Article

Experimental Supersymmetry: Processing the Dimensional Barrier (Part I)

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Abstract

A radical, albeit pragmatic protocol for experimental access to putative String/M-theoretic, Einstein Unified Field Mechanical (UFM) additional dimensionality (XD) of the *brane-bouquet* bulk is presented. If successful, results demonstrate the existence dimensionality beyond the metric of observed physical reality provided by the Standard Model (SM) of particle physics and Cosmology. Quantum Mechanics (QM), as well-known is incomplete and further, should not be considered the *basement of reality*; meaning, Locality and Unitarity – the fundaments of quantum theory are an insufficient basis for extending the representation of reality. A seminal model of Tight Bound States (TBS) below the lowest Bohr orbit in hydrogen, proposed by Vigier, is extended to a Kaluza-Klein-like (KK) cyclical tier of XD hyperspherical cavities defined within a finite radius manifold of uncertainty (MOU) up to a semi-quantum limit, predicting, in its domain, additional spectral lines in Hydrogen. The proposed protocol for this process, with phase modifications, provides efficacy of large-scale additional dimensions (LSXD) of the brane bulk; XD-LSXD incursion duality accesses nonlocal Einsteinian UFM phenomena, leading to myriad new classes of technological innovation beyond the SM.

Part I of this two-part Article includes: 1. Introductory Precis / Motivation; 2. Tight Bound State (TBS) Modeling – Indicia of XD QED Hyperspherical Cavities; 3. Challenge of Dimensionality – Only Resolved Experimentally; 4. What is Matter? - A 3D to 12D Evolutionary Step; and 5. Synchronization Backbone – Inherent XD-LSXD Periodicity.

Keywords: Dirac hypertube, Dirac polarized vacuum, M-theory, manifold of uncertainty, nonlocality, semi-quantum limit, supersymmetry, tight bound states, unified field theory.

Physis kryptesthai philei; Nature hides itself – Heraclitus, ~ 500 B.C.E.

1. Introductory Precis / Motivation

A concatenation of generally overlooked theoretical approaches relative to current thinking is utilized to formulate a protocol for the experimental demonstration of additional dimensionality (XD) of a brane-bouquet Bulk [1] within which observed/realized 3D space is a restricted brane/submanifold inside this bulk which phenomenologically entails a Kaluza-Klein-like cyclic

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duality between the two: 1) compact XD up to a semi-quantum domain wall limit as manifest by the uncertainty principle and 2) large-scale additional dimensionality (LSXD) with likely infinite extension into a multiverse [2,3]. Entry into this local-nonlocal duality can be envisioned in terms of the Dirac electron hypertube model [4,5].

While a dramatic advance suggesting an imminent paradigm shift if successful, since technological innovation is not inherent in this basic TBS spectroscopic protocol, discussion is included on the theoretical framework for required modifications to implement assumed myriad technological innovations. That scenario requires an advanced form of universal quantum computing (UQC) with a dual XD/LSXD UFM/M-theoretic topological phase qubit [6] to program the spacetime vacuum utilizing both ends (local-nonlocal) of the Cellular Least Unit (CLU) Dirac hypertubes tessellating the polarized covariant vacuum of the Dirac type [2-9].

Initial motivation for the protocol design arose from seminal efforts by Vigier on Tight-bound States (TBS) in hydrogen [10-12]. The premise of TBS below the lowest Bohr orbit, ignored initially as implausible because an atomic electron could only have specific defined energies, $E_n = -(hcR_\infty / n^2)$, where R_∞ is the Rydeberg constant, $n \in \{1, 2, 3...\}$ and at $n = 1$, an electron could not be any nearer to the nucleus. Twelve years later after developing a holographic multiverse cosmology [2,3]; the profundity of indicia TBS provided was finally realized as the key to developing low energy tabletop brane topological cross section (sans supercollider particle sprays) experimental protocols able to surmount the finite domain wall manifold of quantum uncertainty (MOU).

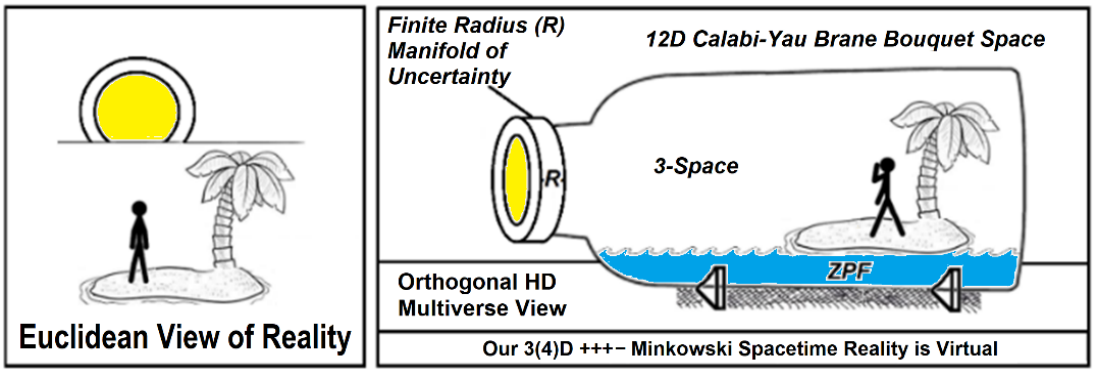

Figure 1. Beyond current 3D Standard Model (SM) spacetime lies LSXD *Hidden* by a finite hypertube domain wall of uncertainty. a) View of current 3D SM reality. b) Duality of XD and nonlocal LSXD brane world.

Figure 1b) symbolically suggests the regime of the proposed TBS protocol predicting new spectral lines within a finite radius Manifold of Uncertainty (MOU) up to a semi-quantum limit, the local end of a wormhole/Dirac hypertube within which is a hyperspherical tier of putative supersymmetric (or mirror symmetric) XD QED cavities (CQED), each with its own spectral line. Note that at the MOU limit (like an atomic electron blowing off to infinity when sufficient energy is achieved for escape); no additional MOU spectral lines will be discovered; as entry to infinite size LSXD of the brane bouquet bulk topology is suggested to occur.

2. Tight Bound State (TBS) Modeling – Indicia of XD QED Hyperspherical Cavities

Tight Bound States (TBS) due to electromagnetic interactions at small distances below the lowest Bohr orbit have been predicted for Hydrogen [10-15]. Reviewing original papers by Vigier - as understood by spin-spin and spin-orbit coupling, atomic perturbations for example, give rise to only tiny corrections in classical Bohr energy levels. In contrast, distances of $1/r^3$ and $1/r^4$ ranges, these interaction terms, in the past overlooked, might be higher than the Coulomb term at distances considerably less than the Bohr radius – indicia suggesting additional physics [10,13]. Corben [14] noticed point charge motion in a magnetic dipole field at rest with orbits of highly relativistic nuclear dimensions. Additional studies by [10-13,15] illustrated by Hamiltonian (1) extended the Pauli equation to a 2-body system:

$$H=\frac{1}{2m_1}\left(\vec{P}_1-e_1\vec{A}(\vec{r}_1)\right)^2+\frac{1}{2m_2}\left(\vec{P}_2-e_2\vec{A}(\vec{r}_2)\right)^2+\frac{1}{4\pi\varepsilon_0}\frac{e_1e_2}{|\vec{r}_1-\vec{r}_2|}+V_{dd} \tag{1}$$

with, m_i mass, $\vec{P}_i$ momentum, e_i charge, $\vec{r}_i$ particle positions $(i=1,2)$, with $\vec{A}$ the electromagnetic vector potential and V_{dd} a dipole-dipole interaction term:

$$V_{dd}=-\left(\frac{\mu_0}{4\pi}\right)\vec{\mu}_1\vec{\mu}_2\delta(\vec{r}_1-\vec{r}_2)+\left(\frac{\mu_0}{4\pi}\right)\left[\frac{\vec{\mu}_1\vec{\mu}_2}{|\vec{r}_1-\vec{r}_2|^3}-\frac{3\left[\vec{\mu}_1(\vec{r}_1-\vec{r}_2)\right]\cdot\left[\vec{\mu}_2(\vec{r}_1-\vec{r}_2)\right]}{|\vec{r}_1-\vec{r}_2|^5}\right]. \tag{2}$$

In the center-of-mass frame, for a usual magnetic moment, $\vec{\mu}=(e/m)\vec{S}$ Hamiltonian (2) is:

$$\begin{aligned}H=&\frac{1}{2m_1}p^2-\left(\frac{\mu_0}{4\pi}\right)\frac{e_1e_2}{m_1m_2}\frac{\vec{S}\vec{L}}{r^3}+\left(\frac{\mu_0}{4\pi}\right)^2\frac{e_1^2e_2^2\hbar^2}{4m_1m_2m}\frac{1}{r^4}+\\&\frac{1}{4\pi\varepsilon_0}\frac{e_1e_2}{r}-\left(\frac{\mu_0}{4\pi}\right)\frac{e_1e_2}{m_1m_2}\vec{s}_1\vec{s}_2\delta(\vec{r})+\left(\frac{\mu_0}{4\pi}\right)\frac{e_1e_2}{m_1m_2}\left[\frac{\vec{s}_1\vec{s}_2}{r^3}-\frac{3(\vec{s}_1\vec{r})\cdot(\vec{s}_2\vec{r})}{r^5}\right],\end{aligned} \tag{3}$$

with $r,p,\vec{S},\vec{L}$ relating to relative motion and where *m* indicates reduced mass. The usual Pauli approximation producing (3) is enhanced by keeping an energy term in the Hamiltonian since *m* is a resonant energy order of interest. This added Hamiltonian depends on energy through an effective mass, m^* as in, $m^*=m+\left(E/8c^2\right)$ [10-13].

For total spin angular momentum, the self-consistent Hamiltonian of the Barut-Vigier model is:

$$\begin{aligned}H=&\frac{1}{2m^*}p^2+\frac{1}{4\pi\varepsilon_0}\frac{e_1e_2}{r}-\left(\frac{\mu_0}{4\pi}\right)\frac{e_1e_2}{8\left(m^*\right)^2}\frac{\vec{J}^2-\vec{L}^2-2\vec{S}^2}{r^3}+\left(\frac{\mu_0}{4\pi}\right)^2\frac{e_1^2e_2^2\hbar^2}{16\left(m^*\right)^3}\frac{1}{r^4}-\\&\left(\frac{\mu_0}{4\pi}\right)\frac{4\pi e_1e_2}{8\left(m^*\right)^3}\left(\vec{S}^2-\frac{3}{2}\hbar^2\right)\delta(\vec{r})-\left(\frac{\mu_0}{4\pi}\right)\frac{3e_1e_2\hbar^2}{8\left(m^*\right)^2}\frac{Q}{r^3}\end{aligned} \tag{4}$$

with operator $Q=\left(1/\hbar^2\right)\cdot\left(\left(\vec{S}\vec{r}\right)^2/r^2\right)$ [10,15].

Still following Vigier [10-13], possibilities for TBS physics derived from Hamiltonian (4) shows by significant spin channel resonance phenomena, $S=1, L=1$ and $J=0$ sense attractive spin interactions are strongest with an effective potential appearing in a radial Schrödinger equation (5) and simplified form (6) when limited to spherical terms:

$$\frac{d^2u}{dr^2}-\left[\frac{2m*}{\hbar^2}\frac{1}{4\pi\varepsilon_0}\frac{e_1e_2}{r}+\frac{2}{r^2}+\left(\frac{\mu_0}{4\pi}\right)\frac{e_1e_2}{4\left(m^*\right)}\frac{6}{r^3}+\left(\frac{\mu_0}{4\pi}\right)^2\frac{e_1^2e_2^2}{8\left(m^*\right)^2}\frac{1}{r^4}-\left(\frac{\mu_0}{4\pi}\right)\frac{e_1^2e_2^2}{8\left(m^*\right)^2}\frac{\delta(r)}{r^2}-\frac{2m*E}{\hbar^2}\right]\mu(r)=0 \tag{5}$$

$$\frac{d^2X}{dr^2}+\frac{2m}{\hbar^2}\left[E-V(r)\right]X=0, \tag{6}$$

which has an effective potential form in the inverse power law:

$$V(r)=\frac{A}{r^4}+\frac{B}{r^3}+\frac{C}{r^2}+\frac{D}{r}. \tag{7}$$

At large distances this potential is an attractive Coulomb tail with a repulsive core due to the A/r^4 term at small distances [11]. Appropriate values of potential (5) have coefficients that could have another potential well in addition to the one at distances of the order of the Bohr radius where the proposed additional physics is suggested occur. More details on Vigier's proposal for TBS are noted in [10-15].

Implementing TBS experimental technology requires significant new concepts and an extension of the basis of fundamental reality beyond SM limits. Gauge theory conditions, the foundation for most contemporary physics, are approximate, hinting new theory is required to complete the SM. Numerous Quantum Electro Dynamic (QED) tests have discovered a range of anomalies at the $\sigma 5$ [16] and $\sigma 6$ levels, hinting at further physics beyond the SM. QED tests are often based on X-ray spectroscopic measurements. Recent results along these lines come from a program by Chantler [16-18]. Several tests of diverse forms over 10 to 15 years produced many possible discrepancies in QED theory; initially, interpretation problems and critical views of possible experimental error generally left those results ignored by the physics community. This changed in 2012 when a more sophisticated experiment by Chantler's team produced more dramatic results [16]. The new QED test ($Z>20$) was for the $w\left(1s2p^1P_1\rightarrow 1s^21S_0\right)$ resonant x-ray line transition energy for trapped Helium-like (2-electron) Titanium (Ti^{20+}) ions with a statistical coefficient rising to the significance of 5 standard deviations; the highest statistically significant QED discrepancy found, for $\left(1s2p^1P_1\rightarrow 1s^21S_0\right)$ orbital transition energy significantly establishing Hydrogen-like lines of highly charged ions as a new class of transfer standards for x-ray spectroscopy [18,19].

Firstly, we suspect, but not with sufficient insight to attempt to calculate from von Neumann's postulate suggesting that *speed of collapse* of the quantum wavefunction [20] could be applied to explain the marked improvement between Chantler's initial two decades of experiments on hydrogen and the 2012 NIST experiment on Helium-like titanium with a $\sigma 5$ statistical standard deviations improvement [16,17]. Is it possible that the difference in radius of electron orbits between hydrogen and 2-electron titanium ions could play a part in explaining the QED violation effect or provide indicia of hidden XD/LSXD? Such a hypothesis utilizing an SM 3-space Copenhagen interpretation seems untenable. Von Neumann's conjecture (merely a statement) is not sufficiently understood to postulate, especially in conjunction with controversy regarding physicality of components of the wavefunction in relation to the maths of the Schrödinger equation or measurement.

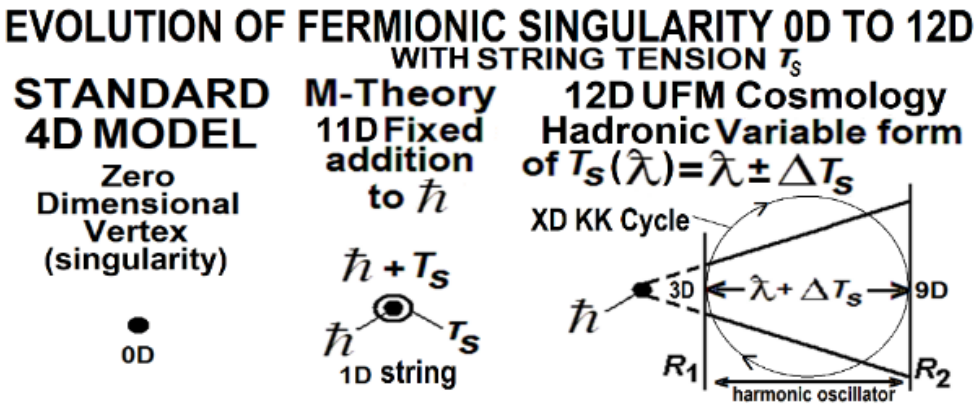

Figure 2. a) Usual 3D representation of a fermion as a fundamental physical object, a 0D singularity. b) 1D object of string theory, with fixed length string tension T_S added to the Planck scale, $\hbar + T_S$. c) M-theoretic / UFM form utilizing original hadronic string theory having variable T_S, in order to include continuous-state KK-like dynamic compactification, $T_S = \lambda\!\!\!^{-} + \Delta T_0$, utilizing $\lambda\!\!\!^{-}$, original Stoney, electromagnet precursor to $\hbar$.

However, taking license for radical suppositions, we postulate von Neumann's speed of collapse conjecture [20] is not a simple comparative Planck time/velocity calculation between the atomic radius of a hydrogen and titanium atom as might be supposed by the SM Copenhagen interpretation. In contrast, for XD-LSXD duality in the context of a periodic Kaluza-Klein (KK) cyclicality and the Dirac electron hypertube [4,5] the scenario could be dramatically different. The Planck length, $\ell_P = \sqrt{G\hbar/c^3} \approx 10^{-35} m/s$ conjectured where quantum zero-point oscillations distort Euclidean spherical geometry as a spacetime foam with $(c/\ell) = (E/\hbar)$ the order of the oscillation frequency, suggested to determine the degree of deviation from Euclidean geometry. Figure 2 attempts to illustrate why a modified M-theoretic/UFM model works better by returning to the earlier hadronic form of T_S, as clarified below in terms of Cramer's Transactional Interpretation, continuous-state dimensional reduction and an alternate derivation of string tension better explaining the TBS view of dynamic dimensionality beyond the Dirac hypertube MOU [2,6,21-23]. Sufficing for now, the original variable string tension, $T_S = \hbar + \Delta T_0$ (abandoned because it contained a tachyon deemed unphysical) supports the cyclical KK-like

TBS basis of XD space built with an inherent tier of Cramer-like standing-wave components [21]. With a string-based world, *h* is not a fundamental constant at the semi-quantum limit; units for a string will not be *h* = 1, but $T_S = 1/\pi$. String tension, *h* and *c* combine forming length, *L*, meaning that *h* in string theory is multiplied by T_S. Adapting strings to XD-LSXD duality suggests *L* can cyclically oscillate asymptotically to the Lamour radius of the Hydrogen atom – indicia of a periodic gateway to LSXD.

Such ruminations allowed a derivation of a unique M-theoretic vacuum that included a simple preliminary equation related to the dynamics of topological charge phase transitions (governing dynamics of Dirac hypertubes), motivating an exploratory inroad into a putative basis for initial superficial parameters of an Einsteinian UFM [23-26] to access XD-LSXD discussed below.

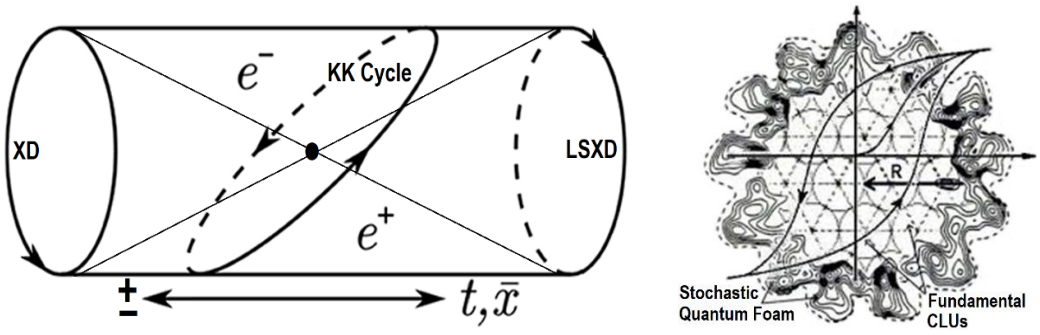

Figure 3. a) Dirac spacetime electron hypertube manifold model. The central point (black dot) is an SM $\hbar$ asymptote (never reached) b) End view with polarized vacuum tessellated with CLUs with a hysteresis loop suggesting precisely a timed applied rf-pulsed resonance incursive oscillator may open or close the hypertube cavity.

Most accept by quantum theory and measurement, if XD exist, since they are *invisible*, they must be Planck scale. But other interpretations exist, such as subtractive interferometry between our 3-brane temporal cycle, rotating on a KK-like nonlocal EPR atemporal instantaneity of the dual XD-LSXD M-theoretic manifold of the brane bouquet bulk, wherein, a simplified nilpotent Wheeler-Dewitt wave function of the observer, $\hat{H}|\Psi\rangle = 0$ [27,28] is cyclically annihilated-recreated hiding behind a Planck-scale domain wall of the uncertainty principle allowing the range of collapse to putatively extend, from the Larmor radius of the hydrogen atom to a virtual $\hbar$ asymptote never actually reached. Although highly speculative, in simplistic defense, the Dirac electron hypertube model suggests it might be correct [4,5]. Compare Fig. 2c to Fig. 3 noting $T_S = \lambda\!\!\!^{-} + \Delta T_0$ with KK cyclicality providing indicia for Dirac hypertube coincidence with the extended electromagnetics of a Dirac polarized vacuum [4,5].

We suggest that Chantler's experiments are indicia of this situation. We will elaborate below in terms of the dimensional conundrum. More saliently the Chantler and putative CERN experiments can at best only produce subtle indicia of QED violation or XD/LSXD respectively because of the 4D limit of the SM and the observational limit inherent by definition in the uncertainty principle. In contrast, our proposed experiment, if successful, promises unfettered low energy complete access to a 3rd UFM brane regime of reality [2-7].

3. Challenge of Dimensionality – Only Resolved Experimentally

"*In three dimensions there is not enough room to put all the laws of physics*." – Michio Kaku. Clearly Yang-Mills (YM) Kaluza-Klein (KK) correspondence (equivalence) could facilitate future particle physics providing an empirical path extending the SM. Although generally known that YM-KK theories define equivalence on principle fiber bundles; specific conditions for equating their Lagrangian have not been rigorously specified. Since the origin of KK theory, virtually all corresponding extensions of the SM rely on a profusion of additional dimensionality (XD) [29,30]; a conundrum that obviously can only be resolved experimentally. For instance, a Riemann KK manifold, M with horizontal and vertical subspaces in the tangent bundle $(\mathrm{M} = \mathrm{X} \times \mathrm{G})$ is defined by orthogonal YM connections relative to a KK metric, with X a 4D spacetime and G an arbitrary gauge Lie group. M is a trivial principle G-bundle for a corresponding YM theory [29,30], suggesting plausible extended orthogonal dimensions beyond the 4D SM utilization. This requires a fundamental change in the concept of dimensionality [22].

XD can be modeled by two special procedures: 1) Dimensions are characterized differently in duality; 2) Dimensions are fundamentally similar for anti-commutativity [22]. A quaternion-octonion Clifford algebra suggesting operational parameters relevant to protocol strategy is under development [34]. Instead of usual String/M-Theory, our model utilizes alternative parameters of prior hadronic string theory because correspondence to essential elements like virtual tachyon/tardon interactions allows three temporal dimensions [35,36]) including variable string/brane tension, T_S postulated to yield experimental design parameters for accessing additional dimensionality [31,33].

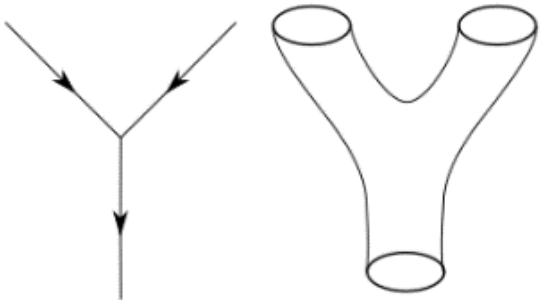

Figure 4. Quantum interactions: a) SM Fermionic 0D point particle world line. b) M-theoretic world sheet with 1D string; extended to a $M_{12} = M_4 \times \square_8$ brane topological model with $\square_8 = \pm \square_4$ a form of mirror symmetric KK cyclicality.

In contrast to ongoing QED violation and CERN LHC SUSY XD experiments, this work explores a radical new M-theoretic / Unified Field Mechanical (UFM) inroad approach surmounting quantum uncertainty outlined in preliminary form [31-33]. Success would validate M-Theoretic dimensionality for the first time, and enable low-energy tabletop UFM *cross section* replacements for *examining* alleged SUSY partners (or alternative mirror symmetric topologies) in trans-dimensional *slices* instead of TeV, PeV supercollider techniques that have produced historically successful collider cross section particle sprays.

The KK formalism appeared as the first suggestion of the utility of XD as a tool in unification procedures. In general, KK models have correspondence to the SM by way of YM Gauge Theory [29,36,37]. Decades later the concept of Higher Dimensionality (HD) became associated with String Theory; recently merged into 11D M-theory with mirror symmetric Calabi-Yau brane topologies [38]. M-theory is degraded by the dearth of experimental proof [39].

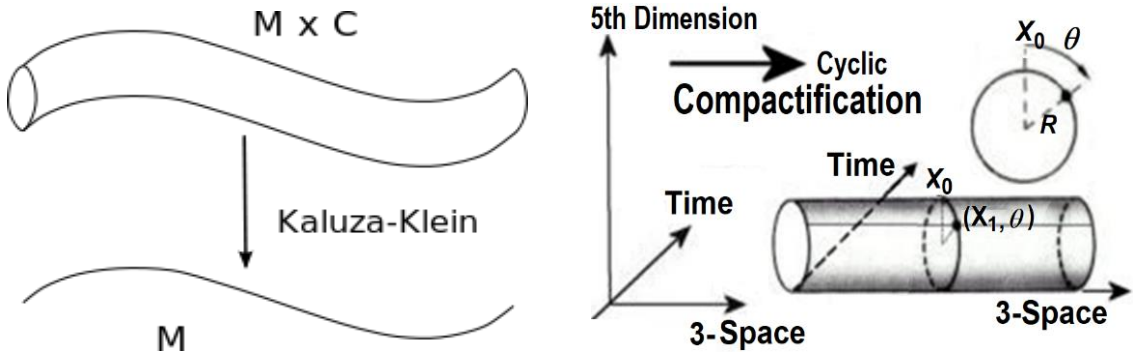

Figure 5. a) $M \times C$ (KK space) is compactified over the set *C*; KK decomposition induces a field theory over *M*. The tangent bundle of $\mathrm{M}(\mathrm{M}=\mathrm{X}\times\mathrm{G})$ defined by the YM connection is orthogonal with respect to a KK metric. b) The inherent cyclicality of KK compactification from 5D.

YM-KK correspondence could extend the SM by the additional degrees of freedom allowed by XD outside the 4D limits of the SM. The existence of YM-KK correspondence is reasonably obvious mathematically [29,36-43] with no explicit argument. Debate, that has continued for at least ninety years, concerns the existence of extended real physical correlations and whether experiments can be designed to test them. For a modicum of completeness, we initially list a couple possibilities: A route to unification began in 1919, however, KK theory was not completed until the 1940's. In 1921 Kaluza developed an invariant 5D line element, $ds^2 \equiv \tilde{g}_{ab}dx^a dx^b = g_{\mu\nu}dx^\mu dx^\nu + \phi^2\left(A_\nu dx^\nu + dx^5\right)^2$ where $\tilde{g}_{ab}$ is the 5D metric and $g_{\mu\nu}$ the 4D spacetime metric; ϕ is the associated scalar field at a 5th diagonal, with *A* the vector potential for Electromagnetism (em), allowing derivation of the equations of both General Relativity (GR) and em [44,45].

In figure 5b Klein suggests 5D KK-space is closed in the X_0 direction with a period ℓ. If QM is applied to the geodesic, $P_0 = \pm N_\ell^h$, with *N* a positive or negative quantum number depending on direction of 5D motion. Thus period, $\ell = hc\sqrt{2\kappa}/\varepsilon = .08\times10^{-30}$ cm, with κ the Einstein gravitational constant and ε electric charge [46]. We have already claimed KK or M-theoretic XD appear Planck-scale because of the mechanism of the uncertainty principle.

The possibility of supersymmetry in other dimensions occurs because spinor properties change radically with dimensionality. Spinor size is $\sim 2^{d/2}$ or $2^{(d-1)/2}$, for example, in d dimensions. If maximum supersymmetry is 32; the largest number of dimensions for existence of a

supersymmetric model is 11D. All known particle interactions can be described by an $SU(3) \times SU(2) \times U(1)$ gauge symmetry group. According to Witten, [42,43] the minimum number of dimensions for a manifold of this symmetry is 7D. Gauge fields occur in $SU(3) \times SU(2) \times U(1)$ group symmetry in a gravitational field as components of more than 4D, which forms a reality of a minimum four non-compact and seven compact spacetime dimensions, $M^4 \times S^7 = 11\text{D}$. Witten [43] calls this a *remarkable numerical coincidence* because this 11D maximum supergravity is the minimum $SU(3) \times SU(2) \times U(1)$ symmetry. For symmetry reasons observed in nature, this the largest practical group obtainable from KK theories in seven XD.

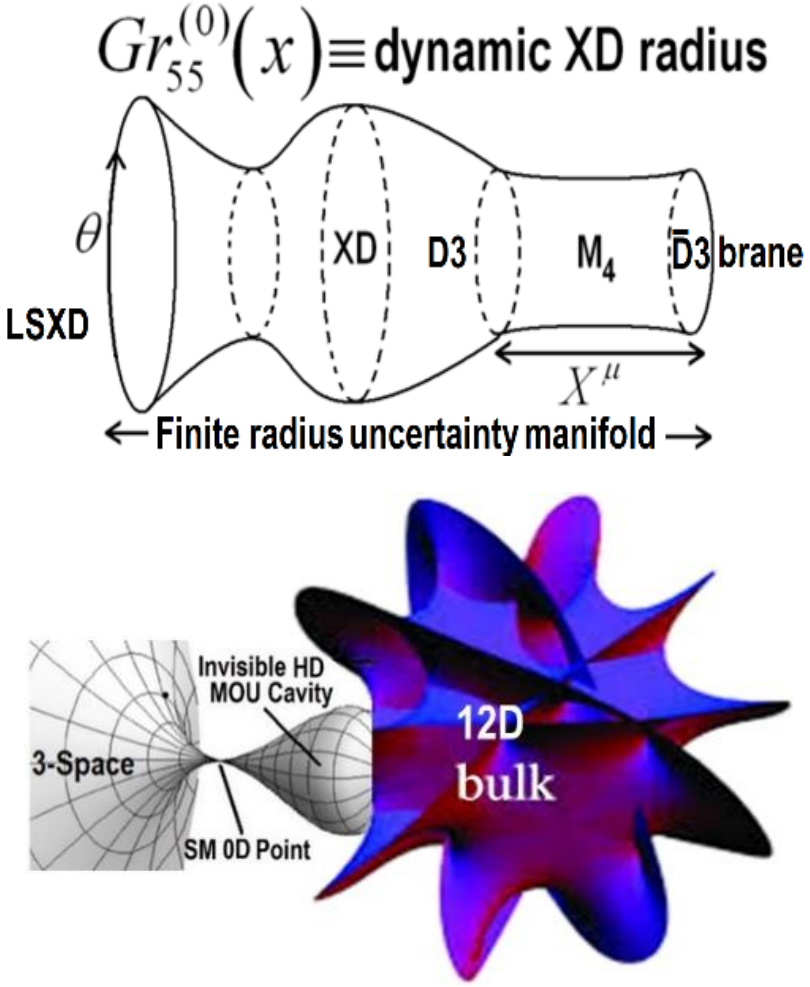

Figure 6. a) Randall-Sundrum warped throat dynamic GR radius example for LSXD fluctuations. X^μ are Lorentz coordinates. Modified from [47]. b) Another XD throat model.

Following Sundrum [47] for 5D GR the Einstein action is $\ni \partial_\mu$ or $\partial_5 Gr_{MN}^0(x) \to 0$ for XD fluctuations $ds^2 \ni Gr_{55}\left(dx^5\right)^2 = Gr_{55}R^2 d\theta^2 \Rightarrow Gr_{55}^{(0)}(x) \equiv$ dynamical XD radius. Randall and Sundrum [48] examined HD methods solving the hierarchy problem by using 3-branes with opposite tensions, $\pm\sigma$ present at orbifold fixed points which together with a finely tuned cosmological constant form sources for 5D gravitation.

The variety of Randall-Sundrum models utilize a 5D warped geometry to describe reality as an anti-de Sitter (AdS^5) space with elementary particles residing on a localized 3 + 1 (4D) brane (D3 Planck brane) and another separated gravity brane. The Randall-Sundrum warped AdS^5 XD position corresponds to our finite radius manifold of uncertainty (MOU) [30,49] giving a modicum of logical credibility to each. An additional group of transformations beyond the Galilean-Lorentz-Poincairé is required for technological access to XD-LSXD.

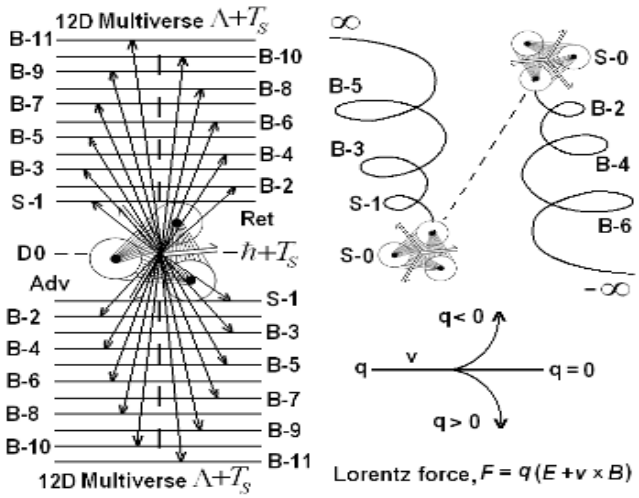

Figure 7. Model of string (S) and brane (B) coupling for advanced-retarded mirror symmetric Calabi-Yau spacetime arising from Cellular Least-Unit (CLU) translations. a) Dualities in string-brane couplings from 0D to 12D for odd-even HD brane topologies. b) Ising model spin-glass rotations can be driven by an internal Lorentz-like UFM force of coherence or applied external resonances for new vacuum energy-based technologies.

All Calabi-Yau manifolds having mirror symmetry or T-duality admit hierarchical families of supersymmetric toroidal 3-cycles. No theory exists at the moment as to whether attempts for formalizing a *continuous-state* boost-compactification cycle might follow a KK spin tower, golden ratio or logarithmic, a genus-1 helicoid parking-garage format, a cyclotron resonance hierarchy, or some other XD-LSXD topological phase transitions structure [2]. We find a Genus-1 helicoid logically attractive since it is able to incorporate Kahler manifolds corresponding to M-Theoretic parameters. Additionally, SO(32) heterotic Bosonic strings allow tachyons not considered anomalous, but part of the internal field coupling of a Cramer transaction-like Lorentz vacuum contraction [33]. Type IIA and Type-IIB open/closed strings occur in odd/even string/brane dimensionality we postulate as an inherent part of the Ising model rotation of the Riemann sphere for *genus-1 parking-garage helicoid* raising-lowering indices in continuous-state dimensional reduction compactification processes [2]. These complex UFM constructs will only be adequately solved by moving beyond limits levied by Copenhagen-Gauge approximations.

Because of the numerous unresolved attempts at finding rigorous realistic XD model, building one is justified in claiming the issue can only be resolved by experiment. Four putative empirical search avenues for additional dimensions (XD) are concurrently being explored:

1. CERN - LHC: Search for LSXD predicts a *leaking* of gravity between HD branes as in the Randall-Sundrum model [47,48] where the visible 4D universe is restricted to a brane inside an HD space called the bulk (Fig. 8). If true, one claim suggests mini black holes (MBH), the energy of which is calculated in terms of what theorists call *gravity's rainbow* [50-53]. The detection of MBH suggests existence of LSXD. 5.3 TeV tests were unsuccessful. Analysis predicts that black hole detection requires a minimum of 9.5 TeV for 6 XD and 11.9 TeV for 10 XD. Absence of results so far is believed to be "*indication of a suppression of higher dimensional black hole production due to Planckian deformation of quantum gravity which was not taken into account*" [40]. Using gravity's rainbow, it was found that the energy needed to form MBH is larger than the energy scale of the LHC, but believed reachable by next generation particle colliders' [51-53].

2. Synthetic dimensions in quantum Hall graphene bilayers. Synthetic dimensions produced by topological phase transitions in quantum Hall bilayers could lead to the discovery of actual XD if topological protection is overcome and topological phase transitions are understood beyond 2D. [54,55].

3. Testing the Casimir force in various isotopes of an element. Recent Casimir related XD models present possibilities of novel short-range gravitational forces. The prediction is that new Casimir forces at sub-micron separations between test bodies made of different isotopes of an element may arise from new spatial XD revealed in the iso-electronic effect of different isotopes [56-58].

4) TBS in atomic hydrogen. Detection of additional spectral lines in hydrogen below the lowest Bohr orbit in hyperspherical XD cavities at the semi-quantum limit utilizing a Bessel function imbued incursive oscillator beat frequency resonance hierarchy [10-12].

Since quantum mechanics cannot be considered the so-called basement of reality, Yang-Mills Kaluza-Klein equivalence is provided as an empirical path extending the standard model of particle physics to include supersymmetry [30]. Feynman proposed a synchronization backbone. We implement his concept by eliciting a novel approach for a Wheeler-Feynman-Cramer Transactional Interpretation of quantum theory with present moment hyperspherical standing-wave future-past transactions. This relies on a Dirac covariant polarized vacuum with a built-in beat frequency inside the spacetime backcloth based on Feynman's concept of a synchronization backbone [59,60]; utility of which allows the uncertainty principal to be supervened cyclically by an rf-pulsed incursive resonance oscillator. Simplistically, the protocol is a hierarchy consisting of electron-nucleon-spacetime spin-spin coupling resonance to induce destructive interference within an oscillating radius determined by incursive oscillator parameters. Reliance is made by suppositions of the Dirac electron hypertube, Randall-Sundrum warped $D\bar{D}-$brane wormhole and Bohm's super-implicate order. The key element is extension of Vigier TBS modeling for the hydrogen atom. Positive results detect 2 to 5 additional TBS spectral lines in hydrogen below the lowest Bohr orbit. This can precisely predict new lines in 4D, 5D and 6D XD utilizing the 1895 equation for hyperspherical volume cavities.

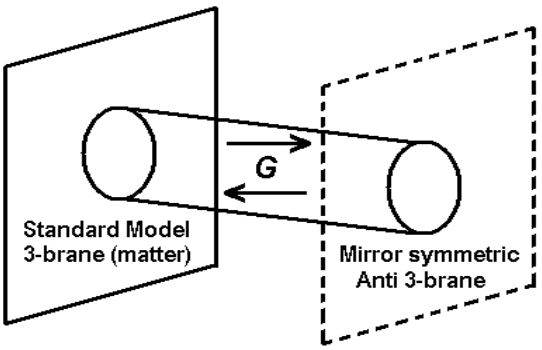

Figure 8. $D\bar{D}$-brane model of 4D SM embedded on a 3-brane with *G* in 11D able to pass through the HD bulk by mirror symmetric brane-antibrane topological phase interactions.

Atomic theory conventionally describes electromagnetic interactions other than Coulomb spin-orbit or spin-spin couplings as perturbations with small energy level corrections. Coulomb's electrostatic inverse square law is, $|F_C| = k_e\left(|q_1, q_2|/r^2\right)$, where k_e is the Coulomb constant and *r* is the Bohr radius. Seminal work by Vigier and colleagues proposed the creation of strong magnetic interactions at small distances and the creation of anti-Born-Oppenheimer states corresponding to rapid motion of heavy particles around essentially stationary electrons. These four models are prime candidates for empirical tests of XD-LSXD physics beyond the SM confines of the Uncertainty Principle.

4. What is Matter? - A 3D to 12D Evolutionary Step

Matter is primarily known as observable extension, duration and particle field interactions occupying a 4D spacetime continuum; which by QED we know the relative space between a proton and electron in atomic hydrogen to be 99.999% empty space. The imminent paradigm shift toward Unified Field Mechanics (UFM) entails passing beyond observation relative to the spacetime continuum into a spatial regime of XD-LSXD duality where matter takes on additional topological properties entailing continuous-state Calabi-Yau brane bouquet phase transformations. Therefore, an essential broad-based extended model must be introduced, with cursory correspondence to current thinking in string / M-theory which seeks a single unique XD compactification to SM spacetime. In line with KK cyclicality, we introduce a periodic continuous-state compactification process (Fig. 7); essential because the local-temporal 3(4D) $+++-$ observer subspace manifold, must make correspondence to nonlocal-instantaneous XD-LSXD M-theoretic/UFM topological phase space [6,24]. Heisenberg potentia (before measurement) is suggested to be infinite by Copenhagen QM. This conforms with spacetime of the observer being nilpotent. A quantum mechanical nilpotent field allows accessibility to coherent elements of UFM (coherent control of HD topological phase transitions) allowing pragmatic protocols for surmounting the virtual barrier of the uncertainty principle providing utility for to accessing the duality of XD-LSXD space. Figure 9 diagrams M-theoretic dualities of the brane bulk bouquet as interpreted by Huerta [61].

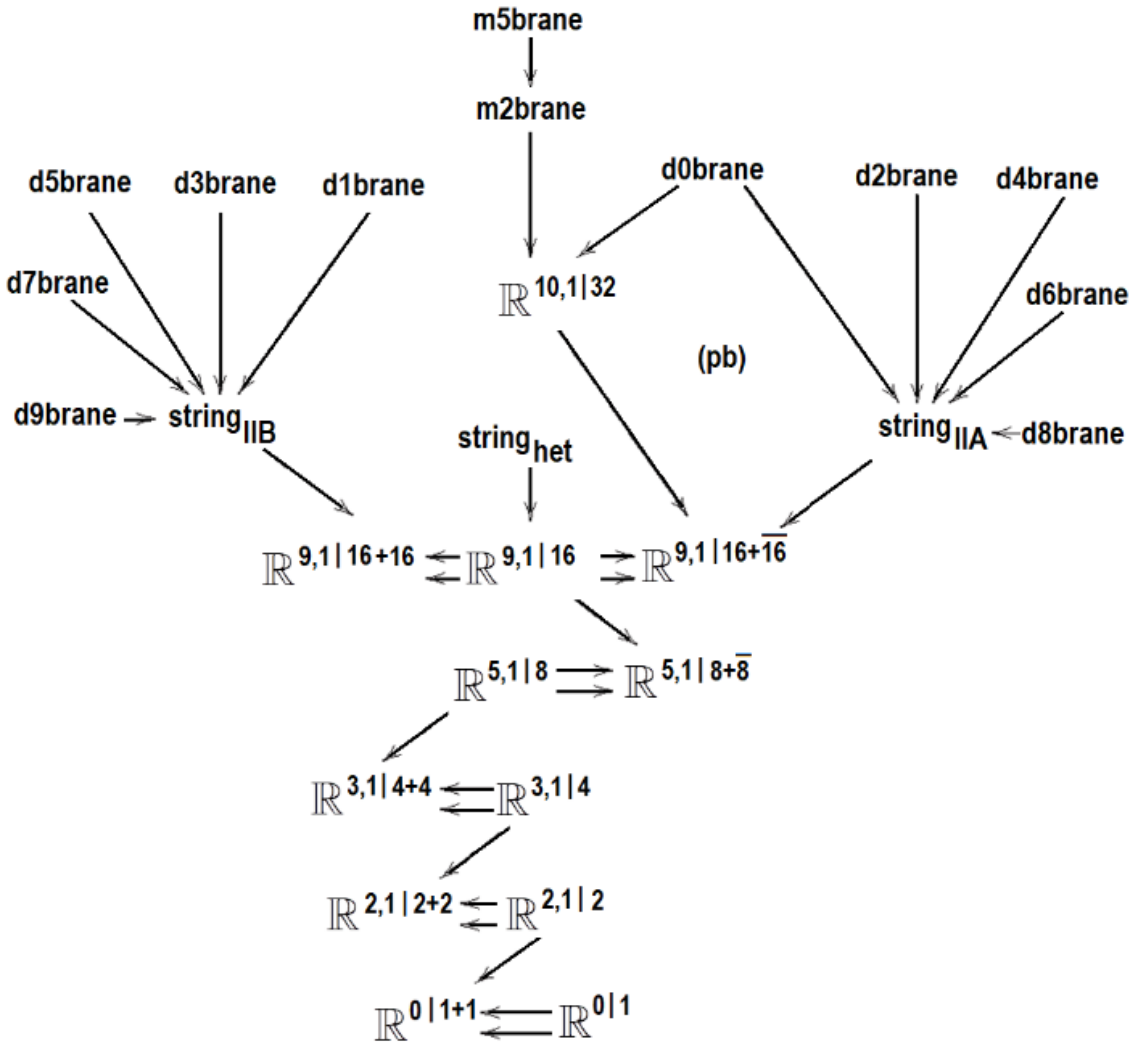

Figure 9. 11D M-theoretic version of the brane bouquet unifying the 5 string theories, Fig. adapted from Huerta [61].

In addition, we must clarify that XD-LSXD M-space is not a SM submanifold of □; r*eal line* Euclidean spacetime of the observer is the submanifold. For centuries before Copernicus, natural science suffered from geocentric cosmology; similarly, now the Terran observer considers itself the center of intelligence rather than a localized distinction in a holographic anthropic multiverse [2]. Logic for this reality is simple – the Einstein brane bouquet unified field is noted as the *mother of all fields* – not the case for classical - quantum mechanical SM limits of virtual observables. CERN clerics claim discovery of XD demonstrates the existence of a multiverse – infinite number of nested Hubble sphere realities beyond the observational limit – each defined by a relative finely-tuned Terran-like fine structure constant to radii of ~13.7 billion light years [3]. Note that while beyond the scope of this paper, as surmised from Fig. 8, dark matter/energy simplistically signifies the gravitational presence of the multiverse.

Because the spacetime KK-like cycle at the XD manifold entails an inherent beat frequency (Sec. 5), resonant interference can be achieved because of the nature of the Dirac polarized covariant vacuum and the inherent Dirac hypertube array within it [4,5]. Figure 9 illustrates a first indicia for conveying this continuous-state cyclic process. Let the two Bloch spheres represent resultant points of an SM line element. Galilean-Lorentz-Poincairé line elements transforming with infinitesimal distance between points contain only usual SM information. With the addition of a KK-like XD brane cyclical topology on the top row of Fig. 10 (represented by a space-antispace mirror symmetric quaternion algebra) topological phase transitions undergo a continuous-state periodic XD reduction to SM 3-space. This process is closed to the 3D observer by the domain wall of the uncertainty principle.

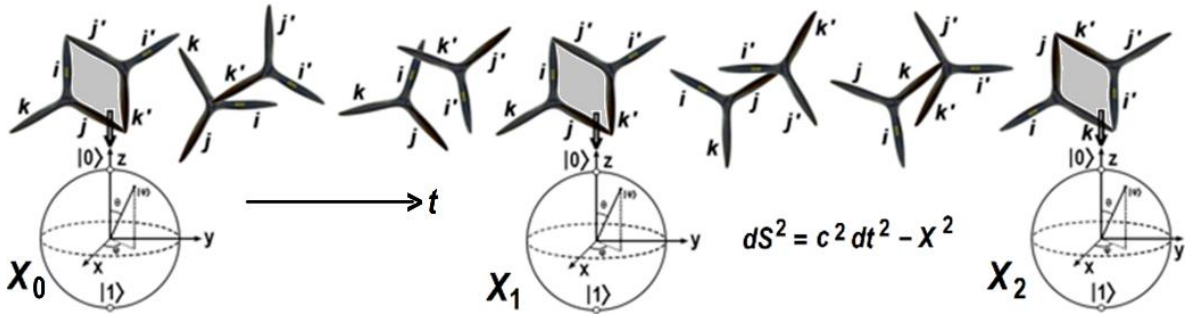

Figure 10. Local-nonlocal XD space-antispace mirror symmetric line element relativistically spinning and evolving in time. a) Top row. Topological phase (depicted by quaternions) of an XD cycle progressing from chaotic to periodic nodes coupling, compactifying by dimensional reduction into resultant (cube faces) 3-space quantum states, depicted in b) Bottom row, as Riemann Bloch spheres, indicating the emergence of local Euclidean reality as a subspace manifold of the XD-LSXD duality brane bulk.

Figure 10 (bottom) illustrates a line element, of semi-classical Riemannian Bloch 2-spheres, X_0, X_1, X_2 as *basement of reality*. At the top, 1st space-antispace mirror symmetric UFM step of quaternion points cycling from 5D QM chaos to topological order as faces of 3-cubes. Also seen is an initial separation of 3-space geodesics into extended KK cyclicality from order to chaos at the semi-quantum limit. The *beat frequency* inherent in this backcloth is experimentally exposed by rf-modulation of the Dirac polarized vacuum when the stochastic background coheres into the face of a cube.

String theory essentially has a single parameter - string tension, T_S, modulated by the string coupling constant (ill determined at present). The lore states simply, all matter is comprised of vibrating strings, but theory remains silent in efforts to construct brane bouquets of resonating strings modeling fermions (Sec. 7). The infinity possible Calabi-Yau configurations, 10^{∞} for finding a single compactification of the 12D bulk producing the 4D SM has remained elusive. A unique vacuum was found applying an alternate derivation of string tension in a continuous-state cycle [2,3,23]. This adapted holographic M-theoretic model, may provide indicia of feasibility; success remains indefinite without another set of UFM transformations beyond the Galilean-Lorentz-Poincairé. At this point in development, we are able to add one significant parameter that turns out to be an essential element in the TBS protocol design (Sec. 5).

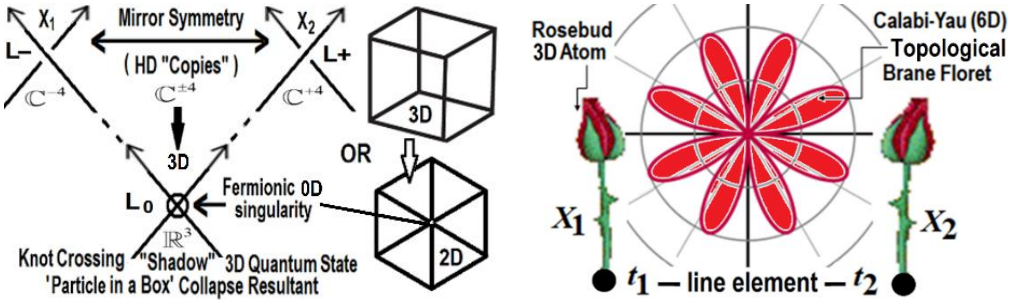

Figure 11. XD-LSXD UFM models of matter. a) L-R over-under diagram of crossing links where arrows show the direction preference. For crossings L_+, L_-, resultants L_0 and $\mathbb{R}^3$ cause changes to the diagram. Elements of braids in an XD complex, $\mathbb{C}^{\pm 4}$ brane topology transform into knot shadows if projected into 3-space, $\mathbb{R}^3$. In terms of space-antispace symmetry, *X* would be a knot shadow, fermion vertex seen in b) with 3-space coordinates *x,y,z*. b) Showing dimensional reduction by a shadow crossing. c) $X_1(t_1)$ and $X_2(t_2)$ are atoms (illustrated as rosebuds) at opposite ends of a line element in Euclidean spacetime.

All atomic matter in 3-space is described as singularities. For de Broglie matter-waves, fields dress 0D fermion singularities. At the fundamental level, we do not know what constitutes a field; by metrical proximity we measure salient features. Similarly, little is known about the fundamental essence of space other than by Einstein's classification of it as *extension* serving mathematical utility. 4D SM matter is termed geometric. An M-theoretic 8D UFM bulk comprises topological phase transitions, with programs to develop topological field theories [5,24,25,49]. Heisenberg potentia is defined as a probability of wave-particle dualities depending on conditions arranged for measurements. The quantum regime is merely a convenient stopping point in the combinatorial hierarchy of reality [2,5,24,25,62-64]. To journey beyond the confines of SM locality and unitarity, barriers of Pauli exclusion and the uncertainty principle, additional processes of reality that include a dynamic periodicity XD-LSXD duality with extended mirror symmetric or putative supersymmetric partners need to be discovered in relation to Dirac MOU hypertubes tessellating spacetime with local and nonlocal parameters.

Einstein proffered, *putting a saddle on a photon, allowed one to circle the universe with no time passing*; he also claimed; by *looking into space far enough, one sees the back of one's head*. The latter (known as the wrap-around universe) has not been excluded by Planck satellite data [65-67] and suggests a multiply-connected multiverse cosmology. These ideas relate to EPR-like nonlocal instantaneity, whereby time dimensions can be transmuted to dimensions of topologically charged UFM phase transition energy (mediator of the unified field) [6,24] in a $s \to t \to e$ (space-time-energy Lorentz boost dimensional transformations).

The bottom cross of Fig. 11a shows a 3-space *knot shadow* fermionic singularity, L_0 by the collapse of XD topological mirror symmetry. The existence of HD is hidden by the uncertainty principle by localization of knot crossover links. The rosebud (Fig. 11c) is a simple illustration of an *x* coordinate; but its mirror symmetric representation is proposed to take the form of a space-

antispace quaternion, $\pm i, j, k$ which is comprised of six buds blooming continually as a Calabi-Yau manifold that cyclically compactifies into 3-space knot crossover link shadows. A shadow is created when a crossover link is projected onto a plane. The cyclical removal (by compactification to 3-space) of some UFM parameters allows this to happen. Rotations of the projection angle reveals this is a one-to-one relation except at crossovers, where knot *shadows* cross themselves transversely once. Similarly, in 4-space, a knotted surface corresponds to surfaces immersed in 3-space.

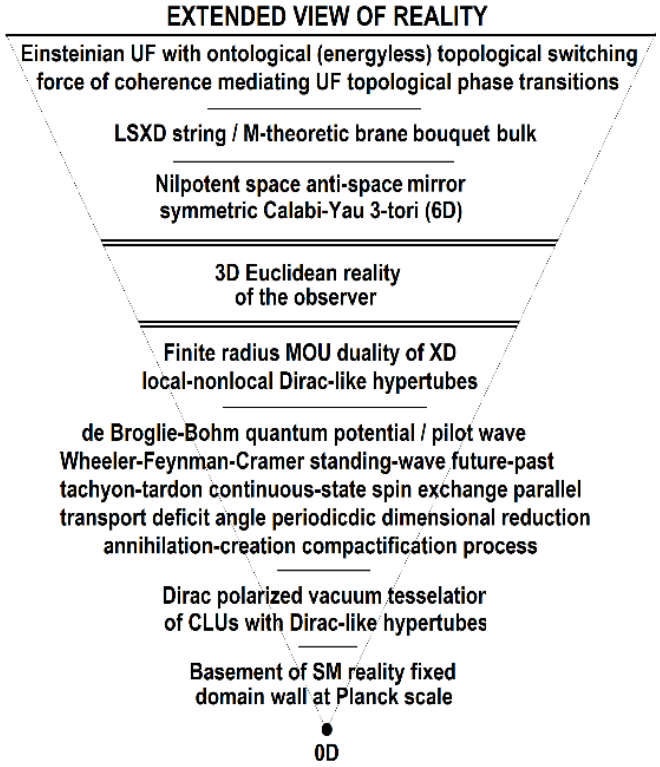

Figure 12. Extended top-down view of reality showing structural phenomenology at various levels of the hierarchy.

Figure 11b shows a knot cross shadow projected as a step into XD, shown as knotted trefoils. We are investigating how Dirac spinors are topologically like trefoils in HD; obscured from view, by the quantum principle of uncertainty.

This section tries to clarify new dynamics of the brane-world bouquet bulk, different from current thinking in the string theory community, saliently because compactification is considered a *continuous-state* cycle. In passing, the reason is anthropic. Einstein claimed that UFM will provide an understanding of self-organized living systems (SOLS).

It is now essential not to think of matter as OD fermion point particles rooted in a (3)4D (+,+,+,-) manifold, which is only the *tip of the iceberg*. SM Matter must now be envisioned as a dynamic compactification cycle of perhaps a dodecahedral wrap around AdS-dS 6D $D\bar{D}$-brane manifold of mirror or supersymmetric Calabi-Yau florets piloted by a UFM-like de Broglie-Bohm super potential driving topological-phase transitions. This (addition to) modification of matter,

incorporates pertinent parameters currently forming the broad array of String / M-theoretic parameters; like those describing T-Duality $D\bar{D}$-brane mirror symmetry, which as well-known, T-duality interrelates two theories with different spacetime geometries, allowing correspondence with common notions of classical atomic geometry, quantum field theory in addition to our reworked UFM formulation of T-duality.

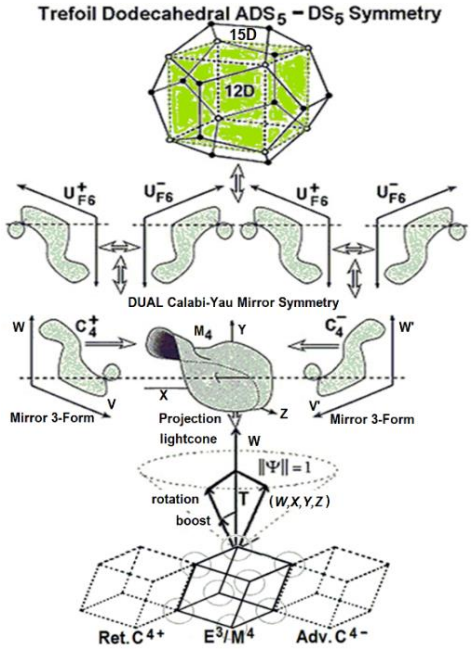

Figure 13. Axiomatic completion of Fig. 10 adding 8 XD to 12 LSXD (embedded in 15D) for a complete extension of added parameters forming a relativistic HD *quantum* state and instantaneous LSXD continuous-state duality of UFM cosmology representing sufficient parameters for supervening uncertainty. a) Bottom row. Replacing the Bloch 2-sphere model (Fig. 10) by a Cramer advanced-retarded future-past 3-cube resultant.

Note: Embedding 12D UFM in 15D represents a gateway to multiverse cosmology leading to technologies like instantaneous subspace communication.

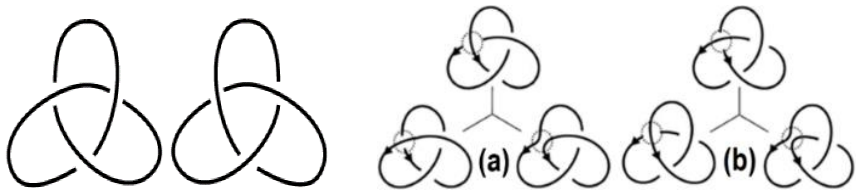

Figure 14. a) L & R-handed trefoil crossings as mirror images. b) Raising and lowering of trefoil over and under crossings allows various topological phase transitions that may be required in the duality of brane-world matter local-nonlocal interactions.

Topological phase transitions are abundant as illustrated by numerous parameters describing the operation of the UFM transformation group. Addressing these elements in an introductory manner in following sections to relate primarily an overview of requirements hopefully seen of

interest for further developments enabling vacuum accessibility.

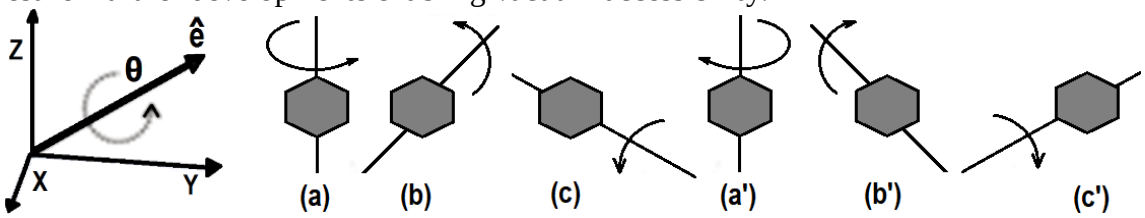

Figure 15. Pertaining to Fig, 14a, during parallel transport crossover links may be unknotted by the spin exchange deficit angle dimensional reduction parameters allowing rotations to be added during transitions in topological phase.

Resultant components of quantum Field Theory are replaced by elements of Wheeler-Feynman Cramer-like Transactions that are piloted by extensions of de Broglie-Bohm causality to a UFM-like Super-implicate order. The Local-Nonlocal XD-LSXD KK-like cycle is driven by a UFM force of coherence mediated by topologically switched phase transitions described by a rudimentary, at this stage of development, Ontological-Phase Topological Field Theory (OPTFT) [6] designed to act on the fundamental semi-quantum fundamental Cellular Least Units (CLU), tessellating the Dirac space/spacetime polarized vacuum [29-33,68].

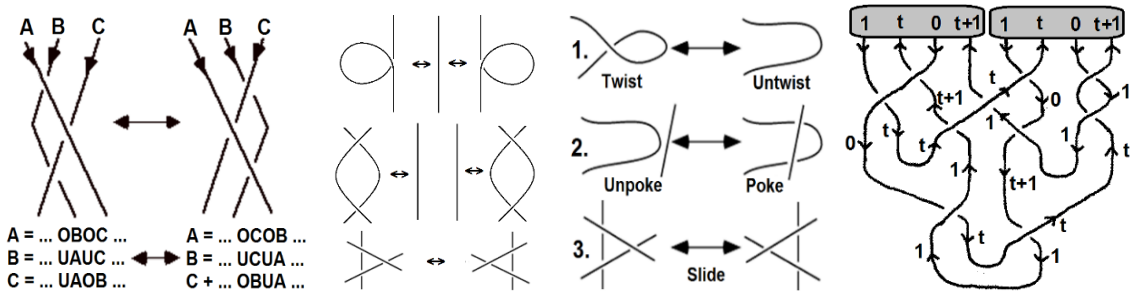

Figure 16. a,b,c) The numerous Reidemeister moves are a useful study because they should apply to parallel transport during the process of continuous-state dimensional reduction for XD-LSXD duality cycles. d) A spacetime roll spun knot.

Currently, elementary constituents of matter are considered as 0D to 3D quantum *particles-in-a-box* (PIB). We wish to elevate this from SM 3-space to a UFM 12-space, where the mirror image of the mirror image is a causally free copy of the local quantum PIB. We postulate the 12-space topological brane configuration of matter is embedded in a 15D (Fig. 15d top) dodecahedral AdS-DS portion of multiverse space. This is also illustrated in Fig. 11c if the rosebud topology was doubled (dual). As stated above, there is preliminary Planck satellite data supporting this theory [65-67]. The first step in representing matter in this manner is three oriented rosebuds X,Y,Z o consider three oriented rosebuds X,Y,Z in a mirror symmetric space-antispace configuration in quaternion notion, $Y = i, j, k$ and $Z = -i, -j, -k$ undergoing Dirac spinor double antispace rotation through 720^{o} instead of the usual 360^{o} required to return to the original position in Euclidean space. For topological phase transitions, it is proposed the Dirac spinor takes the form of three L-R mirror symmetric trefoil knots (Fig. 16b) giving more degrees of freedom to the cyclic XD-LSXD duality of UFM space.

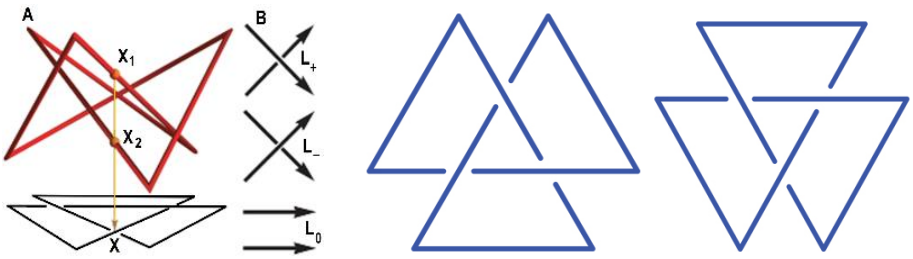

Figure 17. a) Knot diagram of the Conway skein triple with the 2D shadow representing topological reduction form XD space, and b) crossover links. Adapted from [69]. c,d) Visualization of L-R trefoils in triangular form for ease of visualizing relation of overlap to hexagonal CLU geometry Dirac vacuum micromagnetics.

In Fig. 17a, A represents a trefoil knot (red) and 2D projection $X_1 - X_2 \downarrow X$ (black). Similarly, the cross overs in B are projected to the plane. In c,d), the oriented diagrams the L_+, L_-, L_0 look like mirror symmetric Conway skein triples of oriented crossings. The sign of an oriented crossing is defined by following the under crossing in the direction of the orientation; if the over crossing goes L to R, the oriented sign is $+1$, otherwise it is -1 [69].

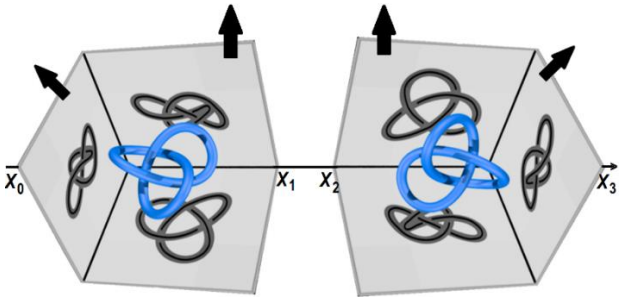

Figure 18. 3 Projections of trefoil knot; black arrow point toward XD-LSXD space with X coordinates representing a Euclidean line element with the trefoils meant to be HD dynamics hidden by the uncertainty principle in the infinitesimal distance between local temporal and interaction nonlocal instantaneous points. Adapted from [70].

It is commonly believed that the Dirac $360^o - 720^o$ spinor rotation can be considered as a Klein bottle comprised of two Mobius strips. We suggest the Dirac spinor has trefoil crossover topology within a Dirac MOU hypertube not yet observed because of the uncertainty principle. The equations for trefoils, ***T*** are $r^3 = 2A\cos(3\theta)$ and $\left(x^2 + y^2\right)^3 = A\left(2x^3 - 6xy^2\right)$ in polar form and Cartesian coordinates respectively. Trefoils have been described as sextic curves having properties, like a genus-1 Platonic surface having 18 equilateral triangle faces able to be exchanged or rotated as icosahedron faces which is the dual of the dodecahedron [71].

Elliptic Dixon functions, formed from $x^3 + y^3 - 3axy = 1$ curves, and trefoils perfectly fit. The Fermat cubic, $x^3 + y^3 = 1$, is interesting because when $a = 0$, Dixon functions produce simple hexagonal symmetry; having the same projective symmetry group, ***T.*** Notably, a Dixon sine, sm

z maps regular hexagons onto Riemann spheres, with a hexagon interior conformally mapped onto the complement of the three rays joining ∞ to a cube root of unity. By this, arc length parameterization of trefoil structure forms a genus-one Platonic surface, having 18 equilateral-triangular faces that can arbitrarily be exchanged or rotated, the same as faces of an icosahedron [71]. The Dixon sine equation, $\mathrm{sm}\, z = \tan\frac{p}{2}e^{i\lambda}$ associates the hexagon point by complex coordinate $z = x + iy$ with latitude sphere point $\pi/2 - p$ and longitude λ. The function $w = \mathrm{sm}\, z$ defines real *z* by $z = \int_0^w dx \Big/ \left(1 - x^3\right)^{2/3}$, and $\mathrm{cm}\, z$ by $\mathrm{sm}^3 z + \mathrm{cm}\, z = 1$. Thus, sm (0) = 0, cm (0) -1, and $\frac{d}{dz}\mathrm{sm}\, z = \mathrm{cm}^2 z$, $\frac{d}{dz}\mathrm{cm}\, z = \mathrm{sm}^2 z$. Caley was instrumental in formalizing sm *z* and $\mathrm{cm}\, z$ as elliptic functions in 1896. Because sm *z* and cm *z* form periods $p_1 = 3K$ and $p_2 = 3\omega K$, where $\omega = -1 + i\sqrt{3}/2$ is a cube root of unity: $\mathrm{sm}\left(z + 3\omega^j K\right) = \mathrm{sm}\, z$, $\mathrm{cm}\left(z + 3\omega^j K\right) = \mathrm{cm}\, z$, $j = 0,1,2$. With elliptic functions, the values for sm z and cm z, $z \in \square$, by tiling a plane from copies of a *period parallelogram P* with edges matching the period pairs. Corresponding triangulations of *P* have 18 equilateral triangles, defining rotational and quasiperiodic translational symmetries [71].

These sm z, cm z trefoil parameters are entry points to apply vacuum micromagnetics. Placing a dipole near a conducting wall causes it to interact with its mirror image. This Casimir–Polder (CP) effect, produces interaction potentials between an atomic ground state and a Cavity Quantum Electrodynamic (CQED) mirror symmetry valid for all separations, *z* between an atom and a mirror resulting from alteration of vacuum fluctuations by the mirror. Experimental evidence of retardation terms in the atom-wall problem, agree with CP predictions. Extension to an M-theoretic UFM approach enables Static-Dynamic (S-D) Casimir Effect cyclical coincidence with topological charge in KK-like T-duality brane transition dynamics. This interaction occurs by ontologically (energyless) transfer of information, not quantal as in the phenomenology of field theory [6].

4.1 Raw Speculation on Hidden Aspects of the Nature of Reality - Observer

Returning to the notion of a simplistic nilpotent Wheeler-Dewitt wavefunction of the universe, $\hat{H}|\Psi\rangle = 0$ [27,28], abandoning theoretical rigor until later to philosophically discuss what natural science might be like after the imminent paradigm shift to a post SM M-theoretic Einsteinian unified field theory in terms of a UFM reality wave for a nilpotent observer. What lurks behind the domain wall of uncertainty? Current tools of observation tell us there is more matter in the universe than antimatter; let's provide indicia that they are equal by assuming that the wave structure of UFM reality takes a sine waveform simplistically illustrated in Fig. 19. If reality is truly holographic, coherent control of the unified field may project a reality wave through a 2-sphere creating a 3D hologram temporally evolving. Rauscher has shown that spatial dimensions may undergo a Lorentz boost transform into a temporal dimension [3]. A 2nd boost can topologically transform the complex temporal boost into a Bohm super-potential de Broglie pilot-wave which in UFM parlance would mediate the unified field force of coherence by a new nonlocal holonomic Realiton particle that subtracts the antimatter portion from view by the 3-space observer where not just quantum particles are nilpotent but also the arrow of time and all

reality itself. The SM shattering Muon g-2 experiment may lead to this discovery. More speculation in terms of missing L-R handed leptons below.

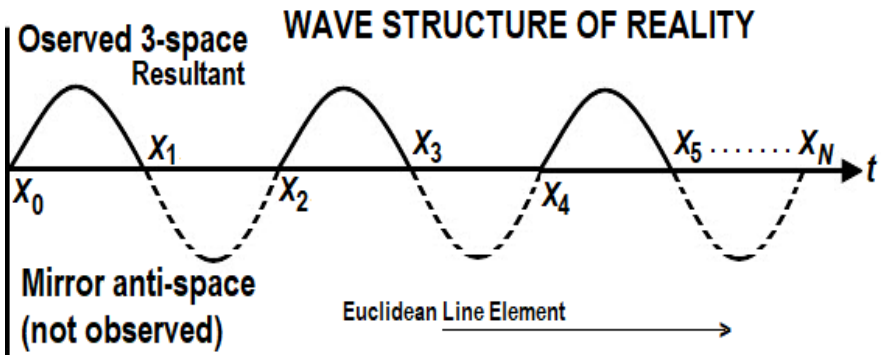

Figure 19. Nilpotent mirror symmetric wave structure proposing reality is like a sine wave evolving in time, where the negative (cosine) half of the reality wave is annihilated from view by destructive interference of KK-like cyclicality as an inherent aspect of the dynamics of the Uncertainty Principle disallowing XD observation for an anthropic 3-space observer.

Here looms indicia; Quigg created a theoretical representation of the underlying structure of SM leptons and quarks he calls the double simplex form, since L-handed and R-handed particles become simplexes (antimatter forms a separate, inverted double simplex) [72]. Protons and neutrons are formed by two types of quarks inside atomic nuclei; up quarks, possessing a 2/3 unit of electric charge, and a down quark of electric charge −1/3. Up and down quarks are L-handed or R-handed depending on if they spin clockwise or counterclockwise in terms of the direction of motion. For the Weak Charge, L-handed up and down quarks may transform into each other, by weak force interactions if quarks exchange a W boson, with electric charge either +1 or −1.

In support of Fig. 20, R-handed W bosons are *not found in nature*, meaning R-handed up and down quarks cannot emit or absorb W bosons, nor do they transform into one another. We claim a different interpretation of the view that XD must be Planck scale since they are invisible. Alternatively, as suggested in Fig. 19, the SM 3-space observer only sees half of the reality wave, mediated by – let's call it a holonomic *Realiton*, which by nature of the unified field would transfer information/energy (topological charge) ontologically (energyless topological phase transition) [6]. The holonomic basis of the Realiton is defined as a holonomy with an Einsteinian UF, with reality of the observer a differentiable submanifold $\Re_M$, a set of basis fields, $\{e_1, ..., e_n\}$ defined for every local point P of a region of the UF holonom $e_\alpha = \lim_{\delta x^\alpha \to 0} \delta s / \delta x^\alpha$, where δs is an infinitesimal displacement line element vector between coordinate points P and Q with separation δx^α along a geodesic curve x^α of the holonomic anthropic realiton manifold. If XD are systematically annihilated from observation by an energyless ontological-phase interaction of the unified field, although momentarily extremely radical; it is logical to assume that time and reality itself (observer) is also nilpotent [6,23-25,30-33].

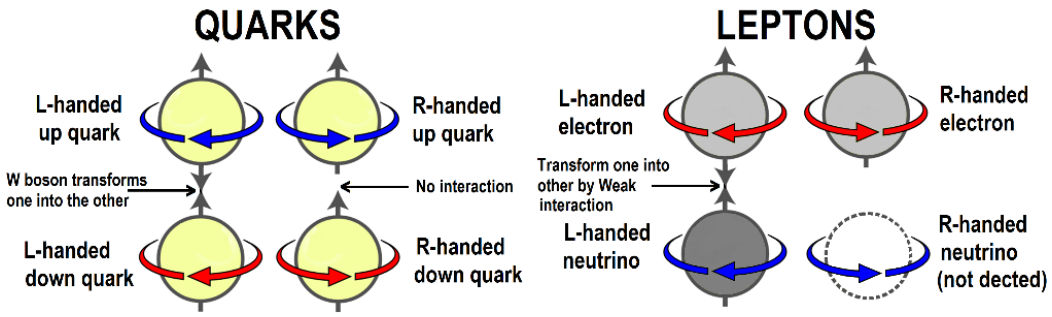

Figure 20. Missing interactions (blocked from observation by Copenhagen Uncertainty Principle) from SM particle physics tools of observation, postulating only half of reality is observed, suggesting reality is like a sinusoidal wave and that in a multiverse reality there is equal nilpotent parts of matter and antimatter.

Quarks also possess a Strong Force charge called color with red, green or blue color charges binding different colored quarks into particle composites like protons and colorless neutrons which have no net color charge. Quarks transform their color by gluon absorption or emission, that mediate the strong force. Since gluons are colored, they interact constantly with each another and with quarks.

Considering leptons, other matter particles coming in two types, the electron, with electric charge −1, and electrically neutral neutrinos. Similar to L-handed up and down quarks, L-handed electrons and neutrinos transform into one another by weak interactions. Nevertheless, again in support of a reality wave, R-handed neutrinos have not yet been observed [72,73]. However, quark-lepton symmetry (Fig.20) hints they may be…

5. Synchronization Backbone – Inherent XD-LSXD Periodicity

Since tests of the uncertainty principle, $\Delta X \cdot \Delta \rho_X \geq \hbar$; $\Delta E \cdot \Delta t \geq \hbar$ are sacrosanct and myriad, one might pertinently ask why should, in many respects, a straightforward simple experiment be able to surmount the uncertainty principle? Firstly, nature already does this routinely behind the veil of uncertainty. But it becomes scientifically accessible because of the inherent existence of what Feynman proposed as a synchronization backbone (originally as a requirement for Quantum Computing) [59,60], getting us halfway for free. During standing-wave future-past Cramer transactions [21] the polarized Dirac vacuum CQED electron hypertube opens and closes cyclically, making it relatively easy for a resonant signal to return, but traversing the XD MOU fully to access LSXD is suspected to be more difficult. An incursive harmonic oscillator must be precisely linked/coupled to a resonating mirror symmetric Bessel function so each destructive node is precisely linked to the tandem levels of the synchronization backbone hierarchy (Table 1).

The number of nodes has not yet been rigorously determined because supersymmetry / mirror symmetry is not sufficiently understood in terms of topological phase transitions. Ultimately, they will have to be determined experimentally one MOU hyperspherical cavity at a time. We do

know theoretically that at 12D the XD-LSXD cycle fully commutes making the *final* periodic copy of the 3-space CQED *particle-in-a-box* is causally free. We also suspect by applying conformal scale-invariance, the MOU structure is not simply connected. This is discerned because cosmology suggests we live in a dodecahedral wraparound universe [65-67]. This additionally suggests the need for an OPTFT beyond confines of quantum locality and unitarity in order to provide utility for the UFM force of coherence [6,25,49].

Mathemagicians are capable of formulating an equation to describe anything, whether it relates to natural science or not; this is the absolute nature of pure mathematics. However, the algebras of Quaternions and Octonions seem to have an inherent ability to describe reality built into them. In that respect, we have found, in preliminary form, a quaternion model that algebraically reproduces the space-antispace face of the periodic resultant cube as depicted in Fig. 10 [80,81]. Our presumption is completion of that program will be an aid in embedding a specific Bessel function with precision nodes of a Dubois incursive oscillator [82-83].

The Dirac concept of a covariant polarized vacuum [74,75] is generally ignored by the physics community as it is believed to conflict with Gauge theory, which is not true because gauge theories are approximations with plenty of room for additional physics. Worse, the Dirac vacuum is troublesome because it is imbibed with extended electromagnetic theory [76-79] bringing in a longitudinal $B^{(3)}$ em-field component, a can of worms filled with photon mass, m_γ anisotropy [2], allowing so-called *tired light* hypotheses. However, it is unlikely there would be Casimir, Zeeman, Sagnac or Aharonov-Bohm effects without it! And as developed here, a Synchronization Backbone with XD-LSXD cyclic periodicity demands it.

Dirac believed the vacuum is made of infinite virtual electrons totally filling the negative portion of the spectrum of a free Dirac operator D^0. If a resonant external field is present, the virtual particles react causing the vacuum to become polarized by;

$$D^0 = -i\sum_{k=1}^{3}\alpha_k\partial_k + \beta := -i\alpha\cdot\nabla + \beta\,, \tag{8}$$

where $\alpha = (\alpha_1, \alpha_2, \alpha_3)$ and $\beta = \begin{pmatrix} I_2 & 0 \\ 0 & -I_2 \end{pmatrix}$, $\alpha_k = \begin{pmatrix} 0 & \sigma_k \\ \sigma_k & 0 \end{pmatrix}$, with $\sigma_2 = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$, and $\sigma_3 = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ [75].

Developing Feynman's proposal of a synchronization backbone [59,60] is likely the most important construct in this paper. Deriving the proper perspective from the hint given by Feynman on how a UQC might operate - by the imperative of the synchronization backbone. Researchers failed in attempts to create such; seemingly because the modeling was bi-local and at best with a semi-classical line element. QCs must operate simultaneously on the quantum superposition of inputs. While definitive, in practice this has not worked beyond a few qubits because of decoherence time. If reality itself is considered to be a form of QC at the level of a Dirac covariant polarized vacuum, we discover that Feynman's proposed synchronization

backbone is an intrinsic property for processing the XD – LSXD semi-quantum UFM duality. Feynman illustrated his synchronization backbone technique with a 1D 2-body cellular automata with the simple Hamiltonian, $\hat{H}1\text{DXY}$. For a periodic system the Hamiltonian took the form, $\hat{H} \equiv \hat{H}_{\text{SYNCH}} = \hat{H}1\text{DXY}$ [59,60].

In this continuous-state parallel transport dimensional reduction compactification hierarchy wherein the space of the observer is a sub-manifold, reality cycles from a dual mirror symmetric Calabi-Yau 3-Tori (6D) annihilated by subtractive interferometry from view of the observer. This KK cyclic hierarchy has additional doublings to 12 D. This is required because topological elements of matter in this 12 D regime are causally free of the 3-space quantum particle-in-a-box (qubit); meaning the image of the mirror image of the mirror image is ontologically (causally) separated supervening uncertainty in the UF panoply.

(*Continued on Part II*)