAIL

Important formulae, variables and constants in Hydrogen atom

We focus on the simplest atom, the Hydrogen atom, consisting of four elementary particles: an electron circling a nucleus composed of two up quarks and a down quark.

First, we determine the physical characteristics of the components of the Hydrogen atom based on well-defined constants and well-known equations:

1. The centrifugal force equation: $F = mv^2/r$
2. Wave length of a rotating body $= \lambda = 2\pi r$
3. Coulomb's equation: $F = Kq_1q_2/r^2$
4. De Broglie's wave equation: $\lambda = h/mv$
5. Conservation of angular momentum [u]: $\omega_e I_e = m_o r_o v_o$ Kinetic energy equation: $E = \mathbf{1/2mv^2}$

The symbols representing the pertinent physical parameters are defined as follows:

General

F = force

m = mass

v = velocity

r = radius

λ = wave length

q_i = the charge of a specific particle designated by the subscript i

E = energy

ω = spin velocity

I = inertia

Known Parameters

h = Planck's Constant = 6.6261×10^{-31} joule second

c= velocity of light = 299,792,458 meters per second.[v]

m_{re} = rest mass of the electron = 9.1094×10^{-31} kg

r_e = radius of the electron = 2.8179×10^{-15} meter (the Lorentz radius)

r_o = radius of the hydrogen atom = 5.2917×10^{-11} meter.

q_e = charge of an electron = 1.6021×10^{-19} joule

K = the Coulomb Constant = 8.9876×10^9 (dimensionless)

π = 3.14159 (dimensionless)

Hydrogen atom reflects the magnetic moment resulting from the intrinsic spin of the electron in orbit. This is insignificant relative to the orbital angular momentum, i. e., it is so small that it doesn't show up in five significant figures. Consequently, it should not impact our data.

[u] where the subscript "*o*" refers to parameters of the electron in orbit around the Hydrogen atom and the subscript "*e*" refers to parameters of the electron free of the Hydrogen atom.

[v] It's exact because the length of the meter is defined from this light constant and the international standard for time.

Parameters to be Determined

v_o = velocity of rotation of the electron in orbit around the Hydrogen atom

m_o = mass of the electron in orbit around the Hydrogen atom

m_e = mass of the free electron

v_e = velocity of rotation of the free electron (the spinning velocity of a free electron stripped from a Hydrogen atom).[w]

Determination of the unknown parameters

To find v_o, the velocity of the electron in orbit $\lambda = 1$ around the nucleus of the Hydrogen atom, we start by applying equations (1.) through (4.) and eliminating all variables except v_o:

Solving equation (1.), $F = m_o v_o{}^2/r_o$, for r_o, $\rightarrow r_o = m_o v_o{}^2/F$ and from equation (2.), $\lambda_o = 2\pi r_o \rightarrow$

$$r_o = \lambda_o/2\pi \qquad (6.)$$ So that

$\lambda_o/2\pi = m_o v_o{}^2/F \rightarrow \lambda_o = 2\pi\, m_o v_o{}^2/F$ \qquad (7.) (Eliminating r_o)

Also, squaring equation (6.) gives $r_o{}^2 = \lambda_o{}^2/(2\pi)^2$ and substituting $r_o{}^2$ into equation (3.), $F = Kq_1q_2/r^2$, Yields:

$$F = (2\pi)^2 Kq_1q_2/\lambda_o{}^2 \qquad (8.) \text{ (Also eliminating } r_o)$$

Squaring equation (4.) yields $\lambda_o{}^2 = h^2/m_o{}^2 v_o{}^2$, which, when substituted into (8.) yields:

$$F = (2\pi)^2 Kq_1q_2\, m_o{}^2 v_o{}^2/h^2 \qquad (9.) \text{ (Eliminating } \lambda_o)$$

Also, from equation (7.) and equation (4.):

$\lambda_o = 2\pi\, m_o v_o{}^2/F = h/m_o v_o \rightarrow F = 2\pi\, m_o{}^2 v_o{}^3/h$ \quad (10.)

Since the centrifugal force of equation (1.) is equal and opposite to the force of equation (3.), allowing the electron to stay in orbit, we can equate (9.) and (10.), to get:

$2\pi\, m_o{}^2 v_o{}^3/h = -(2\pi)^2 Kq_1q_2\, m_o{}^2 v_o{}^2/h^2$, and $q_1 = q_e$ and $q_2 = -q_e$ (the charge of the nucleus).

Dividing both sides by $m_o{}^2 v_o$ and solving for v_o, we have:

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[w] In quantum chromodynamics (QCD), the modern theory of the nuclear forces, most of the mass of the proton and the neutron is explained by special relativity. This accords with our use of the Lorentz contraction in this calculation. The proton mass is about 90 times greater than the sum of the rest masses of the quarks that make it up (the postulated gluons have zero rest mass). However, the *extra energy* of the quarks and gluons in a region within a proton, as compared to the *rest* energy of the quarks alone in the QCD vacuum, accounts for almost 99% of the mass. [67]This may explain why our calculation here must be so precise and to so many decimal places. Lattice QCD provides a way of calculating the mass of the proton directly from the theory to any accuracy. [67] .

$$v_o = 2\pi K q_e^2 /h \qquad (11.)$$

Notice that λ_o, r_o and m_o cancelled out in these calculations giving us v_o in terms of well-defined and well-known constants. Substituting in the values of the constants, we obtain:

$$v_0 = 2\pi\ 8.9876\text{x}10^9\ \text{x}\ (1.6021\text{x}10^{-19})^2\ /6.6261\text{x}10^{-34} = 2.1875\text{x}10^6\ \text{m/sec.}$$

Since this is a large fraction of the speed of light, m_o must be corrected for the relativistic effect. Applying the Lorentz transformation:

$$m_o = m_{er}/[1 - (v_0/c)^2]^{1/2} = 9.1096\text{x}10^{-31}\text{kg}$$

We may check these results for consistency with empirical data as follows:

The kinetic energy of the electron in orbit, $E = 1/2\ m_o v_o^{\ 2} = 2.1804\text{x}10^{-18}$ joules
Converted to electron volts: $2.1804\text{x}10^{-18}$ joules x $1/1.6021\text{x}10^{-19} = 13.61$ Ev, which is in very close agreement with the experimental value of the energy of ionization (the energy required to strip the electron from the Hydrogen atom, leaving a hydrogen ion) of 13.595 Ev.

Also, if there are no external forces acting on the electron, the total angular momentum, L, of the electron is given by equation (5.):

$$\mathbf{L = \omega_e I_e = m_o r_o v_o} = (9.1096\text{x}10^{-31}\text{kg})(5.2917\text{x}10^{-11}\text{m})(2.1875\text{x}10^6\ \text{m/sec.}) = \mathbf{1.0545\text{x}10^{-34}\ J{\cdot}s}.$$

And our calculated value of the angular momentum of the free electron is virtually equal to the basic unit of angular momentum = $\mathbf{h/2\pi}$ = $6.6261\text{x}10^{-31}$joule sec$/2\pi$ = $\mathbf{1.0546\text{x}10^{-34}\ J{\cdot}s}$.

We now have only two parameters remaining in our list of parameters to be determined: the mass and spin velocity of the free electron, $\mathbf{m_e}$ and $\mathbf{v_e}$.

Conservation of angular momentum with a spherical electron

Conservation of angular momentum requires that $\mathbf{\omega_e I_e = m_o r_o v_o}$ where I_e is the spin velocity in radians per second and, if electrons are symmetrical with no internal structure, I_e is the moment of inertia of a solid spherical body with uniform mass $\mathbf{m_e}$ and radius $\mathbf{r_e}$.
The moment of inertia of a solid sphere[x] is described briefly below. [68]

The formula for the moment of inertia of a sphere can be derived by summing the moments of infinitesimal disks about the z axis. The moment of inertia of a thin slice of the sphere is

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[x] See http://hyperphysics.phy-astr.gsu.edu/%E2%80%8Chbase/isph.html for a detailed derivation of
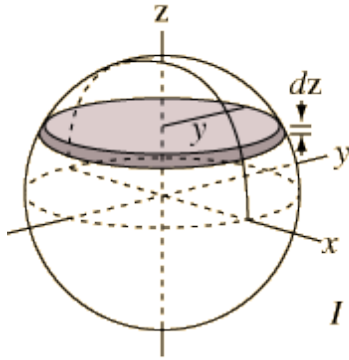
$$dI = \frac{1}{2}y^2 dm = \frac{1}{2}y^2 \rho dV = \frac{1}{2}y^2 \rho \pi y^2 dz$$

and the integral becomes

$$I = \frac{1}{2}\rho\pi \int_{-R}^{R} y^4 dz = \frac{1}{2}\rho\pi \int_{-R}^{R} (R^2 - z^2)^2 dz = \frac{8}{15}\rho\pi R^5$$

Radius = R

Mass = M

Density = $\rho = \dfrac{M}{V} = \dfrac{M}{\frac{4}{3}\pi R^3}$

Substituting the density expression gives

$$I = \frac{8}{15}\left[\frac{M}{\frac{4}{3}\pi R^3}\right]\pi R^5 = \frac{2}{5}MR^2$$

So, with assumption that electrons are symmetrical spheres with no internal structure, the angular momentum of the free electron is given by:

$$L = \omega_e I_e = \omega_e \times 2/5 \ m_e r_e^2 = h/2\pi = 1.0546 \times 10^{-34} \text{ J·s}. \qquad (12.)$$

But conservation of the angular momentum of the orbiting electron as it transitions to a free electron according to equation (5.) and the fact that $v_0 = 2.1875 \times 10^6$ m/sec, a large fraction of the speed of light, means that the mass of the electron in equation (12.) must be adjusted for the relativistic increase due to relative velocity. So we have:

$$L = \omega_e I_e = \omega_e \times 2/5 \ m_{re} \ Y r_e^2 = h/2\pi. \qquad (13.)$$

Where $Y = [1 - (v_e/c)^2]^{-1/2}$. Converting ω_e from radians per second to spin velocity in meters per second, we have: $v_e = \omega_e r_e \rightarrow \omega_e = v_e/r_e$

Thus obtaining an equation in only one unknown: v_e.

Simplifying (13.):

$$v_e \times 2/5 \ m_{re} \ Y r_e = h/2\pi \rightarrow v_e = h/2\pi \times 0.4 m_{re} \ Y r_e \qquad (14.)$$

Substituting the known values of h, m_{re} and r_e,

$v_e = 6.6261 \times 10^{-34} / 2\pi \ 0.4 \times 9.1094 \times 10^{-31} Y \times 2.8179 \times 10^{-15} = 6.6261 \times 10^{-34}/6.4514 \times 10^{-45} \ Y$

Noting that $Y = [1 - (v_e/c)^2]^{-1/2} = [(c^2 - v_e^2)/c^2]^{-1/2}$ and squaring both sides:

$v_e^2 = (6.6261 \times 10^{-34})^2/ (6.4514 \times 10^{-45})^2 \ Y^2 = 1.0549 \times 10^{22} \ c^2/(c^2 - v_e^2) \rightarrow$

$c^2 v_e^2 - v_e^4 = 1.0549 \times 10^{22} \ c^2$, which simplifies to a quadratic equation in v_e^2:

$$v_e^4 - c^2 v_e^2 + 1.0549 \times 10^{22} \ c^2 = 0 \qquad (15.)$$

Which we can solve using the quadratic formula as follows:

$v_e^2 = [c^2 \pm [(c^4 - 4\text{x}1.0549 \text{ x}10^{22} \, c^2)]^{1/2}]/2 =$

$\qquad [c^2 \pm [(8.0776 \text{ x}10^{33} - 3.79239 \text{ x}10^{39})]^{1/2}]/2 =$

$\qquad [c^2 \pm [(- 3.7924 \text{ x}10^{39})]^{1/2}]/2 = c^2/2 \pm [(6.1582 \text{ x}10^{19})/2] \, \mathbf{i}$

$\qquad v_e = [4.4938 \text{ x}10^{16} \pm 3.0791 \text{ x}10^{19} \, \mathbf{i}]^{1/2}$ $\qquad$ (16.)

To some mathematicians, demonstrating a derivation may be unnecessary because square roots of general polynomial equations involve complex numbers: Therefore, rather obviously the square root of a complex number should also be a complex number. However, it could be construed that it needs to be demonstrated that the Square Root of a Complex Number is still also a "simple" Complex Number and is therefore pertinent to the mathematics. So it is listed in the footer so as to preclude any critique that it should be demonstrated, though likely unnecessary. [y] We show our derivation of this, though others exist. This way we can apply it is in converting v_e to a simple complex number.

Therefore, we can state this theorem: If a and b are real and $b \neq 0$, then the square root of a complex number, $\sqrt{(a + bi)}$, is equal to $p + qi$, *another complex number,* and p and q are real numbers given by $p = (1/\sqrt{2})\sqrt{[\sqrt{(a^2 + b^2)} + a]}$ and $q = \pm (1/\sqrt{2})\sqrt{[\sqrt{(a^2 + b^2)} - a]}$ (Where q has the same sign as b.)

Using this formula, the two simple complex values for v_e are derived as follows:
From (15.), $\boldsymbol{a} = 4.4938 \text{ x}10^{16}$ and $\boldsymbol{b} = 3.0791 \text{ x}10^{19}$
Substituting into the formulas for $\boldsymbol{p}$ and $\boldsymbol{q}$, we have:
$\boldsymbol{v_e = p + qi} = 1/\sqrt{2}\sqrt{[\sqrt{(2.0194 \text{ x}10^{33} + 9.4809 \text{ x}10^{38})} + 4.4938 \text{ x}10^{16}]} +$

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[y] Consider the general expression for a complex number: a + bi, where a and b are real and (b ≠ 0). Assume that the positive square root of a + bi = √(a + bi) = $p + qi$ where p and q are real numbers.
Then $(p + qi)^2 = a + bi \rightarrow p^2 + 2pqi - q2 = a + bi$
Equating the real and imaginary parts produces two equations:
$\quad$ (1) $p^2 - q^2 = a$ and
$\quad$ (2) $2pq = b$.
Note that $pq \neq 0$ since $b \neq 0$. Solving equation (2) for q gives
$\quad$ (3) $q = b/2p$
$p^2 - (b/2p)^2 = a \rightarrow 4p^4 - 4ap^2 - b^2 = 0$.
This is a quadratic equation in p^2, which we can solve for p^2 using the quadratic formula:
$p^2 = [4a \pm \sqrt{(16a^2 + 16b^2)}]/8 \rightarrow \boldsymbol{p = 1/\sqrt{2}} \sqrt{[a + \sqrt{(a^2 + b^2)}]}$
Using equation (3), and substitution from the quadratic solution, we have:
$q = b/2p \rightarrow q = b/[\sqrt{2}\sqrt{[a + \sqrt{(a^2 + b^2)}]}] \cdot [\sqrt{[\sqrt{(a^2 + b^2)} - a]}/\sqrt{[\sqrt{(a^2 + b^2)} - a]}]$
$= (b/\sqrt{2})\sqrt{[\sqrt{(a^2 + b^2)} - a]}/\sqrt{(a^2 + b^2 - a^2)} = (b/\sqrt{2})\sqrt{[\sqrt{(a^2 + b^2)} - a]}/\sqrt{b^2}$
$= \pm (1/\sqrt{2})\sqrt{[\sqrt{(a^2 + b^2)} - a]}$
Note that $\sqrt{b^2} = |b|$, so that $b/|b| = \pm b$, the sign of b is plus if $b > 0$ and minus if $b < 0$).
Thus we have proved the following Theorem:
If a and b are real and $b \neq 0$, then the square root of a complex number, $\sqrt{(a + bi)}$, is equal to $p + qi$, *another complex number,* and p and q are real numbers given by:
$p = (1/\sqrt{2})\sqrt{[\sqrt{(a^2 + b^2)} + a]}$ and $q = \pm (1/\sqrt{2})\sqrt{[\sqrt{(a^2 + b^2)} - a]}$ (Where q has the same sign as b.).

$+1/\sqrt{2}\sqrt{[\sqrt{(2.0194 \times 10^{33} + 9.4809 \times 10^{38})} - 4.4938 \times 10^{16}]}i$

Which simplifies to: $v_e = 3.924 \times 10^9 \pm 3.923 \times 10^9 i$

Note that the units used throughout are SI units, so that the results are in meters per second (m/s).

These are the two legitimate solutions of the quadratic equation derived from conservation of angular momentum and relativistic adjustment of mass. Both solutions are complex numbers, indicating that the spin velocity of the free electron has one <u>real</u> component in 3S and one <u>imaginary</u> component in 1T, existing at right angles to 3S.

The electron cloud

Theoretical physics recognizes:
- the half-spin components of the electron as a fundamental property of elementary particles such as electrons;
- a mysterious property that, at times, the electron is not detectable. [69; 70]

Applying these principles, further scientific statements follow relating to what we refer to as the "electron cloud":

1. not only would there be the rotation of the electron around the H atom nucleus, but there is also spin rotation around the electron's axis.
2. There must be a mechanism for the electron in rotational orbit around the Hydrogen atom to transition to or link with the spin of the free electron.

As a tautology to this: Because free electrons are spinning, this illustrates how vortical spin components are fundamental to even such elementary particles. A key basic element of the TDVP model is vortical rotation, therefore the postulate of vortices in TDVP is validated at this elementary particle level.

3. Logically, this should also be applicable to multiple electron atoms, where the probability distribution of the electrons in shells around the atomic nuclei might be likened to an *electron cloud*.
4. Clearly, there have to be counterbalancing forces to stabilize the electron cloud.
5. There should be a logical mechanism to understand the spin of electrons.
6. This can be done by recognizing conservation of angular momentum to the electron spin.
7. We also need to explain why the electrons are not always detectable.
8. Finally and importantly, we must provide a way to lower the overall velocity calculations because the electron velocity calculations would otherwise exceed the speed of light. Applying the basic physics premise of supraliminal velocity being impossible, we try below to solve this dilemma. Such a solution is a separate hypothesis from the Cabibbo calculation in this paper, and even if incorrect would not invalidate our 9D spin hypothesis. But demonstrating a mechanism, would amplify our understanding of

        elementary particles considerably.

We needed to find an explanation for this and link it too to the electrons not always being detectable.

We propose that
    a. the vortical electron cannot be spherical: we have shown from our inertia and velocity calculations, it is clear that a purely spherical vortical electron would become superluminal.
    b. the disappearing electron cloud can be explained by a double Bell distribution curve of the electron cloud.

The Bell distribution curve
However, we proposed that the Bell Distribution curve rotation associated with vortical spin and Dimensional Extrapolation might explain why subatomic particles such as fermions only sometimes appear, suspecting that it might also explain how they avoid supraliminal velocities when they do. We argue that the Bell distribution curve generates probabilistic results that also reflect rotation perpendicular to a plane.

If angular momentum is conserved, the magnitude of each of the two components of v_e, electron spin velocity, is greater than the speed of light. Relativity tells us that this is *impossible*, since the mass of the free electron, m_e becomes infinitely large as its spin velocity approaches the speed of light. Obviously, something is wrong. But all of the parameters are well defined, empirically determined constants and the only assumptions behind equations (12 and 13) are the assumptions of conservation of angular momentum and the assumption that the electron is a uniform spherical object. Are there other dimensionometric features that could slow the spin resulting from the conservation of angular momentum and prevent the calculated v_e from exceeding light speed? We know that a spinning charged particle produces a magnetic field. Could this field interact with some other ambient field and slow the spin of the electron? Or could a 3S-1t shape other than spherical create enough inertia to slow the spin below light speed? *We examine this.*

First, we mathematically eliminated one ostensibly logical alternative explanation immediately: the torus shape. When we tested this hypothesis, the total inertia of the toroidal electron was insufficient to slow the spin below light speed. Therefore, the toroidal explanation did not succeed mathematically.

THE ELECTRON AS A MAGNETIC DIPOLE
The magnetic moment of the electron due to spin is
$$\mu_s = - [g_S \, \mu_B (S) L]/\hbar \qquad (17.)$$
where μ_B is the <u>Bohr magneton</u>, $S = \frac{1}{2}$, the electron <u>spin</u> number, g_S is approximately 2 and L is the angular momentum of the electron. The spin magnetic moment is negative, indicating that it *could* create a force in the opposite direction of the spin.

The Bohr magneton, $\mu_{B} = e\,\hbar/2m_{er}$ is defined as the ground state, or minimum value of the electron's magnetic moment. Substituting μ_B into (17.), 2 for g_S and ½ for S we get:

$$\mu_s = -[2\mu_B(1/2)\mathbf{L}]/\hbar = -\mu_B\mathbf{L}/\hbar = -e\mathbf{L}/2m_e \qquad (18.)$$

$\mathbf{L} = \hbar/2\pi$, so $-e\mathbf{L}/2m_e = -e(\hbar/2\pi)/2m_e = -(1.6021\times10^{-19}\times1.0546\times10^{-34})/2\times9.1094\times10^{-31} = -9.2738\times10^{-24}$ Joules per Tesla (J T^{-1}), the magnetic moment of the electron in orbit around the Hydrogen atom, in close agreement with the generally accepted value of 9.27400968×10^{-24}.

This spin magnetic moment will only slow the acceleration of the spin if there is an ambient field for it to interact with. However, since $\mu_s = -e\mathbf{L}/2m_e$ and $\mathbf{L}$ is conserved, as the velocity of the spinning electron, v_e increases, m_e also increases due to the relativistic effect of the Lorentz transformation factor. If the electron has a non-zero radius [$r_e = 2.8179\times10^{-15}$meter (the Lorentz radius) in our calculations], as the spin velocity approaches c, as it must to conserve angular momentum, m_e approaches infinity and the spin magnetic moment, equation (16.) tells us that μ_s becomes negligible. *Conclusion: the magnetic moment of the electron dipole cannot slow the acceleration of the spin velocity as it becomes a large fraction of the speed of light.*

INDIRECT DETERMINATION OF THE SHAPE OF THE ELECTRON
What else could slow the spin of the spiraling elementary particle? We have assumed that the electron is a uniform sphere, and calculated the inertia accordingly. Is there any other natural symmetrical shape that would have a greater amount of inertia?

Since $\mathbf{L} = \omega_e I_e = \hbar/2\pi$ **(a constant)** [See equations (13.) and (14.)], it is clear that if I_e is larger, ω_e has to be smaller. Since the magnitude of v_e as calculated above is about 13.09 times the speed of light, I_e needs only be on the order of 13.1 times the inertia of the sphere, with r_e equal to the Lorentz radius, to bring the angular momentum conservation spin velocity down to a subluminal level. Is there such a shape? It turns out there is! It was suggested by our recognition of the need to include the quantum uncertainty by introducing a form with normal (Bell curve) distribution.

We find the moment of inertia for an Infinite disk with mass normally distributed on two axes around the axis of rotation is given by $\mathbf{m(a^2 + b^2)}$ where $\mathbf{m}$ = mass and $\mathbf{a}$ and $\mathbf{b}$ are measures of the two axes perpendicular to the axis of rotation [71]. With the appropriate choice of the values of $\mathbf{a}$ and $\mathbf{b}$ relative to r_e, the optimum shape of the elementary particle needed to avoid violating the relativistic spin-velocity limit can be determined. The elementary particle will be symmetrical, so the illustration below[*] is only half the picture. Visualize an inverted, mirror-image of the shape shown, extending below it. The axis of rotation will extend through the maxima of the two shapes. The optimum form will approximate a flattened sphere, except it will be open at the plane of rotation, like cymbals almost, but not quite touching.

The calculations below demonstrate how the inertia of this shape slows the spin of the electron and removes the relativistic contradiction from our calculations.

With this new estimate of the shape of the free electron, we can rewrite equation (14.) as:

$$v_e \times 2(a^2 + b^2)m_{re} \, \forall r_e = h/2\pi \qquad (19.)$$

The theoretical red flag: an important clue

A red flag went up when we saw that the magnitude of the real components of v_e, electron spin velocity, was greater than the speed of light. *Relativity tells us that this is impossible,* since the mass of the free electron, m_e becomes infinitely large as its spin velocity approaches the speed of light. We must realize that the discovery of new methods and technology does not invalidate everything that came before. The discovery of the calculus of Newton and Leibnitz, for example, did not invalidate arithmetic. Relativity did not replace Newton's laws: it extended them.
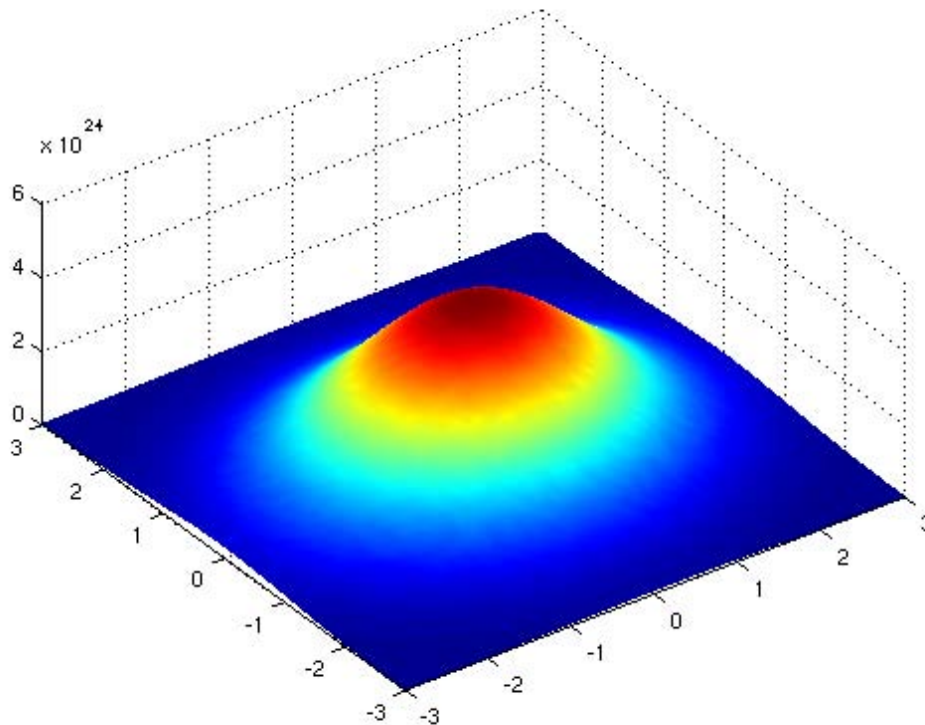
"Figure 1" (Hardy)

How this calculation avoids producing superluminal v_e

Knowing that the spin velocity cannot exceed the speed of light, we may set v_e at an arbitrary value less than c and work backward to obtain a corresponding value of $a^2 + b^2$. Assuming the spinning electron to be symmetric with an overall expected radius equal to r_e, the values

obtained from an arbitrary v_e may not fit the radius r_e. If a and b are too large or too small, we can adjust them and calculate a new value for v_e. Depending upon how near the first estimate of v_e was to the correct value, it may take several iterations to zero in on the target value. Using this method, we find that the limiting conditions of $v_e < c$ and $r_e = 2.8179 \times 10^{-15}$m are met when $a^2 + b^2 = 3.7862 \times 10^3$ and $v_e = 2.9974 \times 10^8$m/sec.

By not automatically rejecting a contradictory result, but looking for ways to explain it, we have found a way to logically and mathematically determine the structure of the electron at a scale far below the resolution of our current technology.

With this new estimate of the shape of the free electron, we can rewrite equation (14) as:

$$v_e \times 2(a^2 + b^2)m_{re} \, \Upsilon r_e = h/2\pi \qquad (19b.)$$

where the probability distribution of the inertia about the axis of rotation (the z axis) as a function of x and y is given by:

$$P(x,y) = (m_e/2\pi ab) \, e^{-[(x/a)2 + (y/b)2]/2} \quad (20.)$$

where e is Euler's number and a and b are parameters indicating the spread of the Bell curve perpendicular to the axis of rotation.

Are electrons uniformly spherical objects?

Since all of the assumptions and parameters leading to the superluminal result above are well defined and empirically verified, except the assumption that the electron is a spherical object of uniform density, we were prompted to ask:

Is there anything that we haven't accounted for that might slow the spin resulting from the conservation of angular momentum and prevent it from reaching light speed?[z]

We have demonstrated mathematically that the electron is cannot be a perfect sphere. If the electron approximates the shape in the figure above, the calculated v_e does not exceed the velocity of light and therefore we conclude either that electrons are not spherical or the Velocity of light c is exceeded. Although the concept of multidimensional time may suggest that c should be addressed relative to the observer in 3S-1t, and in a 9D finite reality light speed may exceed the 3S-1t constant c, a far more parsimonious hypothesis is that electrons are not uniformly spherical.

We have now described the mathematical justification for all the key results:

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[z] Effectively, we find that the limiting conditions of $v_e < c$ and $r_e = 2.8179 \times 10^{-15}$m are met when $a^2 + b^2 = 3.7862 \times 10^3$ and $v_e = 2.9974 \times 10^8$m/sec. By not automatically rejecting a contradictory result, but looking for ways to explain it, we have found a way to logically and mathematically determine the structure of the electron at a scale far below the resolution of our current technology.

Further Discussion:

    TDVP and the mixing angles such as the Cabibbo angle
    A fundamental aspect of TDVP involves vortical rotation through nine finite dimensions. This 9-D vortical model has been mathematically validated as our predicted numerical result was confirmed: Because, within the confidence limits of experimental measurement error, the exact angle was derived, this supports both the fermion mixing angle hypothesis for electrons and the feasibility of our nine-dimensional finite model. Although these results could have been falsified, they were not, being confirmed instead, and the calculation appears accurate.
This methodology has, therefore, been justified by the LFAF philosophy of science method in both confirmation of the hypothesis and feasibility[8].The likelihood of such findings occurring by chance should be very low: empirically and mathematically, certainly, no-one in fifty years had shown such a calculation to be effective.

    More formally, these results confirm the following hypotheses:
a. We demonstrate a mathematical justification for the fermion mixing angle, like the Cabibbo angle.
b. We demonstrate this is not purely a curiosity because it works only with 9 dimensions (and no others) and only by considering the vortical nature of reality.
c. We demonstrate that our proposed 9 dimensional finite reality is a 9 vortical model in TDVP is feasible.
d. Critically, this calculation would be falsified if any other number of finite dimensions were used because the fundamental figure is calculated per spin rotational dimension and only the pre-stipulated hypothesis of 9 dimensions works out. and further support is provided by the lack of any other dimensional model (e.g., 8 or 10 or 11 or 4 or 3) not working with these calculations. This provides support for the hypothesis that this model works exclusively by applying a 9 dimensional model.

    This conclusion provides critical evidence supporting the validity of our TDVP finite 9 dimensional spin model.

    Possible reasons why the exact explanation of the fermion mixing angle (such as Cabibbo) was not previously solved are:
• Apparently no scientists previously examined a 9-dimensional vortical spin model of reality.
• It is very unlikely that the mathematical technique of dimensional extrapolation had been applied before by others: Indeed, the term in this concept is new, as it was mentioned briefly for the first time in the First Edition of our book, *Reality Begins with Consciousness* [9] though some of the principles were cited earlier in two of Dr. Close's books. [28; 72]
    We have provided a solution to the scientific conundrum of why the fermion mixing angle, including the Cabibbo angle for quarks, is approximately 13.04± 0.05 degrees. A possibly more accurate mean figure based on our briefly described calculation is 13.032 degrees, because this is

represented mathematically to five significant figures.[aa] The following is pertinent:

- Like quarks, the electron of the hydrogen atom exhibits the half-spin property and consequently a mixing angle similar to, if not identical with the Cabibbo angle.
- Given that our calculations were on the simplest atom with one electron, it is very likely we can generalize this calculation to all electrons as they all exhibit the same property.
- Moreover, the derivation of the 13.032 degree figure is the same magnitude and virtually the same numerically as 13.04±0.05 derived for the Cabibbo angle. From this we can generalize that the mixing angle of fermions, be they quarks or electrons, is the same order of magnitude and likely to be equivalent: It is extremely likely that this implies Cabibbo angle equivalence — quark mixing angle —in both quarks and electrons.
- Most importantly, the application of the fermion mixing angles has been demonstrated to be applicable in a 9-D spin model.

If the calculation holds, and it appears to do so, *because this is a simple mathematical derivation which can be, and has been checked,* it also has implications for not only finite 9 dimensional rotational realities as in TDVP, but other key concepts in this paradigm including:
- why and how dimensional extrapolation works: DE is directly demonstrated by the feasibility of these calculations requiring extra dimensions.
- vortical spin (with a stimulating proposal) including vortical indivension: This, of itself, provokes another important theoretical model relating to electron shape.
- orthogonality,
- dimensionometry,
- Calculus of Distinctions (CoD) and
- relativity and
- the Fine Structure Constant.[bb]

Generalizing to other models?
Can this be applied to other models? Possibly, but only:

[aa] Recently we replicated this derivation with a "thought experiment" (awaiting refereeing). Interestingly, the figure there is 13.0392 degrees, which we think is even more accurate and close to the original 13.04 to four significant figures.

[bb] Arnold Sommerfeld's 1916 Fine Structure constant, α, is a fundamental physical constant of the coupling constant characterizing the strength of the electromagnetic interaction. It is a dimensionless quantity, with a constant numerical value in all unit systems. It is $\alpha = 7.2973525698(24) \times 10^{-3}$ or the famous 1/137 or more correctly 1/137.035999074(44). It can be expressed in terms of other fundamental constants of physics. [73] In this instance, α indirectly comes out in ratios like velocity of the electron round the hydrogen atom and the calculated spin velocity of the electron. The unwritten assumption is that fermions have an intrinsic spin of one half. The probability matrix calculated relates to the influence of one angle to another under the influence of subatomic forces. [73; 74]

a. if they are 9 finite dimensional models (most String Theory models are not 9 dimensional)

b. and if they involve rotation and intrinsic spin of fermions (so that, for example, any "folding" multidimensional String Theory models should not apply).[cc] No other well-developed proposed models seem to fit these parameters. The closest alternative model appears to be the provocative Subquantal Model modified in Adrian Klein's 2012 version. This recognizes the logic of a 9 dimensional model, but only briefly. However, the vortical spin elements and dimensional extrapolation applied to this calculation are not an essential part of the Klein model. [75]

Implications for Space-Time-"Consciousness" (STC) dimensions

The demonstration specifically of the actual calculation of the fermion mixing angle (as exemplified by the equivalent Cabibbo angle) strongly motivates that our *finite* reality is 9 dimensional and these dimensions are differentiated through spin. However, this finite reality 9-dimensional matrix does not specifically differentiate any configuration of dimensional substrates such as (S3, T3, C3) from say (S5, T4). The TDVP model also includes finite and transfinite elements (the 10th plus dimension) plus the continuity of the infinite reality elements, but our derivation, here, examines purely the finite 9-dimensional spin TDVP reality component.

Perspective and Potential implications:

We can derive the fermion mixing angle from a 9-D finite spin model.
We also broaden the concept of weak universality to hypothesize that all discrete phenomena result from specific dimensional extensions of the same elementary pattern inherent in the multi-dimensional substrate of reality.

The solid mathematical basis derives from the demonstration of the mixing angle by applying a 9-dimensional rotational model, extrapolating through dimensions. Importantly, this calculation cannot be derived by using a conventional Standard Model of Physics with 3 dimensions of space and one dimension of time. Nor can a Cabibbo angle like figure be calculated applying anything but a 9 dimensional model suggesting that models with <9 or >9 finite dimensions are incorrect. Moreover, the requirement of spin rotation suggests that models involving folding dimensions are also falsified.

Einstein brought to our attention the fact that the variables of observation and measurement, and thus of extent and content, are affected by relative motion and proximity to massive concentrations of content. In TDVP we are extending this re-orientation of observation and measurement to include the consciousness of the observer in the context of the space-time-

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[cc] The various String Theories usually postulate 10, 11, 26 or other folded or unfolded dimensions, yet there is no empirical support for any. In contrast, this has empirical justifications of the Cabibbo angle, and now mathematical support in 9 spin dimensions.

consciousness substrate of a nine-dimensional reality.

We can develop another interesting application based on the calculus of distinctions: Observation and measurement are accomplished through the drawing of distinctions.[dd] For an object to be meaningful to a sentient being, it must be observable and measurable in all three dimensional domains, space, time and consciousness. Thus an ostensible three-dimensional object like an electron must also have extent in time and consciousness.

Moreover, this theoretical background to this calculation applies Dimensional Extrapolation in the TDVP model allowing calculations based on the multi-dimensional nature of reality.

This mathematical derivation allows postulations about reality:
It supports several TDVP mathematical constructs:
- the basic TDVP 9 dimensional vortical finite spin model,
- dimensional extrapolation and related dimensionometry,
- the idea of our 3S-1t reality being relative and not absolute,
- concepts of orthogonality at higher dimensions.
6. Furthermore, our derivation applying 9D vortical spin:
- the application of relativity corrections in electron spin, and
- the technique of applying LFAF (Lower-Dimensional Feasibility, Absent Falsification). [ee]
- Our calculations support the finding of electron shape not being uniformly spherical: This is a strong conclusion because otherwise the calculated spin velocity v_e would exceed the velocity of light.

These findings are very broad and could generate several novel ideas for testing and application. These findings potentially change our world-view to a 9D spin finite reality. If justified, and the data below appear cogent, we no longer can claim that reality is purely 3S-1t.

Implications for the future

[dd] A distinction is comprised of three parts: the object distinguished, that from which it is distinguished and the boundary between them. A distinction is measured to distinguish it from, and for comparison with, other objects using standard variables of extent, content and relative impact. The conscious awareness of an N-dimensional object by a sentient being requires the existence of at least N+1-dimensions. The extent and content of a two-dimensional distinction e.g., can only be observed and measured from the perspective of a third dimension, either of space, time or consciousness.

[ee] This is a new but pertinent Philosophy of Science approach to proof: the basis for including logically feasible concepts in hypotheses that may not be falsifiable in 3S-1t. This is applicable at all dimensional levels and refers to whether something is feasible in 3S-1t and not falsified.

This Cabibbo angle 9D spin finding could have *significant speculative implications* for the future of appreciating our reality.

- It implies that most of our finite reality is hidden because we are limited to what we experience in 3S-1t.
- The awareness suggests a potential to apply higher dimensional realities for future research. The most obvious relate to what was previously "science fiction" including space and time travel and communications.
- It provokes serious questions about the concept of finite reality, and about why some dimensions that may be hidden from us in our restricted 3S-1t sentient experience.
- It confirms the derivation of the same approximate angle of 13.032 degrees for mixing angles for electrons.

Our findings, because of their breadth, could generate several novel ideas for testing and application. Effectively, we went searching for an *alligator and we found it (13.032 degrees).*

But this led to the discovery of some dinosaurs, too —not necessarily spherical electrons; extending weak universality; electron clouds in a double Bell normal distribution curve; and most importantly a finite 9 dimensional spin reality.

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