

Empirical Mediation of the Primary Mechanism Initiating Protein Conformation in Prion Propagation

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Abstract

Transmissible prion based spongiform encephalopathies propagate by conformational change of the prion's protein, PrP structure. An experimental design, relying on the utility of a new fundamental teleological action principle inherent in the topological geometry of a covariant polarized Dirac vacuum putatively driving self-organization in all autopoietic complex living systems, is developed to elucidate the fundamental nature of this conformational change. Further, PrP propagation is considered a mechanical action that can be described by 'interactive computational modes' of 'topological switching' driven by incursive oscillations occurring in the bioenergetics of the prions physical chemistry when improperly coupled to the long-range coherence of the noetic action. The experimental apparatus, a multi-level interferometer, is designed to focus this noetic field in a manner that simulates the mechanism driving PrP conformation to pathological form.

Keywords: Complex systems, Noetic field, Prion, Protein conformation, Topological switching

1. Introduction and Overview

An extensive body of literature exists for phenomena related to the zero-point field; but relative to noetic theory this work is considered descriptive metaphorically of only the 'fog over the ocean' rather than the structural-phenomenology of the ocean itself. Instead the deep structure of a real covariant Dirac polarized vacuum is utilized [1-3]. The Casimir and Zeeman effects are considered evidence for a Dirac vacuum. New assumptions are made concerning the Dirac polarized vacuum relating to the topology of spacetime and the structure of matter cast in a twelve dimensional (12D) form of Relativistic Quantum Field Theory (RQFT) in the context of a new cosmological paradigm called the Holographic Conscious Multiverse (HCM) [4-6]. In this anthropic cosmology the observed Euclidian-Minkowski, $E_3 - \hat{M}_4$ spacetime present is a virtual standing wave of highly ordered Wheeler-Feynman-Cramer retarded-advanced future-past parameters respectively [7,8]. See Figs. 4 & 11 for a graphic illustration of this paradigm. An essential ingredient of HCM cosmology is that a new action principle synonymous with the unified field arises naturally and is postulated to drive self-organization and evolution through all levels of scale [9-11].

In this context an experimental design [12] is introduced to isolate and utilize the new noetic action to test empirically its putative ability to effect conformation in prion protein. The Prion, PrP [13-15], the infectious protein responsible for degenerative

spongiform encephalopathies like Mad Cow, Scrapie and Creutzfeldt-Jacob Diseases is designated as 'system zero', the most primitive known system with anthropic properties, albeit purely mechanistic [9,10,16]. Noetic Theory postulates that prion protein, PrP is 'animated' by the self-organizing properties of the long-range coherence [17,18] of the *élan vital* or unitary noetic field [9,10,19-32]. In addition to manipulating conformational change, from the experimental results we attempt to calculate the energy Hamiltonian required to initiate the misfolds.

2. Structural-Phenomenological Micromagnetics of Proteins and Prion Conformation

Biological molecules contain coupled coherence domains with long-range resonant interactions extending throughout the entire living system [17,18] from and into the surrounding spacetime [9]. This resonant coupling produced by the teleology of the noetic field driving its hierarchical self-organization has local, nonlocal and supralocal (complex HD) parameters [9]. The Schrödinger equation, extended by the addition of the de Broglie-Bohm quantum potential-pilot wave mechanism has been used to describe an electron moving on a neural manifold [33,34]; but this is not a sufficient extension to describe noetic aspects of living systems which requires further extension to include action of the noetic unitary field in additional dimensions. The following is a brief review of quantum properties of water illustrating one regime in the noetic hierarchy [35,36].

Properties of water, the fluid medium supporting life, result from the structure of individual H_2O molecules and intermolecular forces between the molecules dominated by Hydrogen bonds. The capacity of H_2O molecules to form diverse 3-D networks (hexagon, square, & pentagon) of H bonds, while maintaining 4-fold bonding at each molecule is structurally significant. Liquid H_2O is a structurally random network of strained and broken H -bonds. This network is labile; bonds break in one place and reform nearby. Isolated H_2O molecules act as though each H -bond bore a $1/3$ proton charge, and as if the O bore $-2/3$.

Dipoles of neighboring H_2O molecules partially align and act in concert under polarizing influences of an EM -field. This alignment and molecular polarizability stems from a large static dielectric constant, relating to H_2O 's ease in dissolving ionic crystals like alkali halides. Also the H_2O molecules small size allows close approach to ions. At room temperature ~ 1 in 55 million H_2O molecules dissociate into H^+ and OH^- ions readily incorporated into the liquid's random H -bond network. The high mobility of H^+ and OH^- ions causes a net transfer of ionic charge along chains of H -bonds. Crucial conformations in the hydrophilic and hydrophobic chemical groups of complex biochemical molecules are caused by H_2O solvation. In liquid phase atoms are disordered and free to move.

The key to understanding protein folding diseases lies in the arrangements of their amino acid structure. Virtually all proteins consist of two periodic structures called **a**

and **b** sheets whose conformation is derived from the hydrogen bond [37]. Protein folding usually occurs spontaneously as a structural property of the protein itself. If unfolded a protein typically refolds properly without assistance; but some are aided during the folding process by enzymatic proteins called molecular chaperones [38,39] because intermediary structures often have the tendency to aggregate deterring the end result. Chaperones prevent aggregation by keeping chaperoned molecules sequestered inside cavities within their structure. Occasionally a protein will misfold; and recently it has been realized that misfolds are a more common property of proteins than previously suspected [40]. Most proteins fold into one shape only; this is not true of the prion protein, PrP which is also said to act as its own chaperone.

Prion protein whose misfold aggregations damage nerve cells in PrP encephalopathies is constantly produced by the body. Normally it folds properly, remains soluble, and is disposed of without problems. But if misfolded encephalopathic prion protein, PrP^{Sc} 'bumps' into the normal-folding intermediate, PrP* it shifts the folding process and the protein, despite a normal amino acid sequence, ends up as more pathological prion protein. This process continues as long as the body keeps producing the normal protein. Thus the encephalopathic prion self-replicates itself without precursor material or nucleic acid of its own by a pathological chaperone mechanism disrupting the normal conformation pathway. Recent research demonstrates that Alzheimer's Disease, Cystic Fibrosis, an inherited form of Emphysema and many cancers although apparently unrelated all result from protein misfolds [41].

About 250 amino acids comprise the normal cellular form of the prion protein PrP^C found in all mammals which in humans is produced on gene 20 with evidence that the gene is evolutionarily pre-mammalian [41]. Whereas PrP^C is soluble, the infectious form PrP^{Sc} is hydrophobic producing aggregates causing neuropathology; however both PrP^C and PrP^{Sc} have the same chemical makeup, differing only in conformation. The normal cellular isoform PrP^C has three **a** - helices and two small **b** strands. PrP^C is **a** rich; whereas the PrP^{Sc} isoform is **b** rich. That PrP^C is the required precursor for PrP^{Sc} propagation has been demonstrated by Prnp^{0/0} genome studies where disruption of both alleles on mouse chromosome 2 blocks PrP expression such that no prion encephalopathy occurs [41].

PrP^C is produced in the endoplasmic reticulum before it is brought to the cell surface where it can be drawn into a caveola, subcellular cavernous sites. In these cavities if the intermediate conformation, PrP* occurs in the presence of PrP^{Sc} normal cellular PrP^C is converted into more of the infectious form, PrP^{Sc}. It is in this context that the prion acts as its own chaperone or that another protein dubbed protein-X catalyzes the misfold; but so far the search for protein-X has failed [41].

The tenets of Noetic Field Theory (NFT) [20-32] suggest that the X-factor is not a protein but a spacetime-coupled cavity-QED effect of a coherence force inherent in the continuous-state parameters of the unified noetic field. Therefore the etiology of PrP encephalopathies could be generalized by developing this model. The Noetic Field [20-32] produces periodic symmetry variations with long-range coherence [9,10,17,18] that

can lead to a critical Noetic Effect¹ [20,21,27] of consciousness. This can be described by a form of double-cusp catastrophe dynamics (Fig. 3). Operationally the plane of equilibrium experiences sustained hyperincursion by the noetic field. The coupled modes of this process rely on a special form of the harmonic oscillator called the incursive oscillator [42-48]. There is a force of coherence [49]. For example for an Earth observer's temporal perception, railroad tracks recede into a point at the horizon. For an atemporal eternal² HD observer, the tracks remain parallel. This is the origin of the coherence force which forms a kind of logic gate driving equilibrium of the Casimir boundaries to parallel or degenerate modes thus giving rise to the possibility of effecting conformational states.

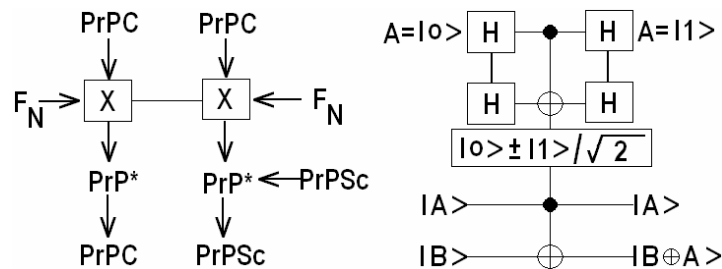


Figure 1. a) Flow chart for Prion propagation, where factor-X is postulated to be the action of Noetic Field, F_N . b) Circuit representation for a possible quantum logic gate configuration for PrP^C Propagation. Two Hadamard gates, H generate a superposed intermediate conformation of PrP^C called PrP* in state $|0\rangle \pm |1\rangle / \sqrt{2}$, illustrating the possibility that the Prion's pathological process acts a quantum Hadamard Controlled-Not Gate; $|A\rangle$ is the control qbit and $|B\rangle$ is the target qbit.

Normal prion protein biochemistry is operationally defined by usual time dependent metabolic quantum fields; but noetic theory postulates that the encephalopathic conformation, probably in conjunction with the PrP* intermediary, in some manner couples to the atemporal realm where a 'force of coherence' creates a telergic 'chaperone effect' acting on the coherence gap created by the presence of the 'stronger' PrP^{Sc} molecule driving conformation in the encephalopathic direction. In this approach, pondering Fig. 2 suggests that molecular serendipity has gifted the fundamental structural-phenomenology of this prion state as a "Rosetta Stone" of anthropic cosmology [50,51]. Soon after this insight we came across a somewhat parallel thought: "...The prion protein thus contained, whether by happenstance or homology, a natural

¹ Noetic Effect – The various resultant effects of the unitary noetic field as its flux enters spacetime and the mind and body of complex living-systems.

² Eternity - Causally free of 4D Euclidian-Minkowski space, with 12D the minimum number of dimensions to define eternity; metaphorically the 'mirror image of a mirror image'.

mechanism for dimerizing about the symmetric tetrapyrrole” [52]. What is meant by this, for noetic theory, is that the PrP* caveola have Cavity-QED resonant properties [53] in synchrony with the noetic field such that the inherent PrP^{Sc} dominance is able to drive PrP^C, when present, to the PrP^{Sc} form.

GEOMETRIC REPRESENTATION OF THE PRION PROTEIN STRUCTURE AND THE NOETIC FIELD EQUATION

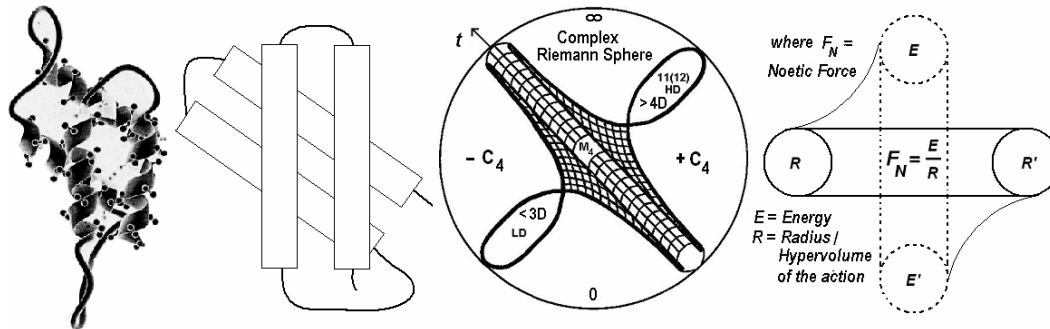


Figure 2. a,b) Best guess putative model of the prion’s protein structure gleaned from over ~300,000 possible choices. a) Ribbon model showing **a, b** sheets. b) A simplified geometry of a). In c,d) Topological and geometric idealizations of the noetic field equation describing an action of the noetic field, called the ‘noetic effect’, on a biological or spacetime manifold.

This noetic postulate is compatible with Prusiner’s view that prion propagation appears to occur by a form of what Prusiner’s group calls ‘Dominant-Negative Inhibition’ [54-56]. They postulate that PrP^{Sc} interferes with PrP^C function in conjunction with an auxiliary molecule called protein-X because PrP^{Sc} exhibits more avid binding properties [41]. However as stated our interpretation for a protein-X differs; we postulate instead that QED cavity dynamics within the canella where PrP* binding occurs can be described as a form of logic-gate for interactive computing³ [57,58]. This is a boundary condition problem; here probably of the Born-von Karman type where the boundary conditions restrict the wave function to periodicity on a Bravais lattice of hexagonal symmetry, stated simply as $\mathbf{y}(r + N_i a_i) = \mathbf{y}_r$, where i runs over the dimensions of the Bravais lattice, a_i are the lattice vectors and N_i are integers [59]. In this model the presence of the periodic spherical rotation effects of the cyclical coherence-decoherence modes allow the action of the noetic field [9,10,60]. This Noetic Processing is governed by the fundamental equation of Consciousness $F_N = E / R$ (Fig. 2). Cyclotron resonance states may maintain homeostasis of the noetic field or induce an electromotive force, the Noetic Effect, on proteins leading to conformational change.

The structural-phenomenology of atoms and molecules is full of domain walls amenable to description by combinations of Gauss’ and Stokes’ theorems ordered in

³ Interactive computing – As opposed to a Turing process that runs unaltered to completion; interactive computing may be interrupted and allows changes to parameters anywhere along the computation process.

terms of Bessel Functions where boundary conditions create resonant cavities built up by alternating static and dynamic Casimir conditions [21,61-63]. As frequency increases central peaks occur with opposite or zero polarity at the domain edges. These properties are relevant to Ising Model [64] spin flips of the domains of the Riemann-Block Spheres effecting homeostatic planes of equilibrium (Fig. 3). The noetic effect can maintain equilibrium or produce catastrophes causing conformational change in protein structures [65].

3. Catastrophe Theory and the Noetic Formalism

Recently the fundamental basis of complex self-organized living systems has been redefined in terms of a new noetic action principle beyond the limitations of 'Biological Mechanism' [9,10]. This model can be utilized to call for a new field of Noetic Medicine [66] based on the structural-phenomenology of the noetic field and whether resultant action of the noetic effect is positive or negative. Living systems exhibit complex self-organization. The noetic field is the factor driving self-organization [9,10]; therefore hyperincursion and anticipatory properties are inherent in the fundamental hierarchical basis of the self-organization which can be formally described in terms of Double-Cusp Catastrophe Theory.

Noetic Action on the Equilibrium Plane of a Double-Cusp Catastrophe

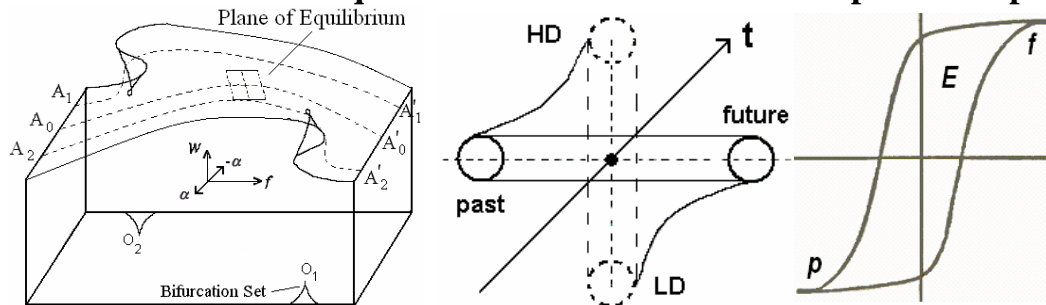


Figure 3. a) The DCC is illustrated showing cusps at each end of the plane of equilibrium. The DCC is said to occur in ≥ 9 dimensions and thought to be the catastrophe form most compatible with the symmetry of NFT. The spacetime component of the plane of equilibrium is a topological manifold tiled of noetic *least units*. The equilibrium manifold undergoes a 'conscious' quantum computation best described by interactive computation. b) Graphically illustrates the fundamental scale invariant noetic equation $F_N = E/R$ of conscious action, the basis of the noetic effect on the plane of equilibrium. c) The hysteresis loop of the Hamiltonian mapped out by the future-past parameters of noetic spacetime. The area E represents the energy of the noetic force F_N .

The structural-phenomenology of Double-Cusp Catastrophe (DCC) Theory in $\geq 9D$ appears homeomorphic to the Riemannian manifold of both 10(11) dimensional M-Theory and the topological geometry of the continuous-state spin exchange dimensional reduction compactification process inherent in the action of the corresponding scale invariant least unit of noetic superspace as cast in HCM cosmology [4-6]. In this general framework the double-cusp *equilibrium surface* is analyzed in terms of a hierarchy of Ising-like *jumps in state* [64] providing a framework for expanding the basis of allopathic medicine and psychology [66] for which the prion is utilized as a fundamental test case. One can say that the noetic least-unit tiling [67,68] the fabric of the Planck backcloth is a complex HD catastrophe manifold with Dirac spherical rotation symmetry mediated by the unitary action of the noetic field.

Any internal or external stress or change in life energy, E is a nonlinear dynamical process producing stability or instability in the boundary conditions of R ; a causal instability in $E \rightarrow \text{stress} \rightarrow \text{displacement} \rightarrow \text{catastrophe} \rightarrow \text{Ising jump} \dots$ whereas stable flux is homeostatic. The hysteresis loop of the noetic field (Fig. 3b) is scale invariant; the same processes occur in HCM cosmology and domains of living systems. The area represents the energy of the string tension or élan vital. This energy, E_N is measured in *Einsteins*, the fundamental physical quantity defined as a ‘mole’ - Avogadro’s number (6.02×10^{23}) of bosons, defined here as noeons of the unitary field [9,10].

Equation (5) describes the equilibrium surface of the DCC [69,70] as modeled in (Fig. 3); where $B \pm Q$ is the state variable and \mathbf{m}_d and \mathbf{u}_d are the control parameters.

$$(B + Q)^3 + (B + Q)\mathbf{m}_d + \mathbf{u}_d = 0 \quad (1)$$

The position of the two cusps is found at $\mathbf{m}_d = 0$ and $\mathbf{u}_d = 0$. At any moment temporal permutations of the noetic catastrophe cycle evolve in time from future to past and higher to lower dimensions in the same manner as the spacetime present of the least-unit of HCM cosmology for the spatial domains: $R^{12} \supseteq \dots R^4 \supseteq R^3 \supseteq R^2 \supseteq R^1 \supseteq R^0$; followed by an Ising rotation where the cycle repeats.

4. Protocol for Experimentally Testing Nosology of Noetic Cosmology

Extrapolating Einstein’s energy dependent spacetime metric, \hat{M}_4 to a 12D standing-wave topology of the noetic multiverse we have designed a spacetime resonance experiment for a Dirac polarized vacuum which has properties like an ‘ocean of light’. If this is true spacetime acts like a ‘surface wave’ on the upper regime of the Dirac Sea and is therefore amenable to descriptive methods of nonlinear dispersive wave phenomena generally of the basic form

$$L(\mathbf{m}) = \mathbf{e} N(\mathbf{m}) \quad (2)$$

where L and N are Linear and Nonlinear operators respectively in the linear limit where $\mathbf{e} = 0$ with elementary dispersive wave solutions $\mathbf{m} = A_i \cos \mathbf{q}_i$, $\mathbf{q}_i = k_i x - \mathbf{w}(k_i)t$ for one dimension plus time where nonlinearity creates resonant interactions between the \mathbf{m}

solutions and the Amplitude, A , depends on t , creating potentially substantial effects where initial absent modes can become cumulative interactions producing shock wave effects.

Motion of a one dimensional classical harmonic oscillator is given by $q = A \sin(\omega t + \mathbf{j})$ and $p = m\omega A \cos(\omega t + \mathbf{j})$ where A is the amplitude and \mathbf{j} is the phase constant for fixed energy $E = m\omega^2 A^2 / 2$. For state $|n\rangle$, with $n = 0, 1, 2, \dots, \infty$ and with Hamiltonian $E_n = (n + 1/2)\hbar\omega$ the quantum harmonic oscillator becomes

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

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

where a & a^\dagger are the annihilation and creation operators, $q = \sqrt{\hbar / 2m\omega} (a^\dagger + a)$ and $p = i\sqrt{m\hbar\omega / 2} (a^\dagger - a)$. For the 3D harmonic oscillator each equation is the same with energies $E_x = (n_x + 1/2)\hbar\omega_x$, $E_y = (n_y + 1/2)\hbar\omega_y$ and $E_z = (n_z + 1/2)\hbar\omega_z$ [71,72].

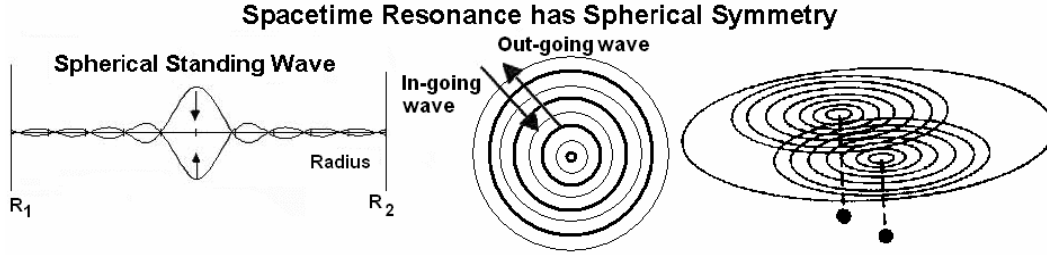


Figure 4. The Dirac polarized vacuum has hyperspherical symmetry. a) Metaphor for standing-wave present showing future-past elements, R_1, R_2 , eleven of twelve dimensions suppressed for simplicity. b) Top view of a) a 2D spherical standing-wave. c) Manipulating the relative phase of oscillations creates nodes of destructive and constructive interference.

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

$$\frac{d^2 x}{dt^2} + \omega^2 x = 0 \quad \text{where} \quad \omega = \sqrt{k/m} \quad (3)$$

which can be separated into the coupled equations [6-9]

$$\frac{dx(t)}{dt} - v(t) = 0 \quad \text{and} \quad \frac{dv(t)}{dt} + \omega^2 x = 0. \quad (4)$$

From incursive discretization, Dubois creates two solutions $x(t + \Delta t)$ $v(t + \Delta t)$ providing a structural bifurcation of the system which together produce Hyperincursion. The effect of increasing the time interval discretizes the trajectory as in Fig. 2 above. This represents a background independent discretization of spacetime [42-45].

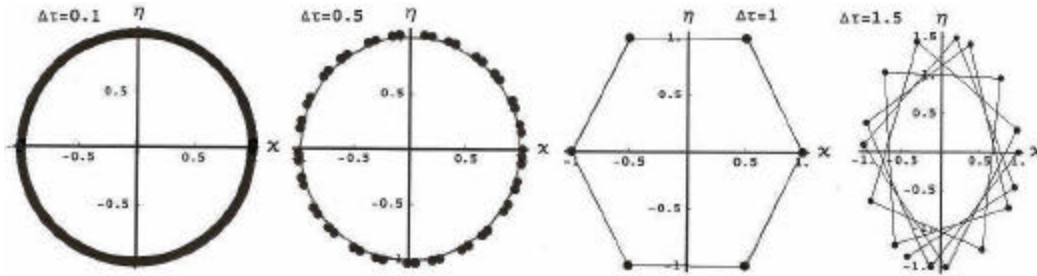


Figure 5. Numerical simulation of the phase space trajectory of the Dubois *superposed incursive oscillator* based on coordinates and velocities $x_n = 1/2[x_n(1) + x_n(2)]$ $v_n = 1/2[v_n(1) + v_n(2)]$ is shown in the figure for values of $\Delta t = \omega t$ equal to 0.1, 0.5, 1.0 and 1.5. Initial conditions are $c_0 = 1, h_0 = 0$ & $t_0 = 0$ with total simulation time $t = \omega t = 8p$. Figure adapted from [42-45].

5. Experimental Design – The L.O.V.E.R.

In NMR spectroscopy often it is easier to make a first order calculation for a resonant state and then vary the frequency until resonance is achieved. For the Noetic Interferometer it is relatively straight forward to determine the spin-spin resonant couplings between the modulated electrons and the nucleons; but achieving a critical resonant coupling with the wave properties of matter and the spacetime backcloth is another matter. Firstly, for HCM cosmology \hbar is not a rigid barrier as in Standard Model Big Bang-Copenhagen cosmology; \hbar is a virtual limit of past-advanced elements of the continuous-state standing-wave present as it cyclically recedes into the past where the least unit [67,68] cavities tiling the spacetime backcloth can have radii \leq the Larmor radius of the hydrogen atom [9,10,73,74]. This new Planck length oscillates through a limit cycle from the Larmor radius of the hydrogen atom to standard \hbar . This is like a wave-particle duality – Larmor radius at the future-retarded moment and \hbar at the past-advanced moment. The dynamics are different for future-retarded elements which have been theorized to have the possibility of infinite radius for $D > 4$ [75]. This scenario is a postulate of string theory. Considering the domain walls of the least-unit structure, the \hbar -Larmor regime is considered internal-nonlocal and the Larmor-infinity regime considered external-supralocal [4-6].

For simplicity we introduce our review of NMR concepts for the hydrogen atom, a single proton with magnetic moment \mathbf{m} , angular momentum \mathbf{J} related by the vector $\mathbf{m} = \mathbf{g}\mathbf{J}$ where \mathbf{g} is the gyromagnetic ratio and $\mathbf{J} = \hbar\mathbf{I}$ where \mathbf{I} is the nuclear spin. The magnetic energy $U = -\mathbf{m} \cdot \mathbf{B}$ of the nucleus in an external magnetic field in the z direction is $U = -\mathbf{m} \cdot \mathbf{B}_0 = -\mathbf{g}\hbar I_z B_0$ where values of I_z , m_l are quantized according to $m_l = I, I - 1, I - 2, I - 3, \dots -1$ [76,77].

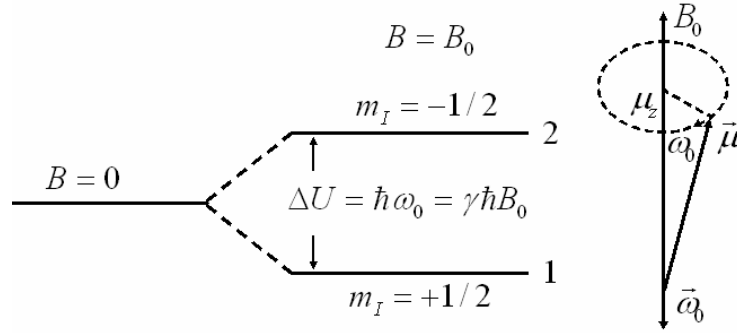


Figure 6. a) The two magnetic energy states for the spin, $I = 1/2$ single proton of a hydrogen atom in a magnetic field. b) Time variation of the magnetic moment of the proton in magnetic field B_0 with precession frequency $\omega_0 = gB_0$, the fundamental resonant frequency from a).

For most nuclear species the z -component of the magnetization, M grows exponentially until it reaches equilibrium according to $M_z(t) = M_0(1 - \exp(-t/T_1))$ where T_1 is the spin-lattice relaxation time. Of interest for the noetic interferometer is the fact that, as shown in Fig. 6a, as \mathbf{m} precesses cyclically from $m_l = -1/2$ to $m_l = +1/2$ the nucleons experience a torque, \mathbf{t} able to change J by $\mathbf{t} = dJ/dt$ or $\mathbf{m} \times \mathbf{B} = dJ/dt$. Under conditions of thermal equilibrium the x - y components are zero; but M_z can be rotated into the x - y plane creating transverse M_x and M_y components $dM/dt = \mathbf{g}M \times \mathbf{B}$ for the entire system by applying a rotating circularly polarized oscillating magnetic field $2B_1 \cos \omega t \hat{i}$ of frequency ω in addition to the constant magnetic field $B_0 \hat{k}$. Now the total time dependent field decomposes into the two counterpropagating fields

$$B_1(\cos \omega t \hat{i} + \sin \omega t \hat{j}) + B_1(\cos \omega t \hat{i} - \sin \omega t \hat{j}). \quad (5)$$

This more complicated form for use with multiple applied fields is necessary, as described below, for use with the Sagnac Effect, quadrupole, and dipole dynamics [78,79] required to operate the noetic 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 $\mathbf{r}(r)$ departure from spherical symmetry defined as the average value of $1/2(3z^2 - r^2)\mathbf{r}(r)$ over the nuclear volume. Q has the dimension of area where the nuclear angular momentum, for which $m_l = I$ where I is the nuclear spin quantum number and m_l is the quantum number for the z component of the spin $m_l = -1, +1, \dots, I-1, I$. Nuclei with $I = 0$ have no magnetic moment and are therefore magnetically inert. Similarly in order for $Q = 0$ the nucleus must be spherical with spin $I \geq 0$. For spin $I = 1/2$ nuclei have

dipole moments, \mathbf{m} but no Q . Q is positive for prolate nuclei and negative for oblate nuclei [80,81].

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 (QT) the length of the nuclear angular momentum vector is $[I(+1)]^{1/2}\hbar$ where measurable components are given by $m\hbar$ with m the magnetic quantum number taking any $(2I + 1)$ value from the series $I, I-1, I-2, \dots, -(I-1), -I$. For the $I = 3/2$ case there are four values along the direction of the applied magnetic field, H_0 .

Of the three types of spin-spin coupling, this experiment relies on the hyperfine interaction for electron-nucleus coupling, specifically the interaction of the nuclear electric quadrupole moment induced by an applied oscillating RF electric field to act on the nuclear magnetic dipole moment, \mathbf{m} . When the electron and nuclear spins are strongly aligned along their z -components the Hamiltonian is $-\mathbf{m} \cdot \mathbf{B}$, and if \mathbf{B} is in the z direction

$$H = -\mathbf{g}_N \mathbf{I} \cdot \mathbf{B} = -\mathbf{g}_N B I_x \quad (6)$$

with $m = \mathbf{g}_N \mathbf{I}$, \mathbf{g}_N the magnetogyric ratio $\mathbf{g}_N = e\hbar/2m_p$ and m_p the mass of the proton [82].

Radio frequency excitation of the nuclear magnetic moment, \mathbf{m} to resonance occurs for a nucleus collectively which rotates \mathbf{m} to some angle with respect to the applied field B_0 . This produces a torque $\mathbf{m} \times B_0$ causing the angular momentum, \mathbf{m} itself to precess around B_0 at the Larmor frequency $\omega_L = \mathbf{g}_N B_0$ [82,83]. This coherent precessing of \mathbf{m} can also induce a 'voltage' in surrounding media, an energy component of the Hamiltonian to be utilized (Figs. 7,10) to create interference in the structure of spacetime [12].

Metaphorically this is like dropping stones in a pool of water: One stone creates concentric ripples; two stones create domains of constructive and destructive interference. Such an event is not considered possible in the standard models of particle physics, quantum theory and cosmology. However Noetic science uses extended versions of these theories wherein a new teleological action principle is utilized to develop what might be called a 'transistor of the vacuum'. Just as standard transistors and copper wires provide the basis for almost all modern electronic devices; This L.O.V.E.R. using the information content of spacetime geodesics (lines) will become the basis of many forms of Noetic Technologies.

Simplistically in this context, utilizing an array of modulated tunable lasers, atomic electrons are RF pulsed with a resonant frequency that couples them to the magnetic moment of the nucleons such that a cumulative interaction is created to dramatically enhance the Haisch-Rueda inertial back-reaction [84-87]. The laser beams are counterpropagating producing a Sagnac effect Interferometry to maximize the violation of Special Relativity. This is the 1st stage of a multi-tier experimental platform designed (according to the tenets of Noetic Field Theory) to "punch a hole" in the fabric of

spacetime in order to isolate and utilize the force \hat{F}_U of the Unitary Field.

The interferometer utilized as the basis for our vacuum engineering research platform has been dubbed the Laser Oscillated Vacuum Energy Resonator (L.O.V.E.R.)⁴. It is a multi-tiered device. The top tier is comprised of counter-propagating Sagnac effect ring lasers that can be built into an IC array of 1,000+ ring lasers. If each microlaser in the array is designed to be counterpropagating, an interference phenomena called the Sagnac Effect occurs that violates special relativity in the small scale [88]. This array of RF modulated Sagnac-Effect ring lasers provides the top tier of the multi-tier L.O.V.E.R. Inside the ring of each laser is a cavity where quantum effects called Cavity Quantum Electrodynamics (C-QED) may occur. A specific molecule is placed inside each cavity. If the ring laser array is modulated with resonant frequency modes chosen to achieve spin-spin coupling with the molecules electrons and neutrons, by a process of Coherent Control [89] of Cumulative Interaction an inertial back-reaction is produced whereby the electrons also resonate with the spacetime backcloth in order to 'poke a hole' in it. This requires a form of RQFT compatible with the 12D version of M-theory called FTheory [90] relying on the symmetry conditions of HCM cosmology within which it is cast [4-6].

LASER OSCILLATED VACUUM ENERGY RESONATOR (L.O.V.E.R.)

Multi-Tiered Experimental Platform

TIER-I	Applied Tunable Laser RF Modulated Pulsed Quadrupole Resonant Counter-Propagating Sagnac Effect Interferometry of Electrons
TIER-II	For the Purpose of Spin-Spin Coupling of Tier-I Electrons to the Magnetic Moment of the Nucleons
TIER-III	By HD RQFT Tier- I & II Undergo Resonant Coupling with the Beat Frequency of the Fabric of Spacetime
TIER-IV	Producing a Multi-Tier Cumulative Interaction of Tier - I - II - III to Destructively Interfere with the Annihilation & Creation operators of Spacetime

Figure 7. Design elements for the HD Cavity-QED trap of the Noetic Interferometer postulated to constructively-destructively interfere with the topology of the 12D spacetime manifold for manipulation of the unitary field. Substantial putative effects are possible if a cumulative interaction of the interference nodes of the cyclotron resonance hierarchy is set up to produce shock waves.

The first step in the interference hierarchy (Fig. 7) is to establish an inertial back reaction between the modulated electrons and their coupled resonance modes with the nucleons. The complete nature of inertia remains a mystery [91]. But if one follows the Sakarov [92] and Puthoff [93] conjecture, the force of gravity and inertia, the initial resistance to motion, are actions of the vacuum zero-point field. Therefore the

⁴ An acronym fostered by the L.O.V.E.R.S. anthropic cosmological elements.

parameter m in Newton's second law $f = ma$ is a function of the zero-point field [84-87,94-96]. Newton's third law states that 'every force has an equal and opposite reaction'. Haisch & Rueda [84-87] claim vacuum resistance arises from this reaction force, $f = -f$. We have also derived an electromagnetic interpretation of gravity and electromagnetism [97] that suggests this inertial back-reaction is like an electromotive force⁵ [9,10] of the de Broglie matter-wave field in the spin exchange annihilation creation process inherent in a hysteresis of relativistic spacetime fabric (Fig. 3). In fact we go further to suggest that the energy responsible for Newton's third law is a result of the continuous-state flux of the ubiquitous noetic field [9,10]. For the L.O.V.E.R. we assume the Haisch-Rueda postulate is correct

$$f = \frac{d\mathbf{r}}{dt} - \lim_{\Delta t \rightarrow 0} \frac{\Delta \mathbf{r}}{\Delta t} \equiv \frac{d\mathbf{r}_*}{dt_*} - \lim_{\Delta t_* \rightarrow 0} \frac{\Delta \mathbf{r}_*}{\Delta t_*} = f_* \quad (7)$$

where $\Delta \mathbf{r}$ is the impulse given by the accelerating agent and thus $\Delta \mathbf{r}_*^{\text{op}} = -\Delta \mathbf{r}_*$ [84-87].

The cyclotron resonance hierarchy must also utilize the proper beat frequency of the continuous-state dimensional reduction spin-exchange compactification process inherent in the symmetry of noetic spacetime naturally 'tuned' to make the speed of light $c \equiv c$. With this apparatus in place noetic theory suggests that destructive-constructive C-QED interference of the spacetime fabric occurs such that the noeton eternity wave, \mathfrak{N} of the unitary field, U_F is harmonically (like a holophote) released into the cavity of the detector array. Parameters of the Dubois incursive oscillator are also required for aligning the interferometer hierarchy with the beat frequency of spacetime.

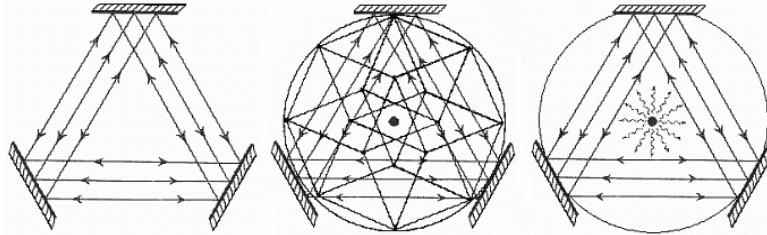


Figure 8. Schematic of a possible configuration for the noetic interferometer. a) Tier 1-RF pulsed laser modulated counterpropagating Sagnac-effect QED cavity. b) Tier 2,3-Resonant electron-nucleon coupling to produce alternating nodes of destructive and constructive interference with the HD topology of the spacetime fabric. c) Tier 4-Holophote release of unitary noetons from the coherently controlled cumulative effect of the interferometry.

If the water wave conception for the 'Dirac sea' is correct, the continuous state compactification process contains a tower of spin states from spin 0 to spin 4. Spin 4 represents the unified field and makes cyclic correspondence with spin 0 where Ising lattice spin flips create dimensional jumps. Spin 0, 1/2, 1, & 2 remain in standard form.

⁵ Electromotive force, E : The internal resistance r generated when a load is put upon an electric current I between a potential difference V , i.e. $r = (E - V) / I$.

Spin three is suggested to relate to the orthogonal properties of atomic energy levels and space quantization. Therefore the spin tower hierarchy precesses through $0, 720^\circ, 360^\circ, 180^\circ, 90^\circ$ & $0 (\infty)$ as powers of i as illustrated in Fig. 9.

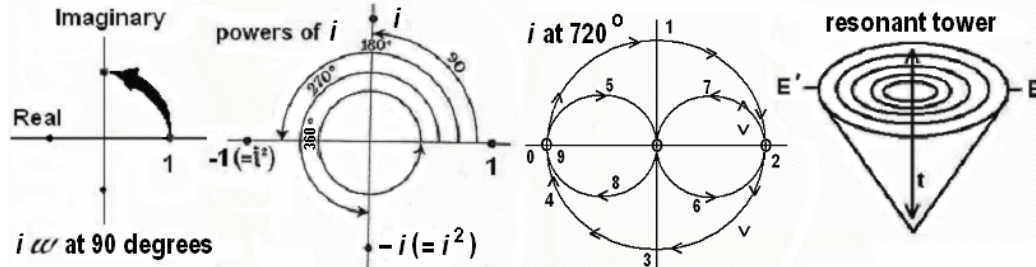


Figure 9. Powers of i in the complex plane. For 90° to 360° the concept can be readily illustrated in 2D; but for 720° and above 4D is required which cannot easily be depicted in 3D so the representation in 9c) is used, which might also be represented by a Klein bottle which was not used because the torus in 9c) more easily shows the rotation topology, which for spin $1/2$ is the Dirac rotation of the electron. 9d) is a simplistic representation of a powers of i resonance hierarchy.

As illustrated in Fig. 10 the coherent control of the multi-level tier of cumulative interactions relies on full utilization of the continuous-state cycling inherent in parameters of HCM cosmology [4-6]. What putatively will allow noetic interferometry to operate is the harmonic coupling to periodic modes of Dirac spherical rotation in the symmetry of the HD geometry. The universe is no more classical than quantum as currently believed; reality rather is a continuous state cycling of nodes of classical to quantum to unitary, $C \rightarrow Q \rightarrow U$. Space does not permit detailed delineation of the parameters of HCM cosmology here; more detailed discussion can be found in [4-6]. The salient point is that cosmology, the topology of spacetime itself, has the same type of spinorial rotation and wave-particle duality Dirac postulated for the electron. Recall that the electron requires a 4D topology and 720° for one rotation instead of the usual 360° to complete a rotation in 3D. The hierarchy of noetic cosmology is cast in 12D such that the pertinent form of relativistic quantum field theory has significantly more degrees of freedom whereby the modes of resonant coupling may act on the structural phenomenology of Dirac ‘sea’ itself rather than just the superficial zero-point field surface approaches to vacuum engineering common until now.

The parameters of the noetic oscillator (Fig.10) may best be implemented by RQFT using a form of de Broglie fusion. According to de Broglie a spin 1 photon can be considered a fusion of a pair of spin $1/2$ corpuscles linked by an electrostatic force. Initially de Broglie thought this might be an electron-positron pair and later 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” [98]. These prospects suggest a deeper relationship in the structure of spacetime of the Cramer type [8] (Fig. 11).

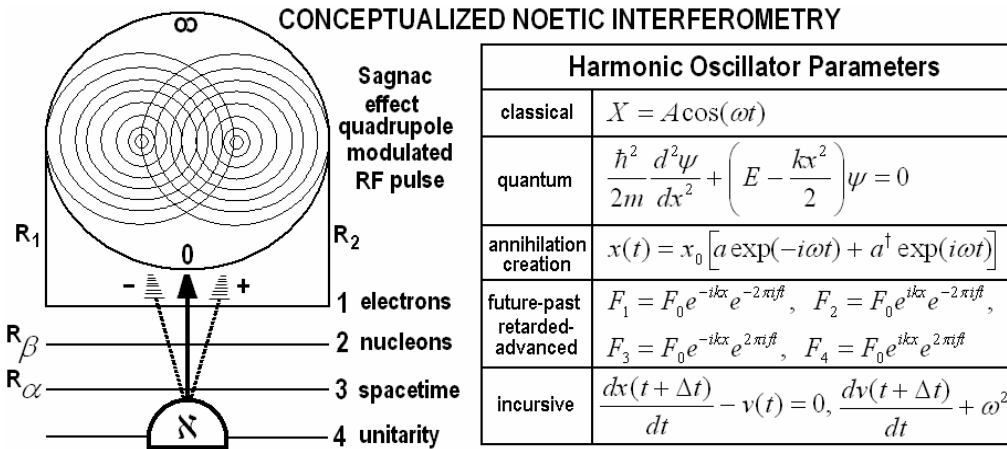


Figure 10. a) Conceptualized cavity-QED multi-level Sagnac effect interferometer designed to ‘punch’ a hole in spacetime to emit the ‘eternity wave , \aleph ’. b) Components of the applied harmonic oscillator - classical, quantum, relativistic, transactional and incursive required to achieve coherent control of the cumulative resonance coupling hierarchy in order to produce harmonic nodes of destructive and constructive interference in the spacetime backcloth.

The epistemological implications of a 12D RQFT must be delineated. The empirical domain of the standard model relates to the 4D phenomenology of elementary particles. It is the intricate notion of what constitutes a particle that concerns us here – the objects emerging from the quantized fields defined on Minkowski spacetime. This domain for evaluating physical events is insufficient for our purposes. The problem is not only the additional degrees of freedom and the associated extra-dimensionality, or the fact that ‘particles’ can be annihilated and created but that in HCM cosmology they are continuously annihilated and recreated within the holograph as part of the annihilation and recreation of the fabric of spacetime itself. This property is inherent in the 12D Multiiverse because temporality is a subspace of eternity [9,10]. This is compatible with the concept of a particle as a quantized field. What we are suggesting parallels the wave-particle duality in the propagation of an electromagnetic wave. We postulate this as a property of all matter and spacetime albeit as continuous-state standing waves.

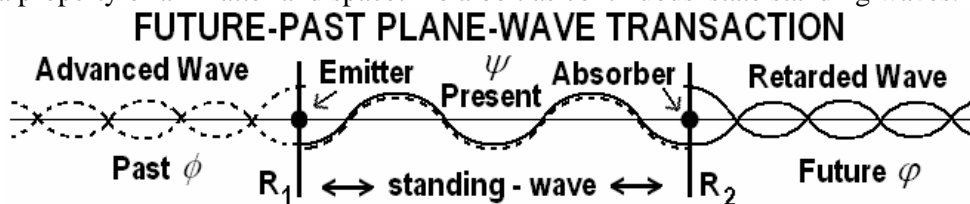


Figure 11. Structure of a transaction (present state or event) where the present is a standing-wave of future-past elements. The separation of these parameters in terms of de Broglie’s fusion model is suggested to allow manipulation of the harmonic tier of the L.O.V.E.R.

For a basic description, following the de Broglie fusion concept, assume two sets of coordinates x_1, y_1, z_1 and x_2, y_2, z_2 which then become

$$X = \frac{x_1 + x_2}{2}, \quad Y = \frac{y_1 + y_2}{2}, \quad Z = \frac{z_1 + z_2}{2}. \quad (8)$$

Then for identical particles of mass m without distinguishing coordinates, the Schrödinger equation (for the center of mass) is

$$-i\hbar \frac{\partial \mathbf{y}}{\partial t} = \frac{1}{2M} \Delta \mathbf{y}, \quad M = 2m. \quad (9)$$

In terms of Fig. 11, (9) corresponds to the present and Eq. (10a) corresponds to the advanced wave and (10b) to the retarded wave [98].

$$-i\hbar \frac{\partial \mathbf{f}}{\partial t} = \frac{1}{2M} \Delta \mathbf{f}, \quad -i\hbar \frac{\partial \mathbf{j}}{\partial t} = \frac{1}{2M} \Delta \mathbf{j}. \quad (10)$$

Extending Rauscher's concept for a complex eight space differential line element $dS^2 = \mathbf{h}_m dZ^m dZ^{*n}$, where the indices run 1 to 4, \mathbf{h}_m is the complex eight-space metric, Z^m the complex eight-space variable and where $Z^m = X_{\text{Re}}^m + iX_{\text{Im}}^m$ and Z^{*n} is the complex conjugate [99,100], to 12D continuous-state noetic spacetime; we write just the dimensions for simplicity and space constraints

$$x_{\text{Re}}, y_{\text{Re}}, z_{\text{Re}}, t_{\text{Re}}, \pm x_{\text{Im}}, \pm y_{\text{Im}}, \pm z_{\text{Im}}, \pm t_{\text{Im}} \quad (11)$$

where \pm signifies Wheeler-Feynman/Cramer type future-past/retarded-advanced dimensions. This dimensionality provides an elementary framework for applying the hierarchical harmonic oscillator parameters suggested in Figs. 7 and 10.

6. Conclusions

We have used prion conformation to illustrate a possible test case for examining the basis of noetic medicine. If the Noetic Interferometer is able to isolate and manipulate the eternity wave, \aleph it will become a primary research platform for developing a whole new class of conscious based technologies; whereas virtually all electronic devices up to now are based on transistors and copper wires. The L.O.V.E.R. could be called a transistor of the vacuum, where rather than copper wires, the geodesics of spacetime are utilized to transfer information.

This brief summary is only a primitive slice introducing the anticipated new field of integrative Noetic Science revolutionizing medicine and psychology and implementing myriad *conscious* technologies like sensory bypass prosthesis or \aleph -wave (eternity-wave) accelerated healing for example. Experimental work is underway to isolate and utilize the noetic field for these tasks.

When the great innovation appears, it will most certainly be in a muddled, incomplete form. To the discoverer himself it will be only half-understood; to everyone else it will be a mystery. For any speculation which does not at first glance look crazy, there is no hope. [101]

Vacuum energy is not 'produced' by the noetic interferometer. The interferometer annihilates the boundary conditions 'insulating' the unitary geodesics of spacetime allowing the holophotic release of noeons by completing a circuit that already exists behind the domain walls. Probably the L.O.V.E.R. releases vacuum energy as a form of superradiance [102].

References

- [1] Dirac, P.A.M. (1952) Is there an ether? *Nature*, 169: 172.
- [2] Petroni, N.C. & Vigier, J-P (1983) Dirac's aether in relativistic quantum mechanics, *Foundations Physics*, 13:2, 253-285.
- [3] Vigier, J-P (1980) *Lett. Nuovo Cimento*, 29: 467.
- [4] Amoroso, R.L. (2002) Developing the cosmology of a continuous state universe, in R.L. Amoroso, G. Hunter, M. Kafatos & J-P Vigier (eds.), *Gravitation & Cosmology: From the Hubble Radius to the Planck Scale*, Dordrecht: Kluwer Academic.
- [5] Amoroso, R.L. (2005) Paradigm for a continuous-state holographic conscious Multiverse, in R.L. Amoroso & B. Lehnert (eds.) *Extending the Standard Model: Searching for Unity in Physics*, Oakland: Noetic Press.
- [6] Amoroso, R.L. (2008) Defining a Context for the Cosmology of Awareness, in R.L. Amoroso & K.H. Pribram (eds.) *The Complementarity of Mind and Body: Realizing the Dream of Descartes, Einstein and Eccles*, Cambridge: MIT University Press.
- [7] Wheeler, J.A., & Feynman, R. (1945) *Rev. Mod. Physics*, 17, 157; Chu, S-Y (1993) *Physical Rev. L.*, 71, 2847.
- [8] Cramer, J. (1986) The Transactional Interpretation of Quantum Mechanics, *Rev. Mod. Phys* 58, 647-687.
- [9] Amoroso, R.L. (2004) The Fundamental Limit and Origin of Complexity in Biological Systems: A New Model for the Origin of Life, in D.M. Dubois (ed.) *Computing Anticipatory Systems*, AIP Conf. Proceedings Vol. 718, pp. 144-159, Melville: American Inst. of Physics.
- [10] Amoroso, R.L. (2008) The Physical Origin of the Principle of Self-Organization Driving Living Systems, in R.L. Amoroso & K.H. Pribram (eds.) *The Complementarity of Mind and Body: Realizing the Dream of Descartes, Einstein and Eccles*, Cambridge: MIT Univ. Press.
- [11] Kafatos, M. Roy, S. & Amoroso, R. (2000) Scaling in Cosmology & the Arrow of Time, in Buccheri, di Gesu & Saniga, (eds.) *Studies on Time*, Dordrecht: Kluwer Academic.
- [12] Amoroso, R.L. (1996) The production of Fröhlich and Bose-Einstein coherent states in in vitro paracrystalline oligomers using phase control laser interferometry, *Bioelectrochemistry & Bioenergetics*, 41:1, pp.39-42.
- [13] Prusiner, S.B. (2002) Research Summary, www.ucsf.edu/neurosc/faculty/neuro-prusiner.html.
- [14] Prusiner, S.B. (1982) *Science*, 216, p. 136-144; Prusiner, S.B. (1998) *Proc Nat. Acad. Sci, USA*, 95, p. 13363-13383.

- [15] Huang, Z., Gabriel, J-M, Baldwin, M.A., Fletterick, R.J., Prusiner, S.B., & Cohen, F.E. (1994) Proposed three-dimensional structure for the cellular prion protein, *Proc. Nat. Acad. Sci, USA*, 91, pp. 7139-7143.
- [16] Varela, F.G., Maturana, H.R. & Uribe, R., 1974, *Autopoiesis: The organization of living systems, its characterization and a model*, *BioSystems*, 5, 187-196.
- [17] Preparata, G. (1995) *QED Coherence in Matter*, Singapore: World Scientific.
- [18] Fröhlich, H. (1968) Long-range coherence and energy storage in biological systems, *Int. J. Quantum Chem.* 2:641-649.
- [19] Driesch, H. (1914) C.K. Ogden (trans.) *The History and Theory of Vitalism*, London: Macmillan.
- [20] Amoroso, R.L. (2008) *Consciousness: The Philosophical Foundations of Noetic Field Theory*, in R.L. Amoroso & K.H. Pribram (eds.) *The Complementarity of Mind and Body: Realizing the Dream of Descartes, Einstein and Eccles*, Cambridge: MIT Univ. Press.
- [21] Amoroso, R.L. & Martin, B., *Modeling the Heisenberg matrix: Quantum coherence & thought at the holoscape matrix and deeper complementarity*, in J. King & K. H. Pribram Eds. *Scale in Conscious Experience* (Lawrence Erlbaum, Mahwah 1995).
- [22] Amoroso, R.L. (1997a) *Consciousness a radical definition: The hard problem made easy*, *The Noetic Journal* 1:1, pp. 19-27.
- [23] Amoroso, R. L. (1997b) *A Brief Introduction to Noetic Field Theory: The Quantization of Mind*, In L. Rakic, G. Kostopoulos, D. Rakovic, & D. Koruga Eds. *Brain and Consciousness*, ECPD: Belgrade.
- [24] Amoroso, R.L. (2000a) *The parameters of temporal correspondence in a continuous state conscious universe*, in R. Bucheri & M. Saniga (eds.) *Studies in the Structure of Time: From Physics to Psycho(patho)logy*, Dordrecht Kluwer Academic.
- [25] Amoroso, R.L. (2000b) *Consciousness, a radical definition: Substance dualism solves the hard problem*, In Amoroso, R.L., Antunes, R, Coelho, C., Farias, M., Leite, A., & Soares, P. (eds.) *Science & the Primacy of Consciousness*, Orinda: Noetic Press.
- [26] Amoroso, R.L (1999a) *An introduction to noetic field theory: The quantization of mind*, *Noetic J.* 2:1, pp. 28-37.
- [27] Amoroso, R.L. & Martin, B.E. (2002) *Consciousness: ‘A Thousand Points Of Light’*, *The Emergence Of Self-Organization From The Noumenon Of The Conscious Universe*, *The Noetic Journal*, 3:4, 289-311.
- [28] Amoroso R.L. (2003a) *Awareness: physical cosmology of the fundamental least unit*, *Noetic Journal* 4:1, 1-15
- [29] Amoroso, R.L. (2003b) *The Fundamental Limit and Origin of Biological Systems*, *Noetic Journal* 4:1; 24-32.
- [30] Amoroso, R.L. (2003c) *The physical basis of qualia: Overcoming the 1st person 3rd person barrier*, *Noetic J.* 4:3, pp. 212-230.
- [31] Amoroso, R.L. (2002a) *The Physical Basis of Consciousness: A Fundamental Formalism, Part 1 Noesis*, XXVI, *Romanian Acad.*
- [32] Amoroso R.L. (2002b) *Developing the cosmology of a continuous state universe*, in R.L. Amoroso, G. Hunter, M. Kafatos & J-P Vigier (eds.), *Gravitation and*

Cosmology: From the Hubble Radius to the Planck Scale, Dordrecht: Kluwer Academic Pub.

- [33] Pribram, K.H. (1995) in J. King & K.H. Pribram (eds.) *Scale in Conscious Experience: Is the Brain too Important to be Left to Specialists to Study?*, Lawrence Erlbaum.
- [34] Jibu, M. & Yasue, K. (1995) *Quantum Brain Dynamics and Consciousness*, Amsterdam: John Benjamins.
- [35] Amoroso, R.L, 2004, *Collective Modes Of Ordered Water As A Synchronization Backbone For Quantum Neuromolecular Computation And Consciousness*, *The Noetic Journal*, 4:4, 370-377.
- [36] Del Giudice, E., Preparata, G. and Vitiello, G. (1988), *Water as a Free Electric Dipole Laser*. *Physical Review Letters*. V.61,9:1085-1088.
- [37] Pauling, L. & Corey, R.B. (1951) *Configurations of polypeptide chains with favored orientations of the polypeptide around single bonds: Two pleated sheets*, *Proc. Natl. Acad. Sci. Wash.*, 37:729-740.
- [38] Fenton, W.A. & Horwich, A.L. (2003) *Chaperonin-mediated protein folding: fate of substrate polypeptide*, *Q Rev Biophys*, 36:2; 229-256.
- [39] Ellis R.J. & van der Vies, S.M. (1991) *Molecular chaperones*, *Ann. Rev. Biochem.* 60:321-347.
- [40] Stefani, M. et al (2001) *Folding & Aggregation are selectively influenced by the Conformational preferences of the alpha-helices of muscle acylphosphatase*, *J. Biol. Chem.* 276:40, 37149-37154.
- [41] Prusiner, S. (ed.) (2004) *Prion Biology and Diseases*, 2nd Edition, New York: Cold Spring Harbor Laboratory Press.
- [42] Dubois, D.M. (2001) *Theory of incursive synchronization and application to the anticipation of delayed linear and nonlinear systems*, in D.M. Dubois (ed.), *Computing Anticipatory Systems: CASYS 2001 –Fifth Intl Conference*, Am Inst of Physics: AIP Conf. Proceedings 627, pp. 182-195.
- [43] Antippa, A.F. & Dubois, D.M. (2008) *The synchronous hyperincursive discrete harmonic oscillator*, in D. Dubois (ed.) *proceedings of CASYS07*, preprint.
- [44] Dubois, D.M. (2008) *The quantum potential and pulsating wave packet in the harmonic oscillator*, in D. Dubois (ed.) *proceedings of CASYS07*, preprint.
- [45] Antippa, A.F. & Dubois, D.M. (2004) *Anticipation, orbital stability and energy conservation in discrete harmonic oscillators*, in D.M. Dubois (ed.) *Computing Anticipatory Systems*, AIP Conf. Proceedings Vol. 718, pp.3-44, Melville: American Inst. of Physics.
- [46] Amoroso, R.L (2005) *Application of double -cusp catastrophe theory to the physical evolution of qualia: Implications for paradigm shift in medicine & psychology*, in G.E. Lasker & D.M. Dubois (eds.) *Anticipative & Predictive Models in Systems Science*, Vol. 1, pp. 19-26, Windsor: The International Institute for Advanced Studies in Systems Research & Cybernetics.
- [47] Di Biase, F. & Amoroso, R.L. (2008) *Holoinformational consciousness: An extension of interactive dualism with anticipatory parameters*, in D. Dubois (ed.) *proceedings of CASYS07*, preprint.

- [48] Amoroso, R.L. & Amoroso, P.J. (2005) Elucidating the Trigger of Alzheimer's Disease: A Complex Anticipatory Systems Approach, in D. Dubois (ed.) proceedings of CASYS03.
- [49] Icke, V. (1995) *The Force of Symmetry*, Cambridge: Cambridge Univ. Press.
- [50] Amoroso, R.L. & Pribram, K.H. (eds.) (2008) *The Complementarity of Mind and Body: Realizing the Dream of Descartes, Einstein and Eccles*, Cambridge: MIT University Press.
- [51] Amoroso, R.L. (2008) *How to Build a Conscious Quantum Computer: The Immanent Era of Conscious Technologies*, submitted, Cambridge: MIT Univ. Press.
- [52] Webmaster, www.mad-cow.org/porphyrin.html
- [53] Berman, P.R. (ed.) (1994) *Cavity Quantum Electrodynamics*, New York: Acad. Press.
- [54] Perrier, V., Kaneko, K., Safar, J., Vergara, J., Tremblay, P., DeArmond, S.J., Cohen, E.E., Prusiner, S.B. & Wallace, A.C. (2002) Dominant-negative inhibition of prion replication in transgenic mice, *Proc. Nat. Acad. Sci.* 99: 13079-13084.
- [55] Perrier, V., Wallace, A.C., Kaneko, K., Safar, J., Prusiner, S.B. & Cohen, E.E. (2000) Mimicking dominant-negative inhibition of prion replication through structure-based drug design, *Proc. Nat. Acad. Sci.* 99: 6073-6078.
- [56] Ueda, Y. & Akamatsu, N. (1981) Chaotically transitional phenomena in the forced negative-resistance oscillator, *IEEE Transactions on Circuits & Systems*, Vol. CAS-28, No. 3, 217-224.
- [57] Wegner, P. (1998) Interactive foundations of computing, *Theoretical Computer Science*, 192, 315-351.
- [58] Milner, R. (1993) Elements of interaction, *Comm. of the ACM*, 36:1, 78-89;
- [59] Calzolari, A., Marzari, N., Souza, I. & Nardelli, M.B. (2003) arXiv:cond-mat/0311018.
- [60] Amoroso, R.L. (2003) Awareness: Physical Cosmology of the Fundamental Least Unit, *The Noetic Journal*, 4:1;7-23.
- [61] Schwinger, J. (1992) Casimir energy for dielectrics, *Proc. Nat. Acad. Sci. USA* 89, 4091-3.
- [62] Schwinger, J. (1993) Casimir light: The source, *Proc. Nat. Acad. Sci USA* 90, 2105-6.
- [63] Schwinger, J. (1994) Casimir energy for dielectrics: spherical geometry, *Proc. Nat. Acad. Math. Psych.* 41:64-67, San Francisco: W.H. Freeman.
- [64] Witten, E. (1996) Reflections on the fate of spacetime, *Phys. Today*, (April) pp. 24-30.
- [65] Amoroso, R.L. (2005) Application of double-cusp catastrophe theory to the physical evolution of qualia: Implications for paradigm shift in medicine & psychology, in G.E. Lasker & D.M. Dubois (eds) *Anticipative & Predictive Models in Systems Science*, Vol. 1, pp. 19-26, Windsor: The International Institute for Advanced Studies in Systems Research & Cybernetics.

- [66] Amoroso R.L. (2007) The Physical Basis of consciousness: Implications for noetic Medicine and Transpersonal Psychology, in J. Mancilha & F. DiBiase (eds.) *O Cérebro E A Consciência*, in press.
- [67] Amoroso R.L. (2003) Awareness: physical cosmology of the fundamental least unit, *Noetic Journal* 4:1, 1-15.
- [68] Stevens, H.H. (1989) Size of a least unit, in M. Kafatos (ed.) *Bell's Theorem, Quantum Theory and Conceptions of the Universe*, Dordrecht: Kluwer Academic.
- [69] Qin, S. et al. (2001) *Int. J of Solids & Structures*, 38, pp. 8093-8109.
- [70] Poston T. & Stewart, I (1978) *Catastrophe Theory & Its Applications*, New York: Dover; Gilmore, R. (1981) *Catastrophe Theory for Scientists & Engineers*, Dover.
- [71] Bohm, D. (1963) *Quantum Theory*, pg. 353, Englewood Cliffs: Prentice-Hall.
- [72] Messiah, A. (1999) *Quantum Mechanics*, pg 438, 444, New York: Dover.
- [73] Hatfield, B. (1992) *Quantum Field Theory of Point Particles and Strings*, Reading: Addison-Wesley.
- [74] Grotz, K. & Klapdor, H.V. (1990) *The Weak Interaction in Nuclear, Particle and Astrophysics*, New York: Adam Hilger.
- [75] Randall, L. (2005) *Warped Passages, Unraveling the Mysteries of the Universe's Hidden Dimensions*, New York: Harper-Collins.
- [76] Slichter, C.P. (1990) *Principles of Magnetic Resonance*, 3^d edition, Springer Series in Solid-State Sciences 1, New York: Springer.
- [77] Schumacher, R.T. (1970) *Introduction to Magnetic Resonance*, Menlo Park: Benjamin-Cummings.
- [78] Farrar, T.C. & Becker, E.D. (1971) *Pulsed and Fourier Transform NMR*, New York: Academic Press.
- [79] Abragam, A. (1961) *Principles of Nuclear Magnetism*, Oxford: Clarendon Press.
- [80] Dehmelt, H.G. (1954) Nuclear quadrupole resonance, *Am. J. Physics*, 22:110.
- [81] Semin, G.K, Babushkina, T.A. & Yakobson, G.G. (1975) *Nuclear Quadrupole Resonance in Chemistry*, New York: Wiley.
- [82] Atkinson, P.W. (1994) *Molecular Quantum Mechanics*, 2nd edition, Oxford: Oxford University Press.
- [83] Hausser, O. (1974) Coulomb reorientation, in J. Cerny (ed.) *Nuclear Spectroscopy and Reactions*, Part C, New York: Academic Press; Humieres, D., Beasley, M.R., Huberman, B.A. & Libchaber, A. (1982) Chaotic states and routes to chaos in the forced pendulum, *Physical Rev A*, 26:6, 3483-34.
- [84] Rueda, A. & Haisch, B. (1998) Contributions to inertial mass by reaction of the vacuum to accelerated motion, *Foundations of Physics*, 28:7, 1057-1108.
- [85] Rueda, A. & Haisch, B. (1998) *Physics Lett. A*, 240, 115.
- [86] Rueda, A., Haisch, B. & Puthoff, H.E. (1994) *Phys. Rev. A*, 49, 678.
- [87] Rueda, A. & Haisch, B. (2002) The inertia reaction force and its vacuum origin, in R.L. Amoroso, G. Hunter, M. Kafatos & J-P Vigier (eds.), *Gravitation & Cosmology: From the Hubble Radius to the Planck Scale*, pp. 447-458, Dordrecht: Kluwer Academic.
- [88] Vigier, J-P (1997) New non-zero photon mass interpretation of the Sagnac effect as direct experimental justification of the Langevin paradox, *Physics Let. A*, 234:2, 75-85.

- [89] Garcia -Ripoli, J.J., Zoller, P. & Cirac, J.I. (2005) Coherent control of trapped ions using off-resonant lasers, *Physical Rev. A* 71, 062309, pp. 1-13'
- [90] Kaku, M. (1999) *Introduction to Superstrings and M-Theory*, New York: Springer.
- [91] Vigier-J-P (1995) Derivation of inertial forces from the Einstein-de Broglie-Bohm causal stochastic interpretation of quantum mechanics, *Found. Phys.* 25:10, 1461-1494.
- [92] Sakharov, A.D. (1968) *Sov. Phys. Dokl.* 12, 1040.
- [93] Puthoff, H.E. (2002) Polarizable vacuum approach to General Relativity, in R.L. Amoroso, G. Hunter, M. Kafatos & J-P Vigier (eds.), *Gravitation & Cosmology: From the Hubble Radius to the Planck Scale*, pp. 431-446, Dordrecht: Kluwer Academic.
- [94] Burns, J.E. (1998) Entropy and vacuum radiation, *Found. Phys.* 28 (7), 1191-1207.
- [95] Burns, J.E. (2002), Vacuum radiation, entropy and the arrow of time, in R.L. Amoroso, G. Hunter, S. Jeffers & M. Kafatos, (eds.), *Gravitation & Cosmology: From the Hubble Radius to the Planck Scale*, Dordrecht: Kluwer Academic.
- [96] Zeh, H.D. (1989) *The Physical Basis of the Direction of Time*, New York: Springer-Verlag.
- [97] Vigier, J-P & Amoroso, R.L. (2002) Can one unify gravity and electromagnetic fields? in R.L. Amoroso, G. Hunter, S. Jeffers & M. Kafatos, (eds.), *Gravitation & Cosmology: From the Hubble Radius to the Planck Scale*, Dordrecht: Kluwer Academic.
- [98] Borne, T., Lochak, G. & Stumpf, H. (2001) *Nonperturbative Quantum Field Theory and the Structure of Matter*, Dordrecht: Kluwer Academic.
- [99] Rauscher, E.A. (1983) *Electromagnetic Phenomena in Complex Geometries and Nonlinear Phenomena, Non-Hertzian Waves and Magnetic Monopoles*, Millbrae: Tesla Books; (2008) 2nd edition, Oakland: The Noetic Press, and references therein.
- [100] Rauscher, E. (2002) Non-Abelian gauge groups for real & complex Maxwell's equations, in R.L. Amoroso, G. Hunter, S. Jeffers & M. Kafatos, (eds.), *Gravitation & Cosmology: From the Hubble Radius to the Planck Scale*, Dordrecht: Kluwer.
- [101] Dyson, F.J. (1958) Innovation in Physics, *Scientific American* 199, No. 3, September.
- [102] Eberly, J.H. (1972) Superradiance revisited, *AJP*, 40, pp. 1374-1383.