

# Experimental Supersymmetry

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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 no longer be considered the *basement of reality*; meaning, Locality and Unitarity – the fundamentals 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.

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

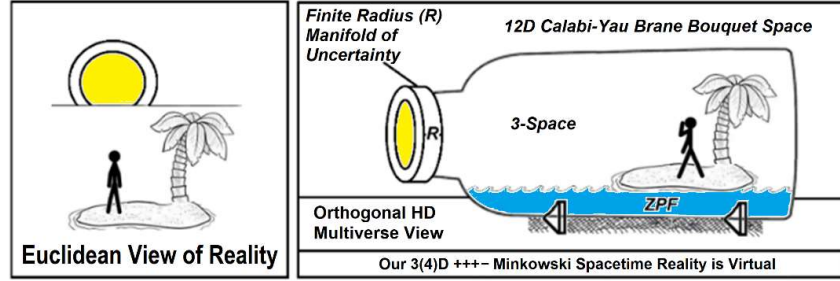
**Keywords:** Dirac hypertube; Dirac polarized vacuum; M-theory; manifold of uncertainty; nonlocality; semi-quantum limit; supersymmetry; tight bound states, unified field theory

## 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 inside this bulk which phenomenologically entails a Kaluza-Klein-like cyclic 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]. 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 sides of the Cellular Least Units (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  $R_\infty$  is the Rydeberg constant,  $n \in \{1, 2, 3, \dots\}$  and at  $n=1$ , an electron could not be 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 low energy tabletop brane topological cross section (sans supercollider particle sprays) experimental protocols able to surmount the finite domain wall manifold of quantum uncertainty.



**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 - suggesting indicia of additional physics [10,13]. Corben [14] noticed point charge motion in a magnetic dipole field at rest with orbits of nuclear dimensions highly relativistic. Additional studies by [10-13,15] illustrated by Hamiltonian (1) extended the Pauli equation to a 2-body system:

$$H = \frac{1}{2m_1} (\vec{P}_1 - e_1 \vec{A}(\vec{r}_1))^2 + \frac{1}{2m_2} (\vec{P}_2 - e_2 \vec{A}(\vec{r}_2))^2 + \frac{1}{4\pi\epsilon_0} \frac{e_1 e_2}{|\vec{r}_1 - \vec{r}_2|} + V_{dd} \quad (1)$$

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:

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

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

$$H = \frac{1}{2m_1} p^2 - \left( \frac{\mu_0}{4\pi} \right) \frac{e_1 e_2}{m_1 m_2} \frac{\vec{S}\vec{L}}{r^3} + \left( \frac{\mu_0}{4\pi} \right)^2 \frac{e_1^2 e_2^2 \hbar^2}{4m_1 m_2 m} \frac{1}{r^4} + \frac{1}{4\pi\epsilon_0} \frac{e_1 e_2}{r} - \left( \frac{\mu_0}{4\pi} \right) \frac{e_1 e_2}{m_1 m_2} \vec{s}_1 \vec{s}_2 \delta(\vec{r}) + \left( \frac{\mu_0}{4\pi} \right) \frac{e_1 e_2}{m_1 m_2} \left[ \frac{\vec{s}_1 \vec{s}_2}{r^3} - \frac{3(\vec{s}_1 \vec{r}) \cdot (\vec{s}_2 \vec{r})}{r^5} \right], \quad (3)$$

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,  $m^* = m + (E/8c^2)$  [10-13].

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

$$H = \frac{1}{2m^*} p^2 + \frac{1}{4\pi\epsilon_0} \frac{e_1 e_2}{r} - \left( \frac{\mu_0}{4\pi} \right) \frac{e_1 e_2}{8(m^*)^2} \frac{\vec{J}^2 - \vec{L}^2 - 2\vec{S}^2}{r^3} + \left( \frac{\mu_0}{4\pi} \right)^2 \frac{e_1^2 e_2^2 \hbar^2}{16(m^*)^3} \frac{1}{r^4} - \left( \frac{\mu_0}{4\pi} \right) \frac{4\pi e_1 e_2}{8(m^*)^3} \left( \vec{S}^2 - \frac{3}{2} \hbar^2 \right) \delta(\vec{r}) - \left( \frac{\mu_0}{4\pi} \right) \frac{3e_1 e_2 \hbar^2}{8(m^*)^2} \frac{Q}{r^3} \quad (4)$$

with operator  $Q = (1/\hbar^2) \cdot \left( (\vec{S}\vec{r})^2 / r^2 \right)$  [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:

$$\frac{d^2 u}{dr^2} - \left[ \frac{2m^*}{\hbar^2} \frac{1}{4\pi\epsilon_0} \frac{e_1 e_2}{r} + \frac{2}{r^2} + \left( \frac{\mu_0}{4\pi} \right) \frac{e_1 e_2}{4(m^*)} \frac{6}{r^3} + \left( \frac{\mu_0}{4\pi} \right)^2 \frac{e_1^2 e_2^2}{8(m^*)^2} \frac{1}{r^4} - \left( \frac{\mu_0}{4\pi} \right) \frac{e_1^2 e_2^2}{8(m^*)^2} \frac{\delta(r)}{r^2} - \frac{2m^* E}{\hbar^2} \right] \mu(r) = 0 \quad (5)$$

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

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

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

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 additional physics is suggested occur. More details on Vigier's proposal for TBS are noted in [10-15].

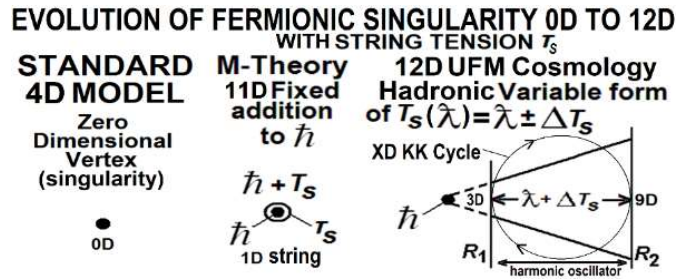
Implementing TBS experimental technology requires significant new concepts and an extension of the basis of fundamental reality. Gauge theory conditions, the foundation for most contemporary physics, are approximate, hinting that new theory is required to complete the SM. Numerous Quantum Electro Dynamic (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  $w(1s2p^1P_1 \rightarrow 1s^2S_0)$  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  $(1s2p^1P_1 \rightarrow 1s^2S_0)$  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 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 mathematics of the Schrödinger equation or measurement.

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) cyclicity 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.

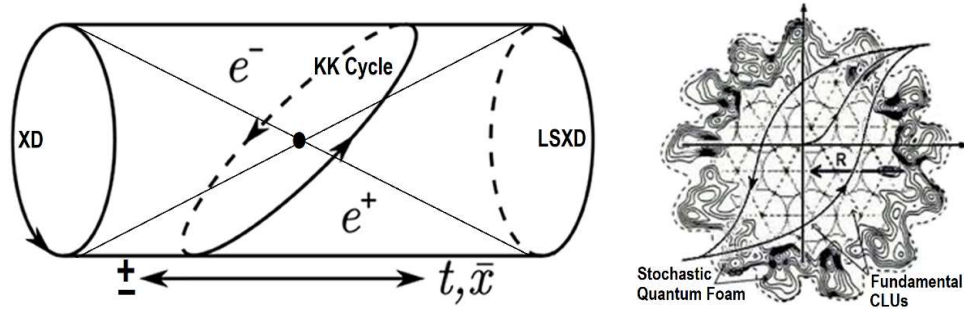


**Figure 2.** a) Usual 3D representation of a fermion as a fundamental physical object, a 0D singularity. b) 1D object of string theory, with fixed length string tension  $T_s$  added to the Planck scale,  $\hbar + T_s$ . c) M-theoretic / UFM form utilizing original hadronic string theory having variable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

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 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 hypertube), 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. b) End view with polarized vacuum tessellated with CLUs with a hysteresis loop suggesting an applied resonance oscillator may open or close the hypertube.

Most accept by quantum theory and measurement, that if XD exist, since they are invisible, they must be Planck scale. But other interpretations exist, such as subtractive interferometry between our 3-brane cycle in time, 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 the domain Planck-scale wall of the uncertainty principle allowing the range of collapse to extend possibly, 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  $T_s = \tilde{\lambda} + \Delta T_0$  with KK cyclicity provides 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 in the uncertainty principle. In contrast, our proposed experiment, if successful, promises unfettered low energy complete access to a 3<sup>rd</sup> UFM regime of reality [2-7].

### 3. Challenge of Dimensionality – Only Resolved Experimentally

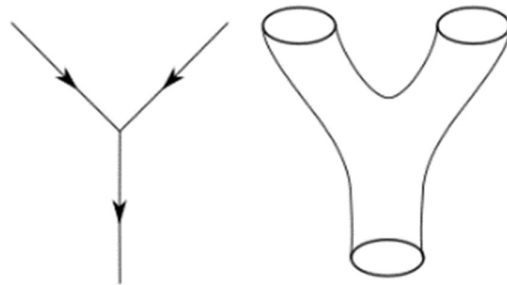
*“In three dimensions there is not enough room to put all the laws of physics.” – Michio Kaku*

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 ( $M = X \times G$ ) 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].

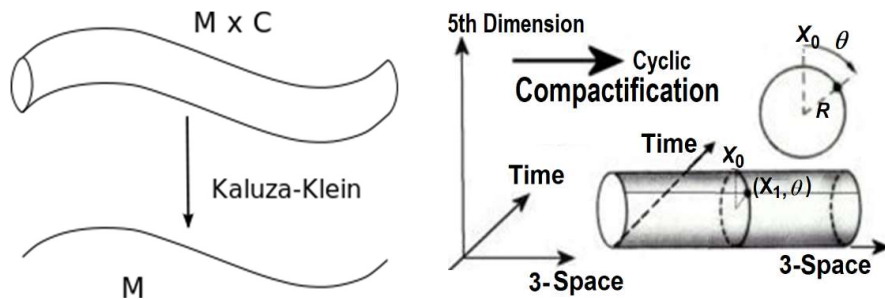
XD can be modeled by two special procedures: 1) Dimensions are characterized differently in duality; 2) Dimensions are fundamentally similar for anti-commutativity [22]. A quaternion-octonion Clifford algebra suggesting operational parameters relevant to protocol strategy is under development [34]. Instead 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].

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.



**Figure 4.** Quantum interactions: a) Standard Model Fermionic 0D point particle world line. b) M-theoretic world sheet with 1D string; extended to a  $M_{12} = M_4 \times \mathbb{C}_8$  brane topological model with  $\mathbb{C}_8 = \pm\mathbb{C}_4$  a form of mirrosymmetric KK cyclicity.

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].



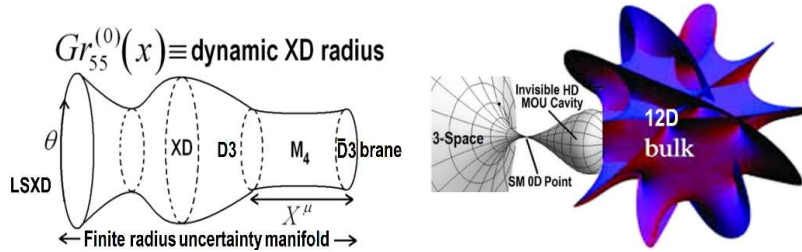
**Figure 5.** a)  $M \times C$  (KK space) is compactified over the set  $C$ ; KK decomposition induces a field theory over  $M$ . The tangent bundle of  $M$  ( $M = X \times G$ ) defined by the YM connection is orthogonal with respect to a KK metric. b) The inherent cyclicity of KK compactification 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 here: A route to unification started in 1919, however, KK theory was not completed until the 1940's. In 1921 Kaluza developed an invariant 5D line element,  $ds^2 \equiv \tilde{g}_{ab} dx^a dx^b = g_{\mu\nu} dx^\mu dx^\nu + \phi^2 (A_\nu dx^\nu + dx^5)^2$  where  $\tilde{g}_{ab}$  is the 5D metric and  $g_{\mu\nu}$  the 4D spacetime metric;  $\phi$  is the associated scalar field at a 5<sup>th</sup> 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  $\ell$ . 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,  $\ell = hc\sqrt{2\kappa}/\mathcal{E} = .08 \times 10^{-30}$  cm, with  $\kappa$  the Einstein gravitational constant and  $\mathcal{E}$  electric charge [46]. We have already claimed KK or M-theoretic XD appear Planck-scale because of the mechanism of the uncertainty principle.

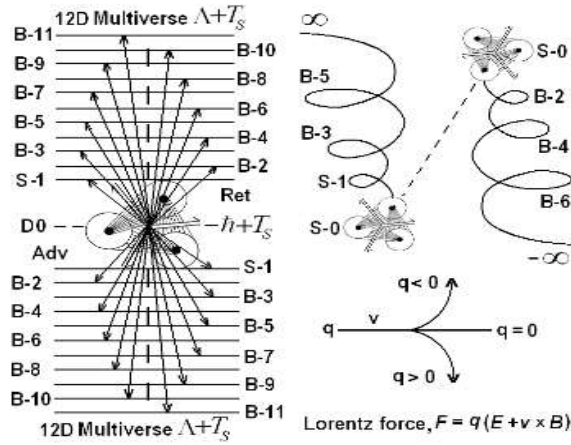
The possibility of supersymmetry in other dimensions occurs because spinor properties change radically with dimensionality. Spinor size is  $\sim 2^{d/2}$  or  $2^{(d-1)/2}$ , for example, in  $d$  dimensions. If maximum supersymmetry is 32; the largest number of dimensions for existence of a supersymmetric 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,  $M^4 \times S^7 = 11D$ . 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.  $X^\mu$  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  $\partial_5 Gr_{MN}^0(x) \rightarrow 0$  for XD fluctuations  $ds^2 \ni Gr_{55} (dx^5)^2 = Gr_{55} R^2 d\theta^2 \Rightarrow Gr_{55}^{(0)}(x) \equiv$  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-Poincaré 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.

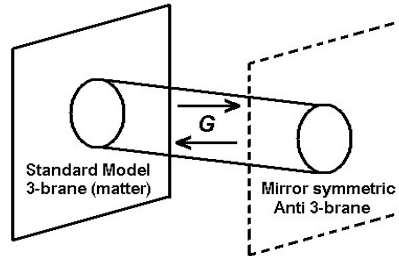
Because of the numerous unresolved attempts at finding rigorous realistic XD model building one is justified in claiming the issue can only be resolved by experiment. Four putative empirical search avenues for additional dimensions (XD) are concurrently being explored:

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 is to be suggestive of 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 predict 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 an incursive oscillator beat frequency resonance [10-12].



**Figure 8.** D-brane model of 4D SM on a 3-brane with  $G$  in 10D able to pass through the HD bulk by mirror symmetric brane-antibrane topological phase interactions.

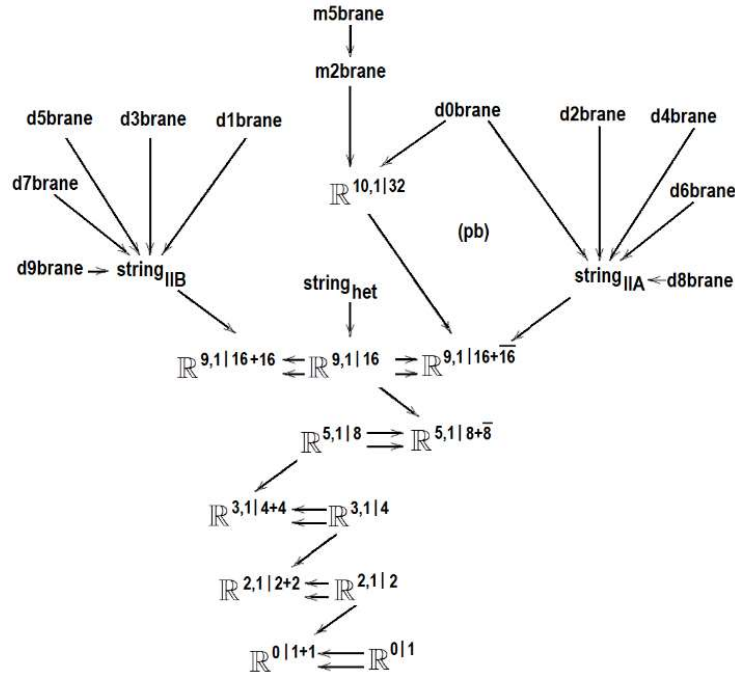
Since quantum mechanics cannot be considered the so-called basement of reality, Yang-Mills Kaluza-Klein equivalence is provided as an empirical path extending the standard model of particle physics to include supersymmetry [30]. Feynman proposed a synchronization backbone; we implement this concept by 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-brane wormhole and Bohm's superimplicate order. The key element is extension of Vigier TBS modeling for the hydrogen atom. Positive results detect 2 to 5 additional spectral lines in hydrogen below the lowest Bohr orbit (TBS) which can be precisely predicted utilizing the 1895 equation for hyperspherical volumes cavities for new lines in 4D, 5D and 6D XD.

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,  $|F_c| = k_e (|q_1, q_2|/r^2)$ , 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 physics beyond the SM.

#### 4. What is Matter? - An Evolutionary Step

Matter is primarily known as observable extension, duration and particle field interactions occupying the 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

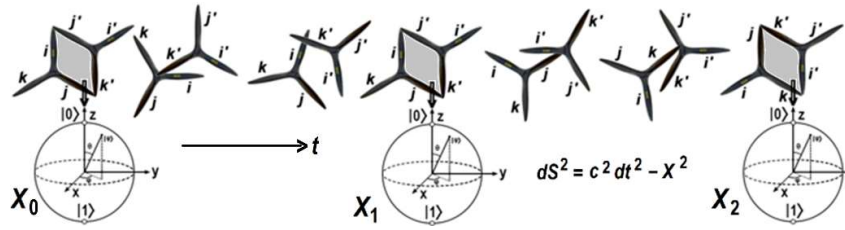
thinking in string / M-theory which seeks a single unique XD compactification to SM spacetime. In line with KK cyclicity, we introduce a periodic continuous-state compactification process (Fig. 7); essential because the local-temporal 3(4D)+++− observer subspace manifold, must make correspondence to 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 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 M-space is not a SM submanifold; spacetime of the observer is the submanifold. For centuries natural science suffered from geocentric cosmology; similarly, now the Terran observer considers itself the center of intelligence rather than a local distinction in a holographic anthropic multiverse [2]. Logic for this insight is simple – An 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 spheres beyond the observational limit – each by a finely-tuned Terran 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 simply signifies the gravitational presence of the multiverse.

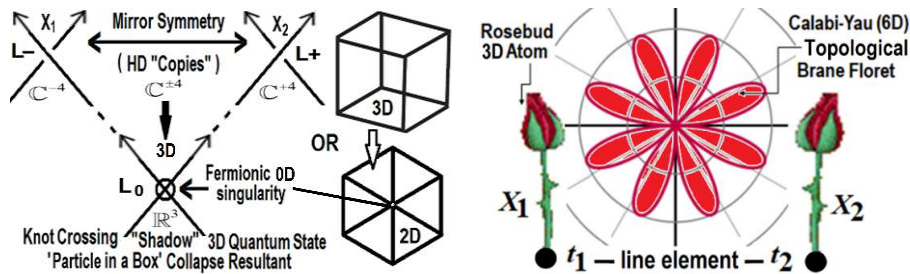
Because the spacetime KK-like cycle at the XD manifold entails an inherent beat frequency (Sect. 5), resonant interference can be achieved because of the nature of the Dirac polarized covariant vacuum and the inherent Dirac hypertube array within it [4,5]. Figure 9 illustrates a first indicia for conveying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



**Figure 10.** Local-nonlocal XD space-antispaces mirror symmetric 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 from 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, 1<sup>st</sup> space-antispaces mirror symmetric UFM step of quaternion points cycling from 5D QM chaos to topological order as faces of 3-cubes. We also see an initial separation of 3-space geodesics into extended KK cyclicity from order to chaos at the semi-quantum limit. The *beat frequency* backcloth is 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,  $T_s$  which is modulated by the string coupling constant (ill determined at present). The lore states simply, all matter is comprised of vibrating strings, but theory remains quiet in efforts to construct brane bouquets of resonating strings modeling fermions (see Sect. 7). The infinity possible Calabi-Yau configurations,  $10^6$  for finding a single compactification of the 12D bulk producing the 4D SM has remained elusive. We found a unique vacuum applying an alternate derivation of string tension in a continuous-state cycle [2,3,23], our adapted holographic M-theoretic model, may provide indicia of feasibility; success remains indefinite without another set of UM transformations beyond the Galilean-Lorentz-Poincaré. 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 (Sect. 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-antispaces 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 made of 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 space, other than by Einstein's classification of it as *extension*. 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

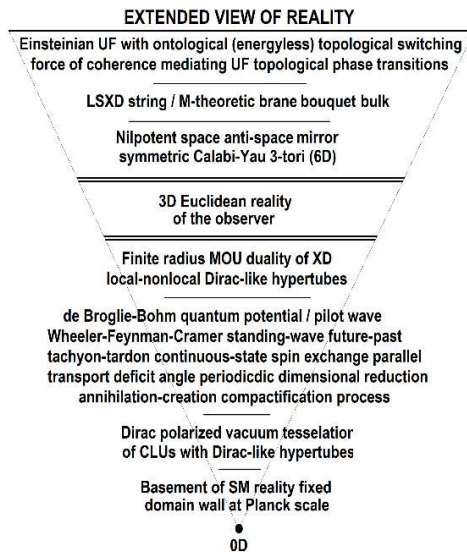
conditions arranged for measurements. The quantum regime is merely a convenient stopping point in the combinatorial hierarchy of reality [2,5,24,25,62-64]. To journey beyond the confines of locality and unitarity, the barriers of Pauli exclusion and the uncertainty principle, additional processes of reality that include a dynamic periodicity XD-LSXD duality with extended mirror symmetric or supersymmetric partners 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, ones 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].

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].

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-antispac 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 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 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.

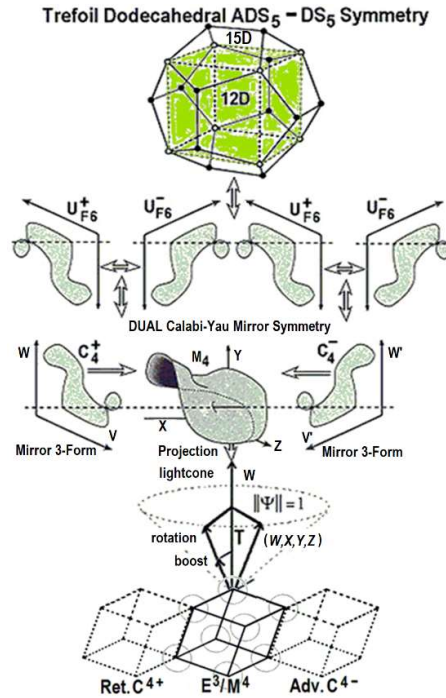


**Figure 12.** Extended view of reality showing structural phenomenology at various levels of the hierarchy.

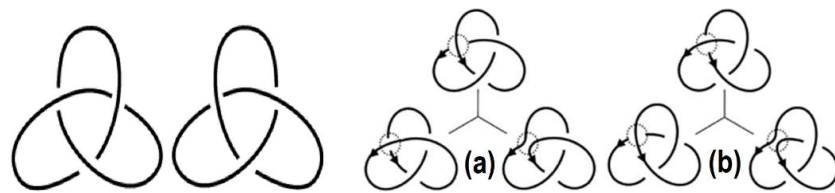
This section tries to clarify new dynamics of the brane-world bouquet bulk, different from current thinking in the string community, saliently because we consider compactification to be a continuous-state cyclicity. In passing, the reason is anthropic. Einstein claimed that UFM will provide an understanding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

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 AdS-dS 6D 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-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.

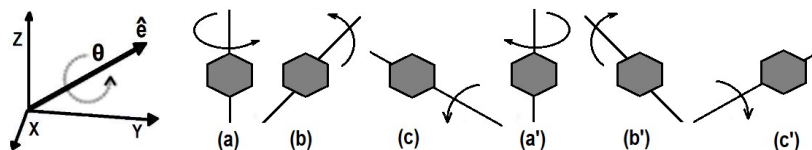


**Figure 13.** Axiomatic completion of Fig. 10 adding 8 XD to 12 LSXD (embedded in 15D) for a complete extension of added parameters forming a relativistic HD *quantum* state and instantaneous LSXD continuous-state duality of UFM cosmology representing sufficient parameters for supervening uncertainty.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



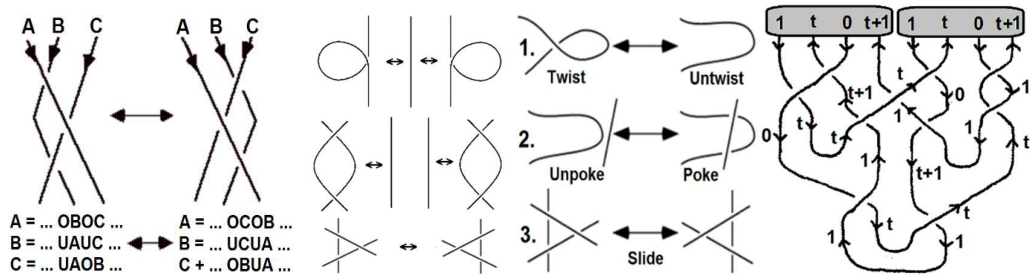
**Figure 14.** a) L & R-handed trefoil crossings as mirror images. b) Raising and lowering of trefoil over and under crossings brings various topological phase transitions that may be required for brane-world matter.

Topological phase transitions are opulent 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.



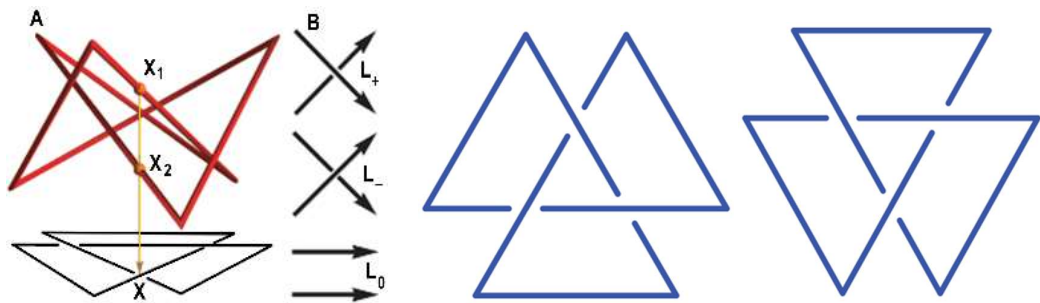
**Figure 15.** Pertaining to Fig, 14a, during parallel transport crossover links may be unknotted by the spin exchange deficit angle dimensional reduction parameters allowing rotations to be added during transitions in topological phase.

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].



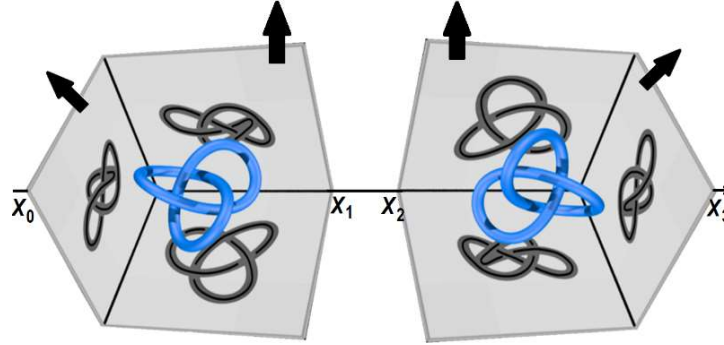
**Figure 16.** a,b,c) The numerous Reidemeister moves are a useful study because they should apply to parallel transport during the process of continuous-state dimensional reduction for XD-LSXD duality cycles. d) A spacetime roll spun knot.

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  $X, Y, Z$  or consider three oriented rosebuds  $X, Y, Z$  in a mirror symmetric space-antispaces configuration in quaternion notion,  $Y = i, j, k$  and  $Z = -i, -j, -k$  undergoing Dirac spinor double antispaces rotation through  $720^\circ$  instead of the usual  $360^\circ$  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 temporal points. Adapted from [70].

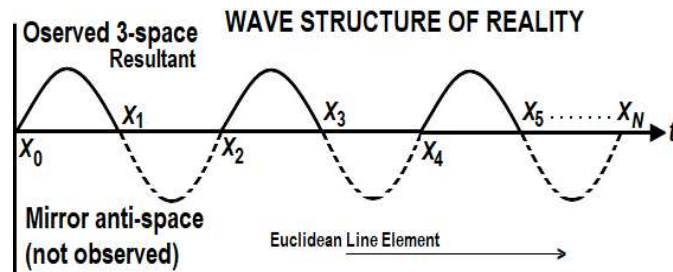
It is commonly believed that the Dirac  $360^\circ - 720^\circ$  spinor rotation can be considered as a Klein bottle comprised of two Mobius strips. We suggest the Dirac spinor has trefoil crossover topology within a Dirac MOU hypertube not yet observed because of the uncertainty principle. The equations for trefoils,  $T$  are  $r^3 = 2A \cos(3\theta)$  and  $(x^2 + y^2)^3 = A(2x^3 - 6xy^2)$  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,  $\text{sm } z$  maps regular hexagons onto Riemann spheres, with a hexagon interior conformally mapped onto the complement of the three rays joining  $\infty$  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,  $\text{sm } z = \tan \frac{p}{2} e^{i\lambda}$  associates the hexagon point by complex coordinate  $Z = x + iy$  with latitude sphere point  $\pi/2 - p$  and longitude  $\lambda$ . The function  $w = \text{sm } z$  defines real  $z$  by  $z = \int_0^w dx / (1 - x^3)^{2/3}$ , and  $\text{cm } z$  by  $\text{sm}^3 z + \text{cm} z = 1$ . Thus,  $\text{sm}(0) = 0$ ,  $\text{cm}(0) = -1$ , and  $\frac{d}{dz} \text{sm } z = \text{cm}^2 z$ ,  $\frac{d}{dz} \text{cm } z = \text{sm}^2 z$ . Caley was instrumental in formalizing  $\text{sm } z$  and  $\text{cm } z$  as elliptic functions in 1896. Because  $\text{sm } z$  and  $\text{cm } z$  form periods  $p_1 = 3K$  and  $p_2 = 3\omega K$ , where  $\omega = -1 + i\sqrt{3}/2$  is a cube root of unity:  $\text{sm}(z + 3\omega^j K) = \text{sm } z$ ,  $\text{cm}(z + 3\omega^j K) = \text{cm } z$ ,  $j = 0, 1, 2$ . With elliptic functions, the values for  $\text{sm } z$  and  $\text{cm } z$ ,  $z \in \mathbb{C}$ , 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  $\text{sm } z$ ,  $\text{cm } z$  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 Electrodynamics (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].

Returning to the simplistic notion of a nilpotent Wheeler-Dewitt wave function of the universe,  $\hat{H}|\Psi\rangle = 0$  [27,28] we would like to save theoretical rigor until later and philosophically discuss what natural science might be like after the imminent paradigm shift to a post M-theoretic Einsteinian unified field theory in terms of a UFM reality wave of the observer. What lurks behind the domain wall of uncertainty? Observation tells 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 wave form as illustrated simplistically in Fig. 19. If reality is truly holographic, coherent control of the unified field my 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 2<sup>nd</sup> boost could 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.

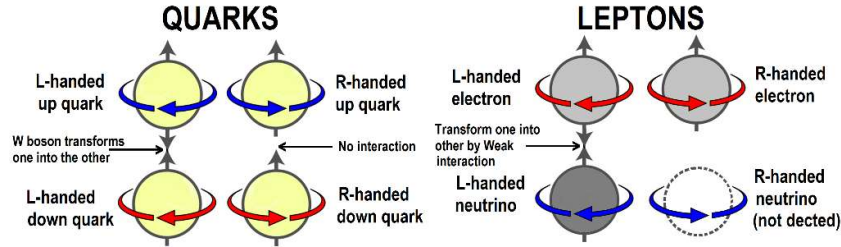


**Figure 19.** Mirror symmetric wave structure proposing reality is a sine wave evolving in time, where the negative half of the reality wave is annihilated from view by destructive interference of KK-like cyclicity as an inherent aspect of the dynamics of the Uncertainty Principle limiting XD observation of the 3-space observer.

Here loom our 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 an alternative interpretation of the view that XD must be Planck scale since they are invisible. Alternatively, as suggested in Fig. 20, 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  $\mathfrak{R}_M$ , a set of basis fields,  $\{e_1, \dots, e_n\}$  defined for every local point  $P$  of a region of the UF holonom  $e_\alpha = \lim_{\delta x^\alpha \rightarrow 0} \delta s / \delta x^\alpha$ , where  $\delta s$  is an infinitesimal displacement line element vector between coordinate points  $P$  and  $Q$  with separation  $\delta x^\alpha$  along a geodesic curve  $x^\alpha$  of the realiton manifold.





**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 multiverse reality there are equal parts 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].

## 5. The Synchronization Backbone of XD-LSXD Periodicity

Since tests of the uncertainty principle,  $\Delta X \cdot \Delta p_x \geq \hbar$ ;  $\Delta E \cdot \Delta t \geq \hbar$  are sacrosanct and myriad, one might pertinently ask why should a, in many respects, 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 a synchronization backbone (originally as a requirement for Quantum Computing [59,60]), which gets us halfway. During standing-wave future-past Cramer transactions [21] the polarized Dirac vacuum CQED hypertube opens and closes cyclically for a resonant signal to return relatively easily, but to transverse the XD MOU fully to access LSXD is suspected to be much more difficult. A Bessel function incursive harmonic oscillator must be precisely linked/coupled to a resonating mirror symmetric Bessel function with each destructive node precisely linked to the nearby 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 and the *final* periodic copy of the 3-space CQED *particle-in-a-box* is causally free. We also suspect by applying conformal scale-invariance, that 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 the utility for the UFM force of coherence [6,25,49].

Mathemagicians are capable of formulating an equation to describe anything at all, 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 form that algebraically reproduces the space-antispaces 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 nodes of the 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 imbued with extended electromagnetic theory [76-79] bringing in a longitudinal  $B^{(3)}$  em-field component with a can of worms filled with photon mass,  $m_\gamma$  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;

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

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 stent 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,  $\hat{H}1DXY$ . For a periodic system the Hamiltonian took the form,  $\hat{H} \equiv \hat{H}_{\text{SYNCH}} = \hat{H}1DXY$  [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; meaning the image of the mirror image of the mirror image is ontologically causally separated the UF panoply.

## 6. Experimental Protocols - Accessing and Manipulating XD-LSXD

Novel tabletop-low energy Unified Field Mechanical (UFM) protocols to empirically test for XD-LSXD are introduced. Now we briefly summarize nine of fourteen proposed protocols; the primary experiment and eight variations:

**I. Seminal Protocol** - Initial test if UFM parameters are correct [6,24]. A Sagnac effect inductive oscillator with rf-pulsed spin orbit and spin-spin resonant coupling interferes destructively with the polarized Dirac vacuum in order to supervene the uncertainty principle opening the 1<sup>st</sup> hyperspherical XD MOU cavity discovering a 4<sup>th</sup> spatial dimension beyond the 3D of observation. Adjustments within the balance of experiments supposedly lead to classes of technological innovation.

**TABLE 1**  
**SYNCHRONIZATION BACKBONE HIERARCHY ELEMENTS**

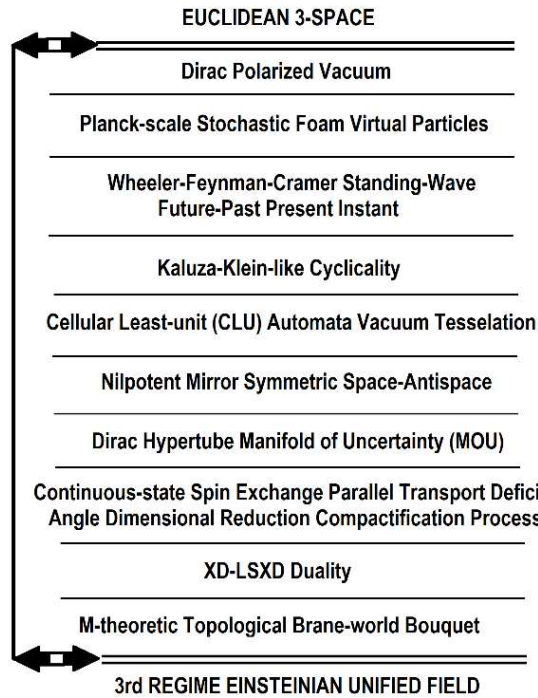


Table 1 attempts to list all pertinent phenomena operating in concert with a Feynman synchronization backbone. It is a speculative model; the hierarchy may not be ordered properly and some elements may be the same as another stated differently. The dramatic point is that the temporal 3-space of the observer is a subspace of a nonlocal atemporal (holographic-like instantaneity) LSXD manifold. The concatenation of phenomena is required for temporal locality-unitarity to surf as it were on the face of nonlocal ubiquity.

Referring to Fig. 10, imagine two mirror symmetric space-antispaces fermionic points,  $i, j, k$  and  $i', j', k'$  as blades of a spinning fan, a light put in front of a mirror periodically flashes when the fan blades come into coincidence forming face of a cube (Fig. 10). When the light is reflected off the mirror image blade, a pulsating flash of light (like a rotating light house beacon) in the direction back towards the source/detector occurs representative of a violation of the uncertainty principle by demonstrating existence of a hidden KK dimension.

**II. Discovery and Utility of Tight Bound States (TBS)** - (compare experiment I) TBS below the ground state in Hydrogen were first postulated by Vigier [10-12]. To develop our experimental design, we first drew on parameters from the early hadronic model of string theory [2,3], which we then integrated with very radical revisions of quantum theory, and an extended electromagnetic model of the Dirac polarized vacuum [74-79] which included his electron hypertube model [4,5] which we extended to include a finite radius manifold of uncertainty (MOU) at the semi-quantum limit [63]. Key to this horrendous concatenation of parameters is the view that string / M-theory should not seek a single unique compactification producing the 3(4)D  $+, +, +, -$  SM metric. Most importantly, as in Fig. 7, compactification must take the form of a dynamic continuous-state dimensional reduction process, essentially because it aligns with KK cyclicity [42-46]. This allows one to incorporate variable string tension, virtual tachyon-tardion interactions [31-33] all built within a Wheeler-Feynman-Cramer future-past standing-wave vacuum [21,28].

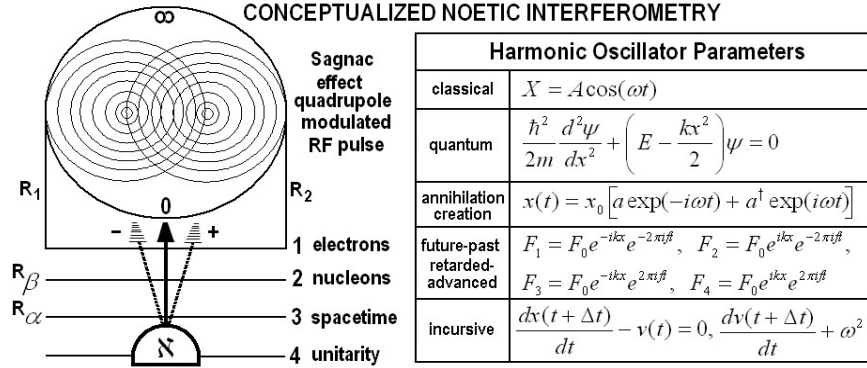
In this model the Planck constant,  $\hbar$  for simplicity can be replaced by the original Stoney  $\lambda$  [3,84], so that  $\hbar$  becomes an asymptotic cycle not achieved in nature, alternatively cycling from virtual

Planck to the Larmor radius of the hydrogen atom. This explains why LSXD are not observed, because they are hidden from view by the barrier imposed by the uncertainty principle [6].

The putative 5D KK cycle extended to an M-theoretic periodic XD MOU hypertube-LSXD duality allows harmonic rf-pulses to produce destructive interference when set to coincide with phase transition TBS cycles [3,12,31,32]. In a simplistic model for a TBS experiment, hydrogen is placed in a sample tube (Fig. 28) and a resonant pulse series in combination with a beat-frequency of space-time for opening a XD QED-UFM cavity is applied, allowing a TBS spectral line to be emitted back to the spectrometer.

**III. Universal Quantum Computing** – From experiment (II) UQC occurs by implementing a new class of XD-LSXD M-theoretic topological qubits with algorithms able to surmount the uncertainty principle [2,6]. The QC is built to enable entangled I/O processes to interact with a Feynman *synchronization backbone* [3,59,60] (Sect. 5) whereby localized copies of initial quantum states undergo XD-LSXD phase transitions by an ontological topological switching of information [6]. This energyless information transfer ontology entails a causally free separation of the local quantum state, which essentially is how decoherence is escaped in this model of UCQ.

**IV. Conformation of the prion protein, PrPc** - (compare [86]). Einstein claimed his unified field (UF) would explain living systems, in that respect we have labeled the proteinaceous particle, the prion, as *system zero* (simpler life-like than a virus). The purpose of the experiment is to test whether creating a dissonance in the *force of coherence* meditating the UF will produce a conformal change in the prion protein from normal cellular form, PrPc to pathological neurodegenerative form, PrPSc. The idea of this experiment is to set up dual Hadamard quantum logic gates as quantum cellular automata on the surface of the Dirac polarized vacuum [6-8] and use micromagnetic oscillations in coupled resonance with the UF to create a stressor to drive PrPc → PrPSc [86].



**Figure 21.** a) Modeling CQED Sagnac Effect interferometry, as a spin-coupled hierarchy with a timed beat frequency programmed to send resonant pulses through the gaps in XD spacetime opened by an incursive rf-modulated oscillator back-reaction emitting the UFM field mediator,  $\aleph$ . b) Generalized examples of 1) classical, 2) quantum, 3) relativistic, 4) transactional and 5) incursive harmonic oscillators needed to produce a coherently controlled collective spin tower of incursive resonance coupling producing cyclic nodes of destructive-constructive Cramer-like standing-waves interference in the Dirac vacuum hypertube. A Bessel-like coupled oscillator with spin-spin coupling hierarchically vibrates electrons coupled to nucleons coupled to spacetime cellular least units opening a hole to XD space.

A 12D brane bouquet is the minimum bulk configuration required to escape from the temporal bounds of uncertainty, a result of the dimensional tower (Figs. 10,11,13) with Euclidean-Minkowski space and time a standing future-past subspace wave of the XD-LSXD M-theoretic topological manifold. Other possible concatenations exist, but for illustrative purposes we choose a logarithmic spiral construction with *perfect rolling motion* in order to make a point about an inherent commutative-anticommutative periodicity relative to our claim of a cyclical continuous-state compactification

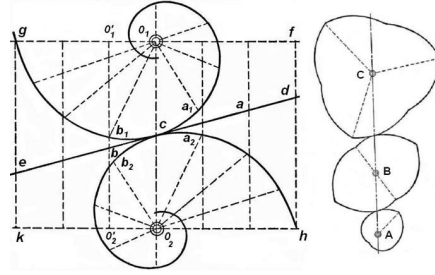
[2,3,6]. With this notion (Fig. 22), Wheeler-Feynman-Cramer transaction elements [21] become paired logarithmic spirals with equal obliquity rolling on a common tangent,  $ed$  for which each coupled point indicates a present instant in spacetime; the locus of which is the arrow of time.

For radiant spiral,  $r$

$$r = ae^{b\theta} \quad (9)$$

$a$  has the value of  $r$  if  $\theta = 0$ ,  $e$  is the base of the Napierian logarithms with  $b = 1 / \tan \phi$ , and  $\phi$  the constant angle between the tangent to the curve and radiant to the point of tangency. When the value of  $\theta$  increases uniformly (quantized) radians,  $r$  become  $ct = 0,1,2,3\dots, n$  with a motion of geometric progression in relation to the hierarchal topology of the space. These logarithmic curves are not closed. In order to adapt for continuous motion, pairs are required. Symmetrical unilobed wheels are formed by joining corresponding sections of the spiral form. The sectors do not need to be equal or symmetrical, but the *wheels* need to be paired with sectors of equal obliquity in contact in order for perfect rolling motion to occur. Wheels can be bilobed or trilobed etc. The Superspace is illustrated (Fig. 22) by a tier of three symmetrical lobed wheels.

It has been proposed that an XD continuous-state cyclicity incorporates periods of partial commutativity and anti-commutativity until reaching 12D where the (starting point) 3-space causal connection is completely broken, metaphorically noted by sections (lobes) of logarithmic spirals applied to perfect rolling motion (Fig. 22). This means, after so many chaotic and partial chaotic (anticommutative) cycles, full commutativity is achieved in matter-brane topology-matter cycles [5].



**Figure 22.** *Perfect Rolling Motion* made from two logarithmic spirals, which could be considered as space-antispacesymmetries. Sections of the spirals are joined into the three spheroids, A,B,C (right). A similitude of the  $360^\circ - 720^\circ$  spinor rotation of a Dirac spin  $\frac{1}{2}$  fermion; the spheroids will only return to the same configuration after a number of  $360^\circ$  rotations dependent on the structure of the lobes.

The mechanics of rolling contact illustrates a context for new LSXD UFM commutators. Coupled logarithmic spirals of the same obliquity undergoes *perfect rolling motion*. To make the rotation continuous 2 sections of the spiral need to be joined into a spheroid so that continuous rolling occurs. Gears can be single, bilobed or trilobed, and perfect rolling motion persistent as long as correct obliquity is maintained. Of interest is that the sensory device of the ear operates by a similar principle. If points of rolling contact are considered as frequencies, and contact points correspond to the  $z$  axis, periodic moments of commutative angular momentum are produced insinuating that there are XD moments of commutation in the 12D KK-like periodic structure.

An electric field flux through any loop  $\Gamma_1$  creates an oscillating magnetic field whenever the frequency increases:  $B = i\omega r / 2c^2 \cdot E_0 e^{i\omega x}$  which is proportional to the radius of the cavity,  $r$ . Such a varying magnetic field is proportional to the rate of change of  $E$  and therefore  $\omega$ , effecting the electric field by Faraday's Law, so that it is no longer be uniform and that it also changes with  $r$ . Corrections to the original uniform field  $E_1$  are required, so that the corrected field is now,  $E = E_1 + E_2 + E_3 \dots E_n$  and is best described by Bessel function  $J_0$  :

$$J_0(x) = 1 - \frac{1}{(1!)^2} \left(\frac{x}{2}\right)^2 + \frac{1}{(2!)^2} \left(\frac{x}{2}\right)^4 - \frac{1}{(3!)^2} \left(\frac{x}{2}\right)^6 + \dots \quad (10)$$

such that  $E$  is now

$$E = E_0 e^{i\omega t} J_0 \left( \frac{\omega r}{c} \right). \quad (11)$$

Key constraints are required for an incursive spacetime oscillator to operate properly. As natural science evolved from Newtonian to Quantum, our description of singularities and particles changed dramatically. With the advent of string / M-theory proposed necessities for XD appeared and cosmologies became laced with holographic, anthropic and multiverse concepts [1-3]. For our work, the three regimes of reality are required to complete the cosmology of our observed Hubble sphere; all combined into a dynamic unified structure: Classical  $\rightleftharpoons$  Quantum  $\rightleftharpoons$  Unified Field, with new modes of observation sought. The absolute nature of the observer and measurement problems are yet to be solved. Tests of quantum theory, produce the uncertainty relations,  $\Delta X \cdot \Delta p_x \geq \hbar$ ,  $\Delta E \cdot \Delta t \geq \hbar$ ; simplistically, this paper is about doing something else. Ignoring all else for the moment, the primary ingredient is utility of a proper form of the Dubois incursive oscillator, embedded in a Bessel function set to modulate the oscillation with MOU hyperspherical XD nodes within a Dirac polarized vacuum hypertube [4-9, 74-79, 82, 83].

We begin with motion of a 1D classical harmonic oscillator,  $q = A \sin(\omega t + \varphi)$  and  $p = m\omega A \cos(\omega t + \varphi)$  with  $A$  amplitude and  $\varphi$  a phase constant of fixed energy,  $E = m\omega^2 A^2 / 2$ . State  $|n\rangle$ , having  $n = 0, 1, 2, \dots, \infty$  and for a Hamiltonian  $E_n = (n + 1/2)\hbar\omega$  the quantum harmonic oscillator is  $\langle n | q^2 | n \rangle = \hbar / 2m\omega \langle n | (a^\dagger a + a a^\dagger) | n \rangle = E_n / m\omega^2$  and  $\langle n | p^2 | n \rangle = 1/2(m\hbar\omega) \langle n | a^\dagger a + a a^\dagger = mE_n$  with terms  $a$  and  $a^\dagger$  annihilation-creation operators,  $q = \sqrt{\hbar / 2m\omega} (a^\dagger + a)$  and  $p = i\sqrt{m\hbar\omega / 2} (a^\dagger - a)$ . For 3D harmonic oscillators the equations are the same having energies,  $E_x = (n_x + 1/2)\hbar\omega_x$ ,  $E_y = (n_y + 1/2)\hbar\omega_y$  and  $E_z = (n_z + 1/2)\hbar\omega_z$ .

In Dubois' notation the classical 1D harmonic oscillator for Newton's second law in coordinates  $t$  and  $x(t)$  for a mass  $m$  in a potential  $U(x) = 1/2(kx^2)$  takes the differential form

$$\frac{d^2 x}{dt^2} + \omega^2 x = 0 \quad \text{with} \quad \omega = \sqrt{k/m} \quad (12)$$

and when separated into coupled Eqs. (13) becomes

$$\frac{dx(t)}{dt} - v(t) = 0 \quad \text{and} \quad \frac{dv(t)}{dt} + \omega^2 x = 0. \quad (13)$$

Dubois forms two results  $x(t + \Delta t)$ ,  $v(t + \Delta t)$  by discretizing incursively, which provides a structured bifurcation of the system, together creating Hyperincursion. The trajectory is discretized by increasing the time interval, which represents a background independent discretization of spacetime - crucial to overcoming space quantization in the usual manner [82, 83].

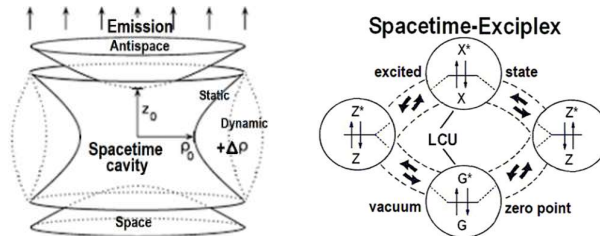
Every quantum harmonic oscillator mode is related to CQED dynamics, hexagon lattices (Fig. 30) of CLU spacetime topology undergoing continuous transitions.  $E$ , the energy state for  $n$  photons, is in the oscillators ground state when  $n = 0$ . For finite energy,  $1/2\hbar\omega$  the ground state is called the zero-point energy, still present in the cavity's region. For Eq. (14), the field energy of the photons quantum harmonic oscillator undergoes cyclical annihilation-recreation in periodic CLU spacetime

$$E_n = \left(n + \frac{1}{2}\right)\hbar\omega. \quad (14)$$

To avoid the barrier to XD by collapse of the wave function imposed by the limitations of the Copenhagen interpretation, requires a UQC programmed to utilize the Dirac vacuum CLU MOU hypertube dynamics tessellating spacetime by action of an rf-modulated incursive oscillator timed to regulate the XD-LSXD opening and closing duality of the local-nonlocal cavity modes. The critical condition is implementation of a de Broglie-Bohm-like modeled oscillator guiding evolution of the wave function by UFM coherent control, a correspondence to a new non-collapse (ontological or energyless) version of RQFT [6]. Another way to illustrate the intended use of coordinated rf-sine wave  $\pi$  - pulses with geometric spatial rotations, is by a pair of common dice showing that some rotations commute,  $a \otimes b = b \otimes a$  and others are noncommutative  $a \otimes b \neq b \otimes a$ . For example, the general equations for putative spacetime exciplex energetics where the emission-absorption cycle never reaches ground (Fig. 42) are:

$$\begin{aligned} G^* + G^* &\leftrightarrow Z^*; \quad Z^* + m_\gamma \leftrightarrow X^* \\ X^* - m_\gamma &\xrightarrow{\text{emission}} Z^* \text{ or } G^* \\ X^* + m_\gamma &\rightarrow Z^* \text{ or } G^* \end{aligned} \quad (15)$$

with G a ZPF ground (never reached in excited excimer cycles), Z, UFM cavity excited states and X the spacetime CQED exciplex coupling. Myriad formations in addition to a large variation of absorbed photon frequencies may allow complete CQED XD-LSXD dual Dirac hypertube absorption-emission equilibrium spectrums. UFM Exciplex parameters concealed behind the domain wall of uncertainty in antispacetime necessitate existence of harmonic *beat frequencies* inherent in a synchronization backbone of an XD-LSXD duality of UFM topological phase transitions. The exciplex complex shown by Fig. 23b and eq. (15) is a programmable mechanism related to a CLU structure of inherent KK-cyclicity [2].



**Figure 23.** Hypertube local-nonlocal UFM Exciplex properties. a) Idealized Penning laser trap with antispacetime static-dynamic oscillating Casimir-Polder cavity extensions integrating essential exciplex energy dynamics. b) Showing exciplex CLU excitation dynamics with energetics for continuously remaining above ground state (eq. 6), theoretically allowing UFM energy to continuously summate into a periodic conductive mean-free path. Figure 23a) adapted from [87].

Rotating a circle around an extended line generates a torus in the plane with the circle becoming a continuous ring. From the general torus equation,  $\left[\left(\sqrt{x^2 + y^2}\right) - R\right]^2 + z^2 = r^2$ ,  $r$  is the radius of the rotating circle, with  $R$  the distance between the center of the circle and its axis of rotation. The torus volume is  $2\pi^2 R r^2$  with surface area  $4\pi^2 R r$ . From the Cartesian formula above, the axis of rotation is the same as the  $z$  axis. The spherical domain of electron charged particles is a toroidal volume filled by the wave motion of the electrons atomic orbit. The radius for the orbit of photons having specific quanta emitted when an electron is present in higher more excited Bohr orbits, will

return to the next lower energy level and decrease the volume of the torus during the process of emission. In proposing these toroidal orbital regimes entail properties similar to cyclic KK QED-like hypertube cavities, we apply these structures to parallel transport deficit angle *topologically switched* phase transitions during the continuous-state dimensional reduction process in the holographic multiverse model [2,3]. In addition to considering the circle generated torus to be a KK-like cyclicity in spacetime when operating the experiment to manipulate the UFM brane bouquet, also, the deformed Einstein energy dependent spacetime metric,  $\hat{M}_4$  is extrapolated as a submanifold of a supersymmetric 12D standing-wave future-past advanced-retarded local-nonlocal duality topology [6,125].

A procedure to manipulate the polarized Dirac vacuum by incursive resonance has been developed. The UF appears to have properties like an ocean of light; if valid, surface waves on the Dirac sea are programmable self-organized CLU tessellations

amenable to descriptive methods of nonlinear dispersive wave phenomena of the general formula

$$L(\mu) = \varepsilon N(\mu), \quad (16)$$

with  $L$  and  $N$  Linear and Nonlinear operators respectively in the linear limit where  $\varepsilon = 0$  having basic dispersive wave solutions  $\mu_i = A_i \cos \theta_i$ ,  $\theta_i = k_i x - \omega(k_i) t$  for 1D plus time where nonlinearity produces resonant interactions between  $\mu_i$  solutions. Amplitude  $A_i$  depends on  $t$ , possibly creating considerable effects where initial missing modes could become cumulative interactions creating shock-wave effects. Motion of a 1D classical harmonic oscillator is shown by  $q = A \sin(\omega t + \varphi)$  and  $p = m\omega A \cos(\omega t + \varphi)$  with  $A$  amplitude and  $\varphi$  a phase constant for fixed energy  $E = m\omega^2 A^2 / 2$ . For state  $|n\rangle$ , having  $n = 0, 1, 2, \dots, \infty$  and Hamiltonian  $E_n = (n + 1/2)\hbar\omega$  the quantum harmonic oscillator is then

$$\langle n | q^2 | n \rangle = \hbar / 2m\omega \langle n | (a^\dagger a + a a^\dagger) | n \rangle = E_n / m\omega^2 \quad (17)$$

and

$$\langle n | p^2 | n \rangle = 1/2(m\hbar\omega) \langle n | a^\dagger a + a a^\dagger | n \rangle = mE_n \quad (18)$$

with  $a$  &  $a^\dagger$  annihilation and creation operators,  $q = \sqrt{\hbar / 2m\omega}(a^\dagger + a)$  and  $p = i\sqrt{m\hbar\omega/2}(a^\dagger - a)$  [125-127].

For a 3D harmonic oscillator, the equations are the same, having energies

$$E_x = (n_x + 1/2)\hbar\omega_x, E_y = (n_y + 1/2)\hbar\omega_y, \text{ and } E_z = (n_z + 1/2)\hbar\omega_z. \quad (19)$$

In the Dubois notation a classical 1D harmonic oscillator for Newton's second law in coordinates  $t$  and  $x(t)$  for a mass  $m$  in a potential  $U(x) = 1/2(kx^2)$  has differential form

$$\frac{d^2 x}{dt^2} + \omega^2 x = 0 \quad \text{where} \quad \omega = \sqrt{k/m} \quad (20)$$

which can be separated into coupled equations

$$\frac{dx(t)}{dt} - v(t) = 0 \quad \text{and} \quad \frac{dv(t)}{dt} + \omega^2 x = 0 \quad [82,83]. \quad (21)$$

From incursive discretization, Dubois formulates two solutions,  $x(t + \Delta t)$   $v(t + \Delta t)$  providing a



structural bifurcation for the system which together cause Hyperincursion. The effect of increasing the time interval discretizes the trajectory (Fig. 24), representing a background independent discretization of spacetime [82,83].

For magnetic fields that are homogeneous, forces exerted on opposing dipole ends cancel and the trajectories of particles remain unaffected. For classical spinning particles the distribution of spin angular momentum vectors is truly random and each particle would be deflected up or down by varied amounts causing the distribution on the screen of the detector to be even. On the other hand, for quantum mechanics, particles are deflected either up or down by a precise amount, meaning that spin angular momentum (space quantization) is quantized, only taking on discrete values. A continuous distribution of possible angular momenta is not possible. For this usual fundamental basis of quantum theory, we need to introduce new experiments able to overcome this. This is key for the changes required: If applying a homogeneous magnetic field causes quantum uncertainty when measured, we must *do something else*.

It is usually easier to achieve resonance in NMR spectroscopy by making a 1<sup>st</sup> order calculation and then varying the frequency until resonance is acquired. There are numerous approaches that could be used for a specific quantum system; a good reason for choosing NMR interferometry for testing UFM accessibility is that it is reasonably straight forward to find spin-orbit and spin-spin resonant couplings between modulated electrons and the desired nucleons; but attaining precise resonant couplings with polarized de Broglie wave properties of matter and the Dirac vacuum backcloth is more challenging because the interlocked tier of hyperspherical MOU hypertube cavities are cleverly bound together by nature. For example, looking at two sides of a coin, on the one hand, modern grand pianos have a cast iron metal plate (harp) holding over 20 tons of string tension. Current supercolliders cannot yet pass the force holding the Planck barrier in place. On the other hand, two or three-hundred years ago early pianos had wooden harp plates and weaker pinblocks, making it difficult to tune a piano as tightening one string bent the harp and pinblock so that other strings went out of tune. By this we explain that the Dirac electron hypertube is finely tuned and penetrating the deeper cavities precise to pass all the way through from the 1<sup>st</sup> XD to the full LSXD regime. Thus, in the SM  $\hbar$  is a rigid barrier only because applied QM makes it so. For UFM;  $\hbar$  is a virtual limit that can be supervened by the correct application of Sagnac interferometry with the Dirac polarized vacuum [125]. The Planck length oscillates as a limit cycle predicted to be the Larmor radius of hydrogen to virtual  $\hbar$  as an asymptote never reached. If thought of as a Cramer transaction, the Larmor radius would be a future-retarded moment and  $\hbar$  a past-advanced standing-wave moment theorized to have the possibility of infinite radius for  $D \geq 6$ . Considering the domain walls of CLU structure, the  $\hbar$ -Larmor regime is considered internal-nonlocal and the Larmor-infinity regime considered external-supralocal [125].

For clarity we review NMR concepts for the hydrogen atoms single proton having magnetic moment  $\mu$ , angular momentum  $J$  correlated by vector  $\mu = \gamma J$  with  $\gamma$  the gyromagnetic ratio and  $J = \hbar I$  for  $I$  the nuclear spin. Magnetic energy  $U = -\mu \cdot B$  for the nucleus in an external magnetic field in the  $z$  direction is  $U = -\mu_z B_0 = -\gamma \hbar I_z B_0$  with values of  $I_z$ ,  $m_I$  being quantized by  $m_I = I, I-1, I-2, I-3, \dots -1$ . The  $z$ -component of the magnetization,  $M$ , for most nuclear species, grows exponentially until reaching equilibrium according to  $M_z(t) = M_0(1 - e^{-t/T_1})$  where  $T_1$  is the spin-lattice relaxation time. To be noted for a UFM interferometer is that as  $\mu$  precesses cyclically from  $m_I = -1/2$  to  $m_I = +1/2$  the nucleons experience a torque,  $\tau$  changing  $J$  by  $\tau = dJ/dt$  or  $\mu \times B = dJ/dt$ . Under thermal equilibrium the x-y components are zero; though  $M_z$  can be rotated into the x-y plane producing transverse  $M_x$  and  $M_y$  components  $dM/dt = \gamma M \times B$  for the entire system by applying a rotating circularly polarized oscillating magnetic field  $2B_1 \cos \omega t \hat{i}$  of frequency  $\omega$  in addition to the constant magnetic field  $B_0 \hat{k}$ . Now the total time dependent field decomposes into the two counterpropagating fields

$$B_1(\cos \omega \hat{t}i + \sin \omega \hat{t}j) + . B_1(\cos \omega \hat{t}i - \sin \omega \hat{t}j) [125]. \quad (22)$$

The more complex form for multiple applied fields is necessary for use with the Sagnac Effect, quadrupole, and dipole dynamics required to operate the UFM interferometer. Nuclear Quadrupole Resonance (NQR) is a form of NMR in which quantized energy level transitions are induced by an oscillating RF-magnetic field in the electric quadrupole moment of nuclear spin systems rather than the magnetic dipole moment. The nuclear quadrupole moment,  $Q$  is based on the nuclear charge distributions  $\rho(r)$  departure from spherical symmetry defined as the average value of  $1/2(3z^2 - r^2)\rho(r)$  over the nuclear volume.  $Q$  has the dimension of area where the nuclear angular momentum, for which  $m_I = I$  where  $I$  is the nuclear spin quantum number and  $m_I$  is the quantum number for the z component of the spin  $m_I = -1, +1, \dots, I - 1, I$  [126,127].

Nuclei having,  $I = 0$  do not have magnetic moments and are thus inert magnetically. Likewise, for  $Q = 0$  the nucleus must be spherical having spin  $I \geq 0$ . Spin  $I = 1/2$  nuclei have dipole moments,  $\mu$  but do not have  $Q$ .  $Q$  is positive for prolate nuclei and negative for oblate nuclei. For an isolated nucleus in a constant magnetic field  $H_0$  with nuclear spin number  $I > 0$  the nucleus possesses a magnetic moment. From Quantum Theory the length of a nuclear angular momentum vector is  $[I(I+1)]^{1/2} \hbar$  for which measurable components are given by  $m\hbar$  with  $m$  the magnetic quantum number having any  $(2I + 1)$  value from series  $I, I - 1, I - 2, \dots, -(I - 1), -I$ . The  $I = 3/2$  case has four values along the direction of an applied magnetic field  $H_0$ . Of the three types of spin-spin coupling, our experiment relies on the hyperfine interaction for electron-nucleus coupling, precisely the interaction of a nuclear electric quadrupole moment induced by an applied oscillating RF-electric field acting on nuclear magnetic dipole moment  $\mu$ . If the electron and nuclear spins are strongly aligned along the z-components, the Hamiltonian is  $-m \cdot B$ , and if  $B$  is in the z direction

$$H = -\gamma_N I \cdot B = -\gamma_N B I_x \quad (23)$$

where  $m = \gamma_N I$ ,  $\gamma_N$  the magnetogyric ratio,  $\gamma_N = e\hbar / 2m_p$  and  $m_p$  mass of the proton [126,127].

Rf-excitation of nuclear magnetic moments,  $\mu$  to resonance occurs in a nucleus collectively rotating  $\mu$  to an angle correlated applied field,  $B_0$  producing the torque  $\mu_i \times B_0$  making angular momentum,  $\mu$  precess around  $B_0$  at Larmor frequency,  $\omega_L = \gamma_N B_0$ . Such coherent precessing for  $\mu$  may additionally induce a *voltage* in surrounding media, an energy component of the Hamiltonian, which we hope to use in the creation of interference in the CLU parameters tessellating spacetime. This is symbolically similar to dropping stones into water: the first stone makes concentric ripples; a second stones causes interfering nodes of constructive and destructive interference. This is not observed in usual SM based experiments. Nevertheless, our proposed UFM model utilizes extended theory whereby teleological action is utilized to develop a *transistor of spacetime*. In similitude of electronic transistors with wires providing the basis for modern electronic devices; The UFM *Laser Oscillated Vacuum Energy Resonator* (LOVER) uses the information in the geometric topology of spacetime geodesics (null lines) the basis for imminent types of UFM Technology [125]. In a Simplified manner for this framework, modulating an arrangement of tunable lasers, hydrogen electrons RF-pulsed by a resonance frequency coupling them to the nucleon magnetic moment, whereby cumulative interactions are formed greatly enhanced by a Haisch-Rueda inertial back-reaction [88-92]. Sagnac effect Interferometry created by counter-propagating beams causes a violation of Special Relativity in the small-scale, 1<sup>st</sup> stage for the multi-tier experimental platform set up to *make a hole* in the fabric of spacetime in conjunction with isolation of the unified field,  $\hat{F}_U$ .

An IC module of over a thousand ring lasers can be built; CQED effects are assumed to occur inside the central ring cavities which can be doped with specific molecules. A xanthene quantum dot

for computing or a prion molecule for example, in the prion propagation experiment. Modulating the ring laser array with resonant frequency modes selected to realize spin-spin coupling for molecular electrons and neutrons by means of Cumulative Interactions that are Coherently Controlled, an inertial back-reaction can be focused so that the array of hydrogen electrons also resonates within the Dirac spacetime background to expose by the addition of hyperincursion, an *oscillating hole in the hypertube* (Fig. 25).

Until we achieve a complete theory of gravitation, a full understanding of inertia remains a mysterious. A hint is given by following the Sakarov and Puthoff conjecture - inertial and gravitational forces, initial resistance to motion, are actions of a flux (sink) in the vacuum zero-point field [94,95]. Thus, the  $m$  term in Newton's 2nd law,  $f = ma$  is a function of the zero-point field. The 3<sup>rd</sup> law says, *every force has an equal and opposite reaction*. Haisch & Rueda state vacuum resistance arises from this Cramer-like standing-wave hysteresis-like loop reaction force,  $f = -f$ . Earlier we formed an electromagnetic interpretation of gravitation suggesting this inertial back-reaction acts as an electromotive force by a piloted de Broglie matter-wave field within the spin exchange annihilation creation process in the stuff of spacetime [99]. In addition, we further propose the energy accountable for Newton's 3<sup>rd</sup> law results from a continuous-state flux of the pervasive UFM field from the Hubble radius to the Planck-scale (Mach's principle). For the protocol it is assumed the Haisch-Rueda hypothesize holds true

$$f = \frac{d\rho}{dt} - \lim_{\Delta t \rightarrow 0} \frac{\Delta\rho}{\Delta t} \equiv \frac{d\rho_*}{dt_*} - \lim_{\Delta t_* \rightarrow 0} \frac{\Delta\rho_*}{\Delta t_*} = f_* \quad (24)$$

with  $\Delta\rho$  an impulse from the accelerating mediator; therefore  $\Delta\rho_*^{zp} = -\Delta\rho_*$  [2,88-92].

De Broglie fusion may be applicable to the UFM oscillator; a spin 1 photon can be thought of as a fusion of a pair of spin 1/2 particles linked electrostatically. At first de Broglie thought this could be an electron-positron pair and later thought a neutrino and antineutrino: "*A more complete theory of quanta of light must introduce polarization in such a way that to each atom of light should be linked an internal state of right and left polarization represented by an axial vector with the same direction as the propagation velocity*" [6]. Such predictions hint at a deeper Cramer-like relationship in the basis of spacetime. Fundamental ideas for what constitute a particle is our concern here - the SM objects existing as quantized fields defined on a 4D Minkowski spacetime. As we move into a XD-LSXD duality, the SM domain is not sufficient for evaluating physical events [6].

What we suggest is similar to wave-particle duality in the propagation of an electromagnetic wave; that all matter and spacetime in XD is comprised of continuous-state dynamic topology of hyperspherical standing waves. Following de Broglie's fusion concept, assume two sets of coordinates  $x_1, y_1, z_1$  and  $x_2, y_2, z_2$  which become

$$X = \frac{x_1 + x_2}{2}, \quad Y = \frac{y_1 + y_2}{2}, \quad Z = \frac{z_1 + z_2}{2} \quad (25)$$

Thus, identical particles of mass  $m$  with no distinguished coordinates, have the center of mass Schrödinger equation

$$-i\hbar \frac{\partial \psi}{\partial t} = \frac{1}{2M} \Delta \psi, \quad M = 2m \quad (26)$$

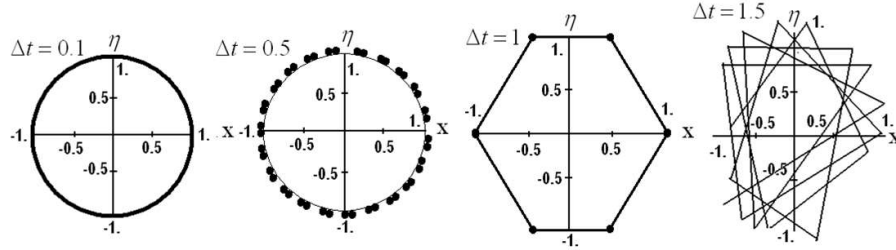
Equation (26) refers to the present. Equation (27a) refers to an advanced wave with (27b) the retarded wave,

$$-i\hbar \frac{\partial \phi}{\partial t} = \frac{1}{2M} \Delta \phi, \quad -i\hbar \frac{\partial \varphi}{\partial t} = \frac{1}{2M} \Delta \varphi. \quad (27)$$

From Rauscher's model of a complex 8-space differential line element  $dS^2 = \eta_{\mu\nu} dZ^\mu dZ^{*\nu}$ , with indices running 1 to 4,  $\eta_{\mu\nu}$  as a complex 8-space metric,  $Z^\mu$  the complex 8-space variable and with  $Z^\mu = X_{\text{Re}}^\mu + iX_{\text{Im}}^\mu$  and  $Z^{*\nu}$  the complex conjugate, to 12D continuous-state UFM spacetime. We only show the dimensions for simplicity,

$$x_{\text{Re}}, y_{\text{Re}}, z_{\text{Re}}, t_{\text{Re}}, \pm x_{\text{Im}}, \pm y_{\text{Im}}, \pm z_{\text{Im}}, \pm t_{\text{Im}}, \quad (28)$$

where  $\pm$  indicates Wheeler-Feynman/Cramer-like future-past/retarded-advanced dimensions. Such dimensionality yields a basic frame for applying hierarchical harmonic oscillator parameters [2,6].



**Figure 24.** Numerical phase space trajectory simulations for Dubois' superposed incursive oscillator  $x_n = 1/2[x_n(1) + x_n(2)]$ ,  $v_n = 1/2[v_n(1) + v_n(2)]$  based on coordinates and velocities shown for values of  $\Delta\tau = \omega t$  equal to 0.1, 0.5, 1.0 and 1.5. Initial conditions are  $\chi_0 = 1, \eta_0 = 0$  and  $\tau_0 = 0$  with total simulation time  $\tau = \omega t = 8\pi$  [82,83].

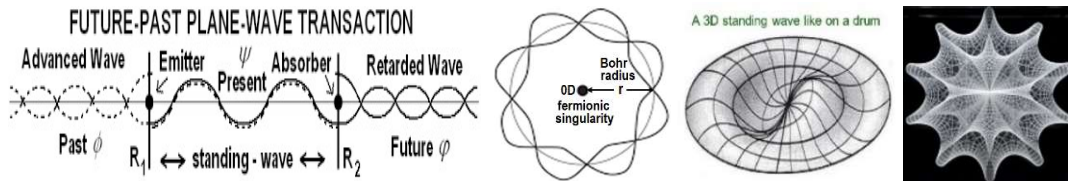
Figure 24 provides key insight into key element for an incursive resonance hierarchy.

Most of the parameters for formulating a new UFM transform group are available, but the basic theory doesn't yet seem sufficient for a formal attempt. It is likely only experiment will reveal the required topological restrictions. Because of the importance, we take liberty to speculate on the necessity of a tachyon and original hadronic form of variable string tension [23,33]. Both these ideas are important in the UFM setting where a present instant is a hyperspherical standing-wave of the future-past [21]. Indeed, for the, Wheeler-Feynman absorber theory,

$$T_{\text{tot}}(X, t) = \sum_n (E_n^{\text{ret}}(X, t) + E_n^{\text{adv}}(X, t)) / 2 + \sum_n (E_n^{\text{ret}}(X, t) - E_n^{\text{adv}}(X, t)) / 2 = \sum_n E_n^{\text{ret}}(X, t) \quad (29)$$

describes radiation as a standing wave [21].

The Cramer transactional interpretation (TI) of quantum mechanics (derived from Wheeler-Feynman absorber theory), in addition defines quantum interactions as standing waves fashioned by retarded (forward-in-time) and advanced (backward-in-time) waves [21]. Ostensibly, Cramer's TI standing-waves are called primitive; but 1D oscillating strings are only a basic model. In reality, extended to mirror symmetric dual Calabi-Yau 3-tori 6D hyperspherical standing wave M-theoretic topological phase transitions; the model seems more appealing.



**Figure 25.** Cramer Transactions for a 1D, 2D, 3D and 6D future-past standing-wave event.

Nilpotent space-antispacesettings for the two mirror symmetric vector spaces is made from arbitrary scalar values which represent 5 generator objects  $E, p_x, p_y, p_z, m$  forming the two commuting vector spaces,

$$(KE + iIip_x + iIjp_y + iIkp_z + iJkm)(KE + iIip_x + iIjp_y + iIkp_z + iJkm) = 0 \quad [34]. \quad (30)$$

This becomes the nilpotent condition,  $E^2 - p_x^2 - p_y^2 - p_z^2 - m^2 = 0$ . This object has squared to zero. This duality is identical, defining the nature of a singularity as norm 0 in either space as a crossover between them. Space in Physics, requires duality to ensure that zero totality is the fundamental condition of the universe. Observed real space as defined by quaternions is  $i, j, k$ . The dual space, I,J,K not until now accessible as a physical quantity is termed *vacuum space*, or *antispaces* since it combines with real space producing a zero totality nilpotency. Creating nilpotent assemblies zeroing all higher terms has a perfect group symmetry that allows complete cancellation, ensuring Nature displays zero totality in every aspect, both material and conceptual; it does so by a fundamental principle of natural science - duality [34,80,81].

Correspondingly, fermions always occur in the two spaces constructing them, real and vacuum spaces, with the *zitterbewegung* Schrödinger discovered in the free-particle solution to the Dirac equation, which represents switching between the two spaces making it possible to define fermions as forming singularities by the intersection of dual spaces. Topologically, singularity creation using its *intersection* with a dual space can be viewed as creating a multiply-connected space from a simply-connected space by insertion of a topological singularity. Also, parallel transport of a vector in a multiply-connected space produce a phase shift of  $\pi$  or  $180^\circ$  in the vector direction, but if transport is around simply-connected space, it will not. In the first case, the vector must perform a double rotation in order to return to the starting point [6]; precisely what happens to spin  $\frac{1}{2}$  fermions, which, as point-singularities, are regarded as existing in their own multiply-connected space. This means fermions requires a double rotation because, like *zitterbewegung*, only half its time is spent traversing observed real space [34].

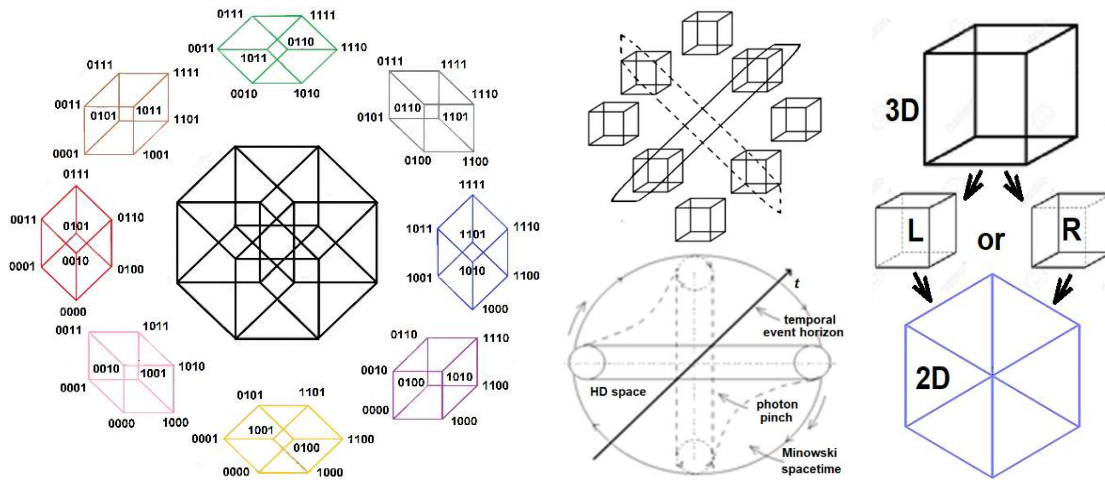
## LASER OSCILLATED VACUUM ENERGY RESONATOR

### Multi-Tiered Experimental Platform

<b>TIER-I</b>	Applied Tunable Laser RF-Modulated Pulsed Quadrupole Resonant Counter-Propagating Sagnac Effect Interferometry of Electrons
<b>TIER-II</b>	For the Purpose of Spin-Spin Coupling of Tier-I Electrons to the Magnetic Moment of Nucleons
<b>TIER-III</b>	By HD RQFT Tier-I & II Undergo Resonant Coupling with the Beat Frequency of the Fabric of Spacetime
<b>TIER-IV</b>	Multi-Tier Cumulative Interaction of Tiers-I-II-III with Destructive Interference by Incurive Bessel Function Annihilation & Creation Operators of Spacetime

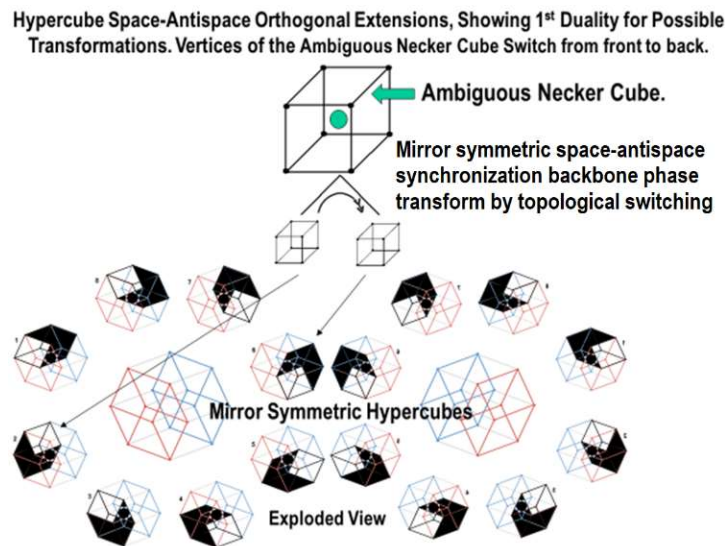
**Figure 26.** Hierarchical tiered elements of XD CQED apparatus of the UFM Interferometer postulated to constructively-destructively interfere with the topology of the XD-LSXD space-antispaces hypertube manifold for manipulation of M-theoretic elements of the unified field. Assumed effects are possible if cumulative interactions of interference occur at resonance nodes in a hierarchy properly aligned for incursion.

In Fig. 26 a Sagnac effect RF-pulsed resonance hierarchy is applied to atomic and spacetime quantum conditions for resonant coupling as a 4-tiered cavity. The Interferometric device must constructively-destructively control the hypertube manifold to manipulate the manifold of uncertainty (MOU).



**Figure 27.** Spatial geometry. a) Expansion of 4D hypercube, with 64 overlying vertices. b-top) Partial CLU exciplex-like array, with one of four orthogonal mirror symmetric configurations labeled. The four orthogonal cubes shown as a cross of dashed and solid lines have interplaying vertex points, dotted – 0101:1011 and 0100:1010; solid – 0110:1101 and 0010:1001. b-bottom) An XD CLU-vacuum complex for *quadrupole* ↔ *dipole* interactions as elements of the UF Minkowski spacetime event horizon at the semi-quantum MOU limit. c) Compactification / dimensional reduction by Necker cube ambiguous L-R phase transitions.

Figure 27 illustrates geometric components for initial mirror symmetric step into XD and how rotations and cyclic boosts / reductions may operate relative to developing required UFM transform based protocol. Every 3-cube represents an ambiguous Necker cube able to perform topological raising and lowering phase transitions.



**Figure 28.** Example of how the periodicity of cyclic supersymmetry or mirror symmetric CLU rotation elements act in dimensional phase transformations by topological switching in boosts and compactification.

The purpose of Fig. 28 in contrast to Fig. 27, is to offer additional clarity for XD mirror symmetric phase transitions of the 1<sup>st</sup> kind by illustrating the myriad elements for dimensional reduction by parallel transport .

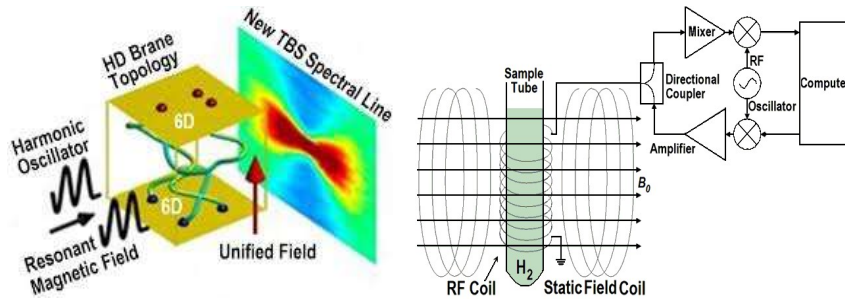
**V. Testing invariance of the Lorentz Transform.** Restrictions from Cramer’s Transactional Interpretation [21] applied to a spacetime exciplex model [2,6] with mirror symmetry can be used for the putative detection of virtual tachyon-tardyion interactions in *zitterbewegung* [33] in violation of Lorentz invariance in special cases circumventing relativistic invariance by warping topological conditions in relation to the three UFM temporal dimensions [62].

**Hypersphere Volumes**

D(n)	Volume	Volume r=1
0	0	0
1	2	2
2	$\pi r^2$	3.14159
3	$4/3 \pi r^3$	4.18879
4	$1/2 \pi^2 r^4$	4.93480
5	$8/15 \pi^2 r^5$	5.26379
6	Degenerate ?	$\infty$

**Table 2:** The general values for Hypervolumes increasing  $n$ -dimensionally in the MOU hypertube radius,  $r$  equal to 1 for unit spheres ( $n$ -balls). If LSXD are found, degeneracy occurs at the MOU hypertube limit of  $r$ , found in the same way the furthest energy level of an atom is detected when the outer electron achieves sufficient energy for escape to infinity. Hyperspherical volumes used to analyze an additional TBS spectrum.

In usual spectroscopy, the first two spectral lines of hydrogen occur at  $.5\text{\AA}$  and  $2\text{\AA}$  suggesting arbitrarily in terms of Table 2, that three additional TBS hyperspherical spectral lines might occur between that range (calculation not performed) at  $.8\text{\AA}$ ,  $1.1\text{\AA}$  and  $1.4\text{\AA}$  for example, to the MOU hypertube limit, whereafter a putative 4<sup>th</sup> TBS spectral line would be degenerate, meaning the input signal would enter LSXD space and fly to infinity.



**Figure 29.** Illustrations of basic TBS protocol. a) Through inductive resonance oscillator signal interferes with the 6D space-antispacespace MOU cavity. If the signal strikes the hyperspherical XD domain wall, as in usual spectroscopic analysis, the signal returns as a new TBS spectral line. b) Simplified experimental NMR-like resonance apparatus for putative LSXD C-QED ionization for hydrogen TBS. Only putative details for rf-modulation for QED resonant TBS are shown, not spectrographic recorders or analytical apparatus.

**VI. Completing Quantum Theory** - Parameters of the de Broglie-Bohm-Vigier causal interpretation of quantum theory are tested by efficacy of the UFM holophote effect (protocol I constraints) as a *super-quantum potential* summing by constructive interference to increase the density of de Broglie matter waves. Leads to military defense shield technologies.

**VII. Coherent Quantum Phase Control** - Supplementary assessment of the de Broglie-Bohm interpretation for presence of a nonlocal *pilot wave - quantum potential* used to manipulate phase space quantization in double-slit experiments controlling which slit a quantum passes through. Proposed aid for quantum measurements and increased transistor lithography density refinements.

**VIII. Manipulation of Spacetime CLU Tessellation Structure** - (similar to the VI<sup>th</sup> experiment) Testing the conformal scale-invariant parameters of the Dirac conformal polarized vacuum, revealing the possibility of a *continuous-state* Feynman synchronization backbone in relation to violation of Lorentz invariance for XD arrow of time modeling (like basic protocol, but more advanced).

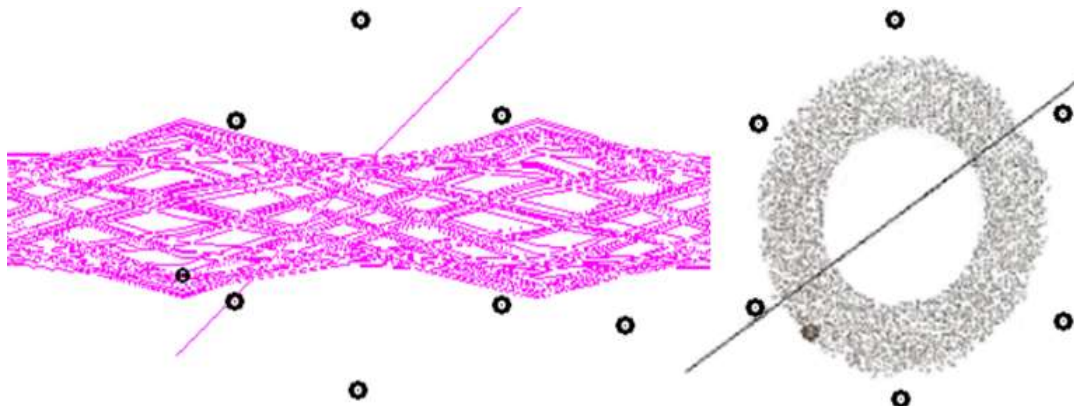
**IX. Testing existence of a UFM Unique String Vacuum** - Currently matter is studied with ever larger supercolliders such as the CERN LHC with analysis occurring by particle spray cross sections.

A new low-energy room temperature table-top method is possible making supercolliders obsolete. Instead of collision spray cross sections; a *slice* may be taken through the M-theoretic topology of the XD-LSXD brane bouquet. This is achieved by sensing variations in topological charge in phase transitions during *topological switching*. This is hinted at in Figs. 11,17,18,30,33.

The taking of brane bouquet cross sections can be understood in terms of the operation of the now common *projected capacitance touchscreen* computer monitor technology where minute frequency changes in conductive traces form capacitive coupling. Instead of a simple X,Y coordinate matrix, a 12D UFM (dual 6D) topological array is required and sensing requires a M-theoretic qubit algorithm UQC [6] to operate. Think of Fig. 33 as a full matrix with petals (branes) from Fig. 11, cycling through the bulk. From Figs. 17,18 we envision nodes crossing, uncrossing and forming knots in periodic cycles. From Fig. 30 we imagine a polarized signal pulsed harmonically through an open hypertube. When the signals field interacts with the topological charge transitions (receptor fields) measurable phase changes occur providing information for the brane dynamics of XD matter parameter. This occurs in a unique brane vacuum with continuous-state parameters [2,3,6].

As shown in Fig. 30, we were able to devise a 2D computer simulated 3-brane production of a Dirac hypertube with a rf-pulsed oscillator configuration to facilitate opening and closing its radius. It was assumed that hexagonal configurations of spacetime are significant in manipulating the Dirac vacuum. Autodesk Chaos Software was utilized in running the simulation [107].

Schönflies theorem proved [108] there cannot be topological knots in a plane. Thus, no topological torsion in a reality of 2D. From the canon of M-Theory for gravity, *matter remains on the 2-brane and gravity is free to pass between branes*. Using Autodesk Chaos Software, we simulated a 2D image of a 3-brane to test aspects of a Dirac electron hypertube as if it were embedded in a Dirac polarized vacuum [74,75] as performed in Fig. 30 [107]. Elements from Figs. 3,25 illustrate the standing-wave dimensional hierarchy of a Cramer-like transaction where 1D to 6D (L-R dual 3-tori) undergo XD dimensional raising and lowering cycles. It is hoped that further study of the computer simulation [107] would reveal parameters required to utilize the inherent beat frequency of the Feynman synchronization backbone [6-9,59,60].



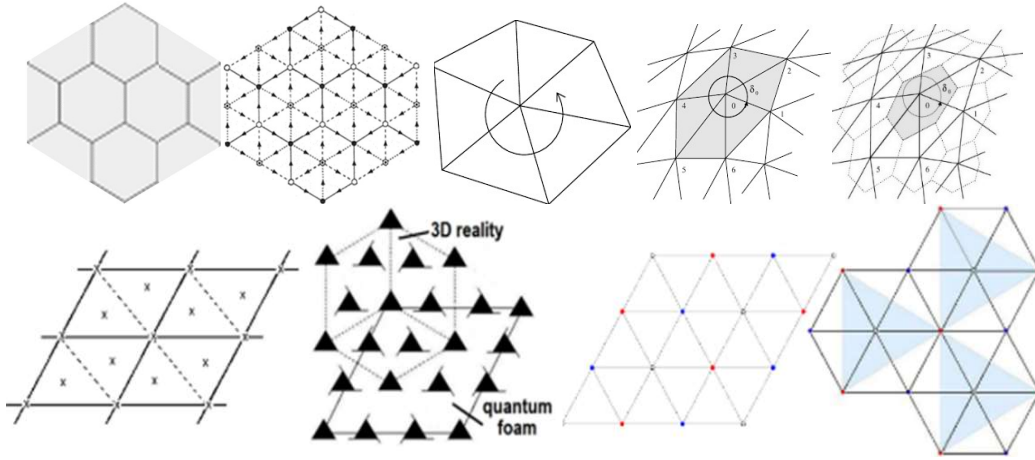
**Figure 30.** Simulated orthogonal renditions of a Dirac electron hypertube, one along its MOU radius and the other from the top as a hexagonal view of a spacetime tessellation rendered by computer simulation. production of a 2-brane from parameters of the hexagonal geometry of the putative Dirac polarized vacuum. An applied hysteresis loop harmonic oscillation of standing-wave dynamics (as in Fig. 3) creates resonant nodes of alternating destructive and constructive interference able to dynamically open and close the hypertube. The software simulates 3-brane dynamics of the CLU geometry of spacetime. Oblique lines represent harmonic rf-resonance pulses rotating around the hexagon as spherical insertion angles and the two tiny dots nearby are holophote insertion points of UFM energy.



**Table 3. SPACETIME HARMONIC OSCILLATOR PARAMETERS**

PARAMETER	VALUE USED	POSSIBLE RANGE
Charge	3	$\pm 500$
Magnetic Capture Radius	5	0 to 20
Magnetic Field Radius	11	1 to 60
Pull Towards Center	27	$\pm 500$
Frequency	33	2 to 10,000
Friction (String Tension)	1.37	0 to 500

Van der Waals forces are susceptible to perturbation and quickly vanish at long distance between molecules (or spacetime CLU tessellations). Both Van der Waals and Casimir forces arise from quantum interactions with the zero-point field [109]. Van der Waals can be either attractive or repulsive [110]. The foundation of C-QED is the Casimir-Polder interaction arising from a neutral atom and a neighboring surface. Conventionally, electron standing-waves oscillate around an atomic nucleus. In this work we want to expand the wave nature of matter as standing-waves centered on CLU hypertube cavities, necessitating adaptation of the de Broglie wave equation,  $mvr = n(h/2\pi)$  to a static form agreeable to the parameters of continuous-state cosmology [2,6]. For Hyperspherical Representation the magnitudes of the radial coordinates of a two-state wavefunction,  $\psi(\vec{r}_1, \vec{r}_2)$  in hyperspherical representation are substituted with the hyperspherical radius,  $R$  and hyperspherical angle,  $\alpha$  so  $R \equiv (r_1^2 + r_2^2)^{1/2}$  and  $\alpha \equiv \arctan r_2/r_1$  allowing the symmetries to be plainly exposed. Hyperspherical radius,  $R$  characterizes size of a 2-state system and hyperspherical angle,  $\alpha$  is the quantity of radial association of the 2-state system [2]. It is important to notice that if  $\alpha = \pi/4$ ,  $r_1 = r_2$ ; and  $\alpha = 0$  or  $\pi/2$  one of the states is at a greater distance from the CLU vertex than the other.



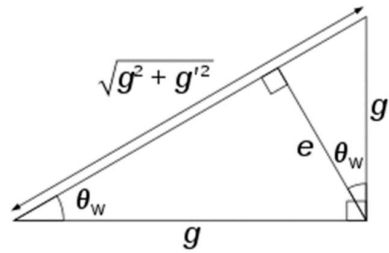
**Figure 31.** Periodic hexagon tiling. a) 2D plane. b) 3D Spacetime with restricted micromagnetic interactions. c) D deficit angle parallel transport 3D to 2D. d,e) Embedding in spacetime CLUs. f) Hexagonal embedding. g) Boost from 0D Planck foam to 3D. h) Hexagonal trefoil. i) Trefoil boost 2D to 3D.

In regards to Fig. 31, projections of 2D and 3D CLU tiling's, give rise to emergent XD in a Dirac vacuum. CLU hypertube tessellations lose stochasticity at the semi-quantum limit; becoming more ordered by coherent control at the deeper range of the MOU by UFM coherence. These are CLU exciplex C-QED backcloth tessellations of space, able to accommodate any geometry and any transform by topological switching [7,8,24].

## 7. Beyond Electroweak-Strong Interaction Symmetry - Metatron Cube of Platonic Solids

Electroweak scale Supersymmetry (SUSY) has been popular over its 40-year development history as a likely candidate to ameliorate the hierarchy problem within Gauge theory without any fine-tuned quadratic divergency cancellations in perturbation theory. More recently strong SUSY is being explored in ATLAS experiments. However, our choice aligns with an XD-LSXD duality. This LSXD ADD model (Arkani-Hamed, Dimopoulos, Dvali), attempts to solve the hierarchy problem by postulating our 4D universe exists on a submanifold of 11D M-theoretic space. The natural forces (electromagnetic, strong, weak) operate within the 4D membrane, but gravity operates across all 11D branes, suggesting why gravitation is much weaker than other three forces [111].

The Glashow-Salam-Weinberg Electroweak unification introduced self-similar geometric symmetry structures producing a renormalizable Yang-Mills field spontaneous symmetry breaking mechanism for the  $SU(2) \times U(1)$  gauge group for the SM  $W^\pm$  and  $Z^0$  bosons [112-115].



**Figure 32.** Weinberg weak mixing angle,  $\theta_w$  with coupling constants,  $g, g', e$ ; adapted from [116].

The spontaneous symmetry breaking mechanism causes the  $W_3$  and  $B$  bosons to coalesce into the  $Z^0$  boson and a photon,  $\gamma$ .

$$\begin{pmatrix} \gamma \\ Z^0 \end{pmatrix} = \begin{pmatrix} \cos \theta_w & \sin \theta_w \\ -\sin \theta_w & \cos \theta_w \end{pmatrix} \begin{pmatrix} B \\ W_3 \end{pmatrix}, \quad (31)$$

with  $\theta_w$  the weak mixing angle where the particle axes have been rotated in the  $(W_3, B)$  plane by angle  $\theta_w$ .

Here we take a cursory look at a weak-strong SUSY alliance and LSXD hierarchy problem in terms of terms of a coincidence of all 5 Platonic solids. Because as suggested in protocol 9 above, the concept becomes experimentally testable in terms of a new class of XD-LSXD low energy room temperature table top cross sections that could reveal the geometric topology of string configurations comprising the structure of subatomic particles and atomic nuclei.

A menagerie of electromagnetic strong mixing angles restricted by mass-charge, angular momentum "Electromagnetic strong force" in 2003 Vigier briefly mentions, with no attempt at correspondence, the Platonic solids [117]. I recently discovered the Metatron cube, a coincidence of all 5 Platonics, the idea is that a particle element can exist at each vertex. With the Weinberg electromagnetic mixing angle in mind (elevated to a 6D topological manifold, in a 12D Einstein space) with myriad more mixing angles for the strong force (spacetime tessellation), I think it might be possible to find correlated *restrictions* to describe a fundamental string for M-theory for the 1st time!

It doesn't appear that quaternions provide a sufficient nilpotency to complete a 12D UFM regime. A configuration called the Octonion snowflake model allows the octonions fold into a cube, I believe it will take Qs and Os to close the Einstein UFM space [118].

In terms of protons and neutrons with extended nuclei, how to build *tight* nuclei with numerous protons and neutrons, is yet to be solved. We look at this scenario in terms of extended non-zero electromagnetic charges within protons and neutrons near new short-range spin zero Coulomb type-

forces existing within protons and neutrons. Current models of these nearby forces say protons and neutrons are repulsive until close proximity, then a binding force appears forcing them to bind. At small enough distances neighboring protons and neutrons directly interact [117].

Assuming:

1) EM charges in extended protons and neutrons, are considered point-like, they interact by spin zero Maxwellian EM 4-vector potentials,  $A_\mu$  related to non-zero photon mass,  $m_\lambda$  with static forces in the KeV region corresponding to spin-0 components of Coulomb fields [117].

2) Equilibrium between protons and neutrons in extended nuclei is approximated at point-like charges ignoring that charges oscillate at velocities  $\vec{v} \simeq c$ , around centers of mass: calculations which ignore any space extension, performed in rest-frame centers of mass. This considers protons and neutrons as point charges which works in a special Lorentz frame where protons and neutrons in our model contain three EM Charges  $\pm 1$  or two EM charges ( $\pm 1$  and neutrinos) so neutron mass is a bit greater in reaction  $n \rightarrow \rho + e^- + \bar{\nu}$  [117].

3) From a model by Moon [119], neutron and proton substructures are not at random locations, but at vertex angles of the five 3D Platonic solids made from equal lengths between their point angles which lying at equal distances on the surface of a 3-sphere (circumsphere) and with only one sphere inscribed (insphere) inside them [117]. They are defined by Table 3 and Fig. 33.

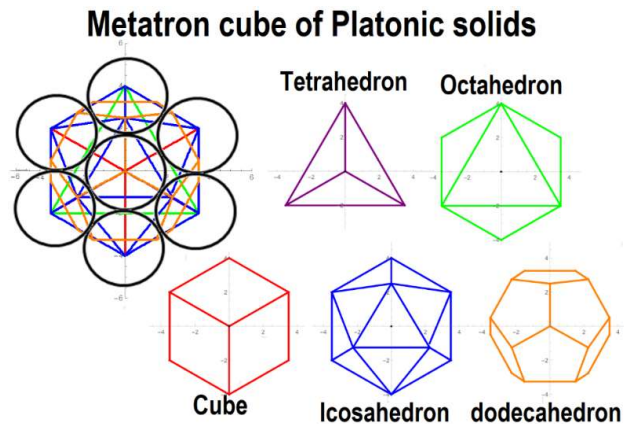
**TABLE 4 – Platonic Solids**

<b>Polyhedron name</b>	<b>Vertices</b>	<b>Faces</b>	<b>Edges</b>
Tetrahedron	4	4	6
Cube	8	6	12
Octahedron	6	8	12
Icosahedron	12	20	30
Dodecahedron	20	12	30
<b>METATRON CUBE</b>	<b>50</b>	<b>50</b>	<b>90</b>

**Table 4.** Geometric elements of the five Platonic solids and their coincidences in the Metatron cube.

Table 4 shows the 50 nested vertices (Metatron cube) with space-antispaces mirror symmetric standing-wave duality seems sufficient to putatively begin to contemplate how to conceptualize the string/brane basis of particle physics and inherent strong interaction UFM mixing angles. Eventual utility of the TBS protocol provides a new type of low energy table-top (sans supercollider) cross sections methodology for testing M-theoretic elementary particle dynamics. The uncertainty principle arises two times: first determining range of the strong nuclear force, and second determining size of the tiniest physical space.

4) The Platonic solids define a limit of what can be constructed in 3-space. The five solids are the only ones that are formed by equal faced, regular planar figures - equilateral triangle, square and pentagon and equal solid angles. The derivative semi-regular Archimedean solids, are formed using two or three regular plane figures for faces in each solid. These solids are all able to be circumscribed by what is called a circumsphere. All the vertices are touched by the sphere. Platonic solids are unique because each has only one sphere - the isosphere, sitting inside, each tangent to the interior of one of the Metatron's 50 faces [117].



**Figure 33.** The Metatron cube, a superimposed assembly of the five Platonic solids on a close packed Cellular Least Unit assembly tessellating spacetime. Adapted from Wolfram [120].

The geometry of these 3D figures can explain the periodicity of atomic volumes of the elements. Atomic number maxima, 3, 11, 19, 37, 55 and 87 categorize atomic species beginning every period of the Mendeleev Table having minima that occur at, or near, atomic numbers 8, 14, 26, 46 marking the complete proton shells. The electromagnetic charge for protons and neutrons moves at velocities close to  $c$  around each internal angle of protons and neutrons, which can only exist at extremities of the 3D volumes having centers separated by precise distances. This is illustrated by Moon's model where tight charges are separated by different distances, lying at different angle points on the vertices of two identical pairs of nested 3D solids [119].

Presuming the protons and neutrons of the 92 natural elements are located at the vertex of two equal pairs of nested solids: they are like the Platonic and Archimedean solids. This is only an approximate description because protons and neutrons carry three and two moving EM charges with  $\bar{v} \approx c$ , therefore having slightly different masses and interior structure. In terms of the center of mass rest frame, volumes are generally spheroid, EM point charges are located in neutrons at opposite sides of their diameter.

5) Elemental properties like compressibility, expansion coefficient, and melting point reciprocity have the same periodicity as atomic volumes, so abrupt changes in nuclear parameters occur around *Magic Numbers*; which can explain how the observed periodicity of physical properties of nucleons is not the same as proton shell periodicity inside nucleons [119].

A path to new physics may be provided for by the Strong Interaction applied to the vertices of the Platonic solids as mixing angles for string / brane topological phase transitions. The field in which a particle is embedded carries the force exerted by the particle mediating its motion through space, the range of which is limited by the Uncertainty Principle,  $\Delta E \Delta t \geq h / 4\pi$ , limited to the Planck time,  $\Delta t \approx \geq h / 4\pi \Delta E$ . This process cannot be detected within the current status of field theory.  $\Delta E$  is associated with a mass,  $\Delta E = mc^2$ , limiting the distance the mediating field particle can travel to  $d \approx c\Delta t$ .

This Metatron cube scenario is highly speculative and axiomatic at this point in development; but to us seems logically sound and internally consistent. Further, if our group is not the one to perform the experiments; it seems of high importance to allow the concepts an arena for debate in the hopes that progress may be accelerated.

## 8. Discussion

From the 60 Years of Yang-Mills Gauge Field Theories conference, I fondly recall Nobel Laureate Davis Gross' comment to me during my presentation on Tight Bound States (TBS): "Some crazy

experiment...” [121]. I supremely appreciating the necessity of rigor, but alas it is too possible to misinterpret precision results by myopic expectations. For example, recalling the biopic film of Steven Hawkins life, he said, “*who is God to tell me how to write my equation.*” Summarizing Hossenfelder: There has been little progress since the 1970s in foundations of physics since the SM of particle physics was formed. Ever since, theories describing observations have remained unchanged. The Higgs-boson, the last established particle, was proposed in the 1960s. But failings, such as no quantization of gravity, dark matter, quantum measurement problem, etc. have remained unsolved for 80 years [122].

No paradigm shift has occurred for over a hundred years, or new physics for 40 or 80 years depending on how one calculates. We suspect three salient reasons: 1) Myopic insistence for the quantization of gravity – which is not the regime integration occurs. 2) If additional dimensions exist, they must be curled up at the Planck scale because they are not observed – there are other interpretations. 3) Ignoring the reality of a Dirac covariant polarized vacuum because it is believed it interferes with Gauge Theory – not so, Casimir, Zeeman, Sagnac and Aharonov-Bohm effects, for all practical purposes, demonstrate the existence of a Dirac covariant polarized vacuum. This scenario justifies a Radical Divergence from Current Thinking; therefore, license has been taken to present radical views, attempting to help induce the imminent paradigm shift.

Feynman claimed gravity may not be quantized [123]; recent Nobel Laureate Roger Penrose spoke more clearly: people think you should quantize GR and this would give you some kind of crazy foam structure... My view for the combination of QM with GR you need a marriage. That marriage will not be a QG in the general sense of the word a QG. It will have to be a theory where QM itself is modified because QM is a self-inconsistent theory. QT can't survive at all levels; it consists of 2 parts. 1) the quantum systems evolution, the Schrödinger equations unitary evolution where a state evolves in time which is an indeterminate equation. 2) what happens when you take a measurement, a completely different theory. The measuring device is supposed to be treated classically according to standard Copenhagen point of view, which doesn't make sense. Why does the quantum system suddenly choose one of the alternatives available? So, there is something missing in the theory itself, the thing missing has to do with gravity. There are conflicts between QM and GR, resolving those conflicts will result in a change in QM [124]. In contrast to Penrose we go one step further; QM is not complete so of course it will be falsified at the semi-quantum limit, however, we propose that there is no QG (except a virtual form at the semi-quantum limit) because the arena of integration is with a 3<sup>rd</sup> regime of natural science – that of an Einsteinian UFM.

I apologize to reviewer(s) of this paper for the license incautiously taken for radical postulates; but the author believes they are logical and delineate sufficient correspondence to current theory, just not in a popular manner. It goes without saying, the panoply proposed is empirically testable; that is what the paper is promulgating; and in spite of problems the issues are in dire need of debate.

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