The Fundamental Limit and Origin of Complexity in Biological Systems: A New Model for the Origin of Life

Richard L. Amoroso*, Paul J. Amoroso¶

*Noetic Advanced Studies Institute - Physics Lab, 120 Village Square MS 49, Orinda, CA 94563-2502 USA, Email: cerebroscopic@mindspring.com
¶DoD Injury Surveillance and Prevention Work Group, U.S. Army Research Institute of Environmental Medicine, Natick, MA 01760 USA, Email: paul.amoroso@na.amedd.army.mil

Abstract. Generally unicellular prokaryotes are considered the most fundamental form of living system. Many researchers include viruses since they commandeer cellular machinery in their replication; while others insist viruses are merely complex infective proteins. New biological principles are introduced suggesting that even the prion, the infectious protein responsible for transmissible spongiform encephalopathies, qualifies as the most fundamental form of life; and remains in general concordance with the six-point definition of living systems put forth by Humberto Maturana and his colleagues in their original characterization of living organisms as a class of complex self-organized autopoietic systems in 1974.

Keywords: Autopoiesis; Biological mechanism, Complexity; Living-systems; Prion

1 INTRODUCTION

"What is the necessary and sufficient organization for a given system to be a *living unity*?" [1]. Maturana and his collaborators posed this question in their effort to formalize the general definition of a living system. They further stated that all other functions are secondary to the task of establishing and maintaining this unitary organization; defining this process as *autopoiesis* [1]. For review, the description of an autopoietic living system is as follows:

Autopoiesis from the Greek 'self-production' is a fundamental expression of the basic complementarity of structure and phenomenology [2,3,4]. An autopoietic system is self-organized, complex, open, dissipative, self-referential, auto-catalytic, hierarchical, far from equilibrium and autonomous. A system is autopoietic when its primary function is self-renewal through self-referential activity. This contrasts an allopoietic system like a robot deriving function from an external source. Stated another way autopoiesis is a network of production components participating recursively as a globally stable structure operationally separable from the background [1,2].

These properties operate in an ascending hierarchy:
- An autopoietic system is an open non-equilibrium system. If closed in equilibrium all processes die down.
- The processes are cyclical.
- As a complex self-organized system, operations occur within multi-levels where higher levels contain all lower levels.
- Function – the primary function of the system is autopoiesis as defined above [1].

1.1 Summary Of Maturama's Six-Point Key For The Determination Of Life

1. Does the entity have identifiable boundaries?
2. Does the entity have unique constitutive elements?
3. Is the entity a *mechanistic system* possessing properties satisfying certain relations for its interactions and transformations?
4. Do the components constituting the boundaries of the entity act through preferential relations and interactions between the components?

5.   Are the components constituting the boundaries of the entity produced by interactions of the components either by transformation of previously produced components, or by transformations and/or coupling of non-component elements that enter the entity through its boundaries.

6.   If all the other components of the entity are produced by the interaction of the components as in 5, the entity is an autopoietic entity in the space in which it exists [2].

1.2 Non-Autopoietic Entities That Seem To Satisfy Maturana's Conditions

Automata - Superficially automata [5] seem to obey Maturana's six points for autopoiesis, especially in terms of self-reproduction and autonomy; but they are readily disqualified for two salient reasons: Automata are generally nonphysical and cannot naturally escape or exist outside of the computer system they are programmed in.

Crystals - Crystalline structures conform to many of Maturana's six key requirements. The symmetry of the *unit cell* contains the geometric framework of the whole periodic structure, which is repeated in translations of the unit cell. So although a crystal has open self-organized boundary conditions, appears to be recursive and can reproduce; a crystals main failing is that it remains mainly a chemical reaction because its 'unique constitutive elements' can only be reproduced and remain structure preserving under precise conditions of chemical reactivity.

Ribosomes - Although partially comprised of components produced by the ribosome, as entities they are produced by processes beyond those comprising their operation and their function is not completely self-referential [1]. Ribosomes have high level metabolic properties but they are organelles not unique unities.

Belousov-Zhabotinsky Reaction - A key aspect of a self-organized autopoietic system is its globally stable structure over an extended time. These are called *dissipative structures* because they maintain a continuous production of entropy, which is then continually dissipated. The best known dissipative structure is the Belousov-Zhabotinsky Reaction produced by the oxidation of malonic acid by bromate where rotating concentric or spiral waves create interference patterns oscillating with a periodicity maintaining itself for many hours [2,6]. Although self-organized with environmental interplay, can this be more than a recursive chemical reaction?

Jantsch and Maturana both state that dissipative chemical reactions like the Belousov-Zhabotinsky reaction and the glycolytic cycle qualify as primitive autopoietic systems [1,2]. Should these or any of the entities in section 1.2 above be accepted as living systems? Maturana's six-point key is not experimental; but a set of logical premises, and in that sense arbitrary philosophical deduction. Even if these systems are considered autopoietic by the claim of definition, the thesis developed here is to not accept these types of entities as living-systems but to make a case for requiring additional physical principles added to Maturana's key to complete the requirements for properly defining a unique class of autopoietic systems qualifying as true living-systems. Our conclusion is that Maturana's autopoiesis at best only defines the mechanistic components of self-organization.

2 MECHANISM IN BIOLOGY AS A SEMI-CLASSICAL LIMIT

Autopoietic systems as defined by Maturana are a special class of *mechanistic system*. This is a challenging philosophical issue. It is generally considered an open question whether all biological process can be described completely in terms of the 'mechanisms' of physics and chemistry. In the philosophy of biology *mechanism* is defined as the view that every event described as a biological event is the same as those exemplified in non-biological physical chemistry [7,8]. Beckner in a discussion of *mechanism* states:

"It is plausible to suppose that biology contains terms that could not be defined by reference to physics and chemistry, particularly if we count psychological phenomena as special cases of the biological, but perhaps even if we do not. Biological theory takes account of the circumstances of an event's occurrence in a way that the physical sciences do not. For example, it is a biological fact that lions hunt zebras. The biological mechanist ought to insist merely that everything that happens in a given case of zebra hunting is identical with a sequence of physicochemical events, not that the concept of hunting can be defined in physicochemical terms. It may be the case that *hunting* can be defined only in intentional language" [8].

This has left the final sense of reduction for the standard model of biology an open question; and until recently this is where conceptual development had to remain. The philosophy of biological mechanism reviewed here is akin to philosophical naturalism that states that 'the natural world represents the whole of reality without requiring any additional teleological parameters'. This suggests that the current limits of scientific pragmatism provide sufficient explanation for all universal phenomena. Arguments on mechanism and naturalism have probably not been quite beaten to death but let it suffice here to postulate that additional scientific laws are yet to be discovered because 'lion hunting' as intentional action is not describable by the laws of physics and chemistry.

One cannot in good conscience label the Belousov-Zhabotinsky reaction [2,6] as a living system any more than one can logically allocate consciousness with reasonable definition to the bi-level state of a thermostat as is often done in Artificial Intelligence (AI) circles. The sophistication of self-organization in autopoietic systems cannot be

discounted. While this inherent complex order provides a highly efficient substrate for living systems to be built on, like a little finger applied to the helm of a megaton ship, mechanism alone provides an insufficient basis for describing living systems. A teleological principle, inherent in a conscious universe [9,10], acting in concert with mechanism is required for life; providing components of what cosmologists have recently called the holographic cosmological principle.

2.1 New Cosmology Leads To Redefinition Of Biology

Until the advent of the Noetic cosmology [9,10,11,12] physical cosmologists generally believed that the universe could not be ordered enough to have a symmetric spacetime with an inherent periodicity where events are structured such that the future-past prepares the 'nows' evolution into the future [9]. These spacetimes were considered nonphysical and appeared to violate the causal principles of quantum theory [13]. The semi-classical limit in physics refers to the boundary between classical mechanics and quantum mechanics where an incomplete understanding of the dynamics of a system allows only statistical predictions to be made on the behavior of a system rather than a precise determination [14]. Consciousness is able to violate quantum causality. Quantum mechanics is known to be both incomplete and not able to describe biological systems; therefore how can biological mechanism offer a complete framework for living-systems!

Self-organization produces *freedom* and the degree of autonomy a system achieves in relation to its environment provides one way to loosely define *consciousness*. Jantsch says "this autonomy appears as an expression of the fundamental interdependence of structure and function which is one of the most profound laws of dissipative self-organization" [2]. Drãgãnescu further adds "If a virus is alive it has a phenomenological subconscious, if not, it cannot have any form of consciousness, because there is no structural organization with sufficient complexity to process structural information significantly"[4]. This is similar to Maturana's idea that the autonomy obtained by autopoiesis relegates a primitive form of consciousness, even to chemical dissipative structures, which he calls a *cognitive domain* in relation to the systems environment [3]. This is where we will draw a line in the sand giving a definitive description of the term *cognitive domain* that goes beyond mechanism.

Consciousness, and not necessarily that with self-awareness, requires a sufficient number of degrees of freedom beyond those of an allopoietic mechanistic automaton. While one might reluctantly concede that the Belousov-Zhabotinsky reaction [2,6] is autopoietic by Maturana's original definition [1]; one cannot proscribe a cognitive domain with the structural-phenomenology of intentional awareness to such an autocatalytic pattern-producing chemical reaction. How is this ultimately different than programmed automata? We believe that embracing biological mechanism leads one into the trap of 'conscious thermostats'. The autocatalytic chemistry of the Belousov-Zhabotinsky reaction has a cyclical self-organization that keeps the cycle in motion recursively by a chaotic component in the symmetry of the boundary conditions leading generally to a global stabilization of the reaction until a chance occurrence of an ordered ground state occurs. One could argue the reaction is the result of the inherent activity in the reactions so-called *cognitive domain* because it includes a self-referential multilevel hierarchy that maintains the cycle of the reactions self-production. One could carry this argument further to lend correspondence with Prigogine's symmetry breaking factors in the thermodynamics of evolution [15,16]. But the driving force described by these arguments is not an intrinsic *intentional awareness*; it is more like the incongruent geometric symmetries driving the chain of unstable intermediaries in a radioactive decay series– an automatic unraveling continues as long as a stable ground state with boundary conditions that preserve the unity of the intermediate atom cannot be reached.

3 LIVING-SYSTEMS AND CONSCIOUSNESS

Recall Jantsch's claim that the Beluzov-Zhabotinski reaction, as a result of its classification as an autopoietic system by Maturana's definition [3], has rudimentary consciousness [2,17]. For decades researchers have believed that consciousness is merely a computer program, "a special software in the hardware of the brain or just a matter of information processing" [18]. This does not seem acceptable; and is more a reflection of the current state of bias in the field of consciousness studies where the dominant cognitive model is aligned with the standard model of biology. This *philosophy of biological mechanism* provides only half the story of mind. Our aim is to show that an addition to and clarification of Maturana's key allows classification of the prion [19,20] as the fundamental living system.

The *cognitive domain* [3] of a prion[1] does not create and dissipate entropy in its own right as higher life forms do. The prion is not even at the same level as the virus where this critical factor of far from equilibrium complex

---

[1] The prion propagates through conformational changes in the geometry of its protein structure [19, 20].

processing is satisfied by proxy when the virus protein commanders the existing cellular machinery of the host. The prion, as the zeroth case of a living system, does not 'live' at the viral level. The factor that separates the prion from the non-autopoietic entities listed in section 1.2 (which utilize only the mechanistic half of the complementarity required for a complex self-organized living system) is the prions utilization of the coherent energy of the *élan vital* in its propagation. This is a prediction of the noetic theory we intend to demonstrate empirically [21].

3.1 Quantum Biology

Current thinking in Quantum Theory states that all atomic and subatomic particle interactions can be described by evolution of the Schrodinger equation pertaining to action of a particle moving on a manifold

$$i\hbar \frac{\partial \psi(x,t)}{\partial t} = -\frac{\hbar^2}{2m} \nabla^2 \psi(x,t) + V(x)\psi(x,t). \tag{1}$$

The Schrodinger equation takes myriad forms. The one above is a positional representation of the equation in Cartesian coordinates where $\hbar$ represents Planck's constant, the ∂ terms denote the time derivative with respect to the wave function ψ, m is mass, ∇ denotes the space derivative and V is the potential energy function of (x,t).

In terms of the present status of biological theory explored above it should be noted, as is generally known to physicists, that the founders of quantum theory emphatically stated that the standard phenomenological model of quantum theory (The Copenhagen interpretation) designated to describe all atomic and subatomic phenomena is incapable of describing biological systems.

Neurophysiologists have attempted a number of modifications of the Schrödinger equation, which could be used to describe trajectories of a neuronal action potential on a brain manifold in the neural bioplasma [22,23,24]. These extended forms of the Schrödinger equation relate to the ontological interpretations of quantum theory developed initially by physicists de Broglie and Bohm. The ontological interpretation attempts to overcome the quantum uncertainty principle by adding an additional term to Schrödinger's equation called the quantum potential Q.

$$\frac{\partial S(x,t)}{\partial t} + \frac{(\nabla S_{(x,t)})^2}{2m} + V(x) + Q(x,t) = 0 \tag{2}$$

where the quantum potential

$$Q = -\frac{\hbar^2}{2m} \frac{\nabla^2 R(x,t)}{R(x,t)}, \tag{3}$$

and real functions R and S are the 'amplitude' and 'phase' respectively [22,23,24]. A reasonable step, but these incarnations of the ontological formalism do not complete quantum theory, i.e. do not extend far enough to provide the necessary substrate for intentional action missing from the standard model of quantum theory because they do not make correspondence to the unitary field which Einstein among others claimed provided the basis for all life.

Activity in the various structures of the neural bioplasma is considered a complex many body problem. When reduced to the molecular level only the scale has changed and the standard rules of quantum theory still seem to apply. This is the crux of the problem of biological mechanism. In mechanics, whether classical or quantum, objective analysis follows coherent lines. But in applying similar rules to biological systems there is a breakdown.

One can find little argument with these applications of quantum theory since obviously quantum fluctuations occur not only relative to all microscopic actions but also in relation to aspects of neural networks primarily because they are a quantum chemistry. But all descriptions of this type (particle activity on a manifold – what the Schrödinger equation was derived for) still represent action at the semiclassical limit. As noted above – such physicochemical interactions, although under the panoply of the standard model of quantum theory, draw a line in the sand beyond which the founding fathers of quantum theory maintained that the quantum formalism offered no description of biological systems because whether linear or nonlinear there is no provision for the additional degrees of freedom that come with intentional agency – the application of change to the motion.

3.2 Is There More To Biology Than Mechanism?

Returning to the analysis of the fundamental philosophy of biology we summarize Brillouin's [25] categorization of the issues of mechanism versus teleology into three general positions:

- Knowledge of physics and chemistry is essentially complete and life could be explained without introduction of any additional *life principle*.
- Considerable physics and chemistry is known, but not everything. A new law or principle needs to be discovered to explain life; but this concept will not be outside the laws of physics and chemistry already known. Whether or not this is considered a *life principle* or not is irrelevant.
- A *life principle* is mandatory for an understanding of life because living systems are much different and more complex than inert matter. The laws of thermodynamics describe only inert and *dead* matter to which life is an exception requiring a new principle to explain.

Theories of mind abound with great disparity between them [4,11]. It could be said to be like the early days of electromagnetism when 'for every 100 theorists there were 101 theories'. Simply stated, and reducing from the top down, mind theory can be generally categorized as follows:

Classical Reductionism – Newtonian mechanics deemed sufficient to describe mental activity
- Neural action – Consciousness can be completely explained by brain processes
- Information processing in Neural Networks / Cellular Automata / Physics and Chemistry

Heisenberg Cut – Additional degrees of freedom, possibility of nonlinear & nonlocal interactions
- Quantum computation in brain microstructures like synapses, microtubules or ordered water
- Copenhagen phenomenology – collapse of wave function essential for mental activity

Cartesian Cut – requires additional 'life' and/or physical principles beyond mechanistic theory
- Dualism / Interactionism – ontological extension of quantum theory, collapse not required for evolution
- Monism – all is mind, consciousness is ineffable

The first four types above fall under the domain called the philosophy of biological mechanism. Theories in the Classical and Heisenberg arenas have defined consciousness as a hard problem too difficult to research [22,26]. This provides significant motivation to explore below the Cartesian divide where additional physical laws are anticipated. What evidence exists to justify such a search?

Continuing with the premise that quantum theory is incomplete, Schrödinger in relating the 2nd law of thermodynamics and life says:

"We cannot expect that the 'laws of physics' derived from it to suffice straightway to explain the behavior of living matter…We must be prepared to find a new type of physical law prevailing in it. Or are we to term it a non-physical, not to say a super-physical law [27]?"

But what can this new physical law be?

4 COMPLEX SYSTEMS THEORY: A NEW MODEL FOR THE ORIGIN OF LIFE

It appears unanimous that unicellular prokaryotes are considered the most fundamental form of living system with the inclusion of viruses controversial. By defining awareness as a fundamental physical quantity like the concept of *charge* in electrodynamics [10,28,29], it is possible to show how the prion recapitulates, in the sense of its organization, the propagation of its infective state by maintaining the 'charged' form of its conformation by merely being coupled to the Noetic Field. Prion propagation therefore represents the most fundamental form of biological mechanism and provides the root of its redefinition. Although slightly more complex, the self-organization pertinent to viral replication also falls under this new definition of biological mechanism. Something else happens at the level of bacteria or perhaps any motive unicellular life form. The cognitive domain has sufficient capacity for activity based on an *interactive computational model* [30]; the evolution of the content (qualia) is driven by more than the mere presence of teleology as in the case of the prion or virus, i.e. more degrees of freedom are available.

The *continuous state* of this new action principle, as already suggested, is a 'force for coherence' like the well-known radiation pressure in the QED of light propagation. This symmetry enhancing force acts not only on the topological states of prion conformation by constructive interference as the base state of biological mechanism, but also by higher order conditions of self-organization (defined in section 1). The structural-phenomenology of the new noetic action principle [9] is a complementarity of mechanism and the noetic field, together forming a teleology that is the general driving principle governing all aspects of complex self-organized living systems [21]. Applying the concept of a *unit cell* from the nomenclature of crystal structure to this fundamental teleology in the topology of spacetime, forms the scale-invariant hierarchical basis of living-systems from the microscopic origins of mechanism to macroscopic intentional systems. The complementarity of mechanism and teleology is a structural-phenomenology that is the primary cosmological principle of the conscious universe; the fundamental least unit of which is defined as awareness [10,12].

Defining awareness as a fundamental principle like charge in Electromagnetic Theory [10,17] provides two paths to formulate a theory of life and consciousness. 1. The currently popular cognitive avenue poses the question '*what*

processes in the brain give rise to awareness?' Unfortunately this creates a *hard problem*, which at present is deemed impossible to study empirically [26] - an investigative dead end! Charge has been considered fundamental physically and indivisible; but this definition appears to hold only to the semi-classical limit. Physicists are finding out that the so-called unit of elementary charge arises from a deeper wormhole structure in the higher dimensional topology of spacetime [31]. This is also true in defining the fundamental unit of awareness. Charge, or in this case awareness, does not arise as a brain process. 2. Only looking beyond the brain leads to a model of awareness (consciousness) that is both definable and empirically testable. In brief, the fundamental basis for the least unit of awareness has <u>three</u> complementary components [10,29]:

- Elemental Intelligence – A non-local atemporal HD domain or set of boundary conditions co-eternal with God that define an individual entity.
- Noetic Ordering Principle – A new action principle synonymous with aspects of the unified field and mediated by an exchange particle called the noeon that is synonymous with spirit or an *élan vital*.
- Local Fermi and Bose brain/body States – Classical, semi-classical and quantum modes associated with neural activity and other aspects of simpler autopoietic or complex self-organized living systems.

Remaining problems center around the fundamental nature of space; suffice it to say that Einstein's superceding of Newton's 3D absolute space with a 3(4)D relativistic space was a significant milestone, but not a final answer. The triune complementarity above provides a sufficient structural-phenomenology of the 11(12) noetic space to define the psychosphere of an individuals mind and body.

4.1 Action Of The Unified Noetic Field

Frohlich [32] proposed a new energy that produces coherent long-range order in biological systems. Some authors have suggested this coherence is a type of Bose condensate. Einstein and Hagelin [33] further postulate this coherent principle arises from the unified field, which is also proposed here by Noetic Field Theory. The action of the unified field is the basis for a life principle governing the evolution of complex self-organized living systems.

We will show generally how the continuous transformation of the topology of the 12D superspace of the noetic least unit introduces by periodic holophote action evanescence of a life force from the HD energy covering of each moment of the present [9,10,12]. First we illustrate one of a number of possible models of how at the semi-classical limit from the stochastic background of the vacuum zero-point field, this energy of the *élan vital* is harmonically injected into every point and atom in spacetime by a mechanism like a 'chaotic gun' [34,35].

Using equations for a chaotic gun developed by Ciubotariu [9,31,34,35] the nonlinear dynamics of the model for a charged noeon in a spacetime cavity can be described as follows:

$$\dot{X} = \frac{dX}{dT} = \frac{1}{\gamma}P_x = \frac{1}{(1+P_x^2+P_y^2)^{1/2}}P_x, \tag{4}$$

$$\dot{P}_x = \frac{dP_x}{dT} = \Omega_c[\beta\cos(X-T)+1]P_y, \tag{5}$$

$$\dot{P}_y = \frac{dP_y}{dT} = -\Omega_c[\beta\cos(X-T)+1]P_x + H\cos(X-T), \tag{6}$$

Equations (4 to 6) illustrate a possible quantum model for entry of the new noetic action principle into the 3D phase space P_X, P_Y, X where photons of the Noetic field (noeons) are injected into each point (least unit) in spacetime and every atom by a periodic 'gun effect' of the continuous holophote action of the continuous state dimensional reduction compactification process inherent in the topology of Noetic Superspace [9,10,11]. Ciubotariu's equations are a combination of Maxwell's equations and relativistic equations of motion for the phase space P_X, P_Y, X where the Ω terms represent the cyclotron frequency of the chaotic gun effect. Infusion of the noeon photons mediating the life force field from the spacetime cavities only occurs in certain preferred directions allowed by the parallel transport conditions of dimensional reduction and compactification [9,10].

This effect appears in the Noetic cosmology because in its energy dependent spacetime metric $\hat{M}_4$ [10] just as a periodicity of wave and particle moments occur in photon propagation so does charge or energy arise in periodic moments of the Noetic least unit (see Fig. 1). Because as Wheeler showed in 1962 [36] 'charge is topology'. According to Wheeler [36] lines of force in a wormhole can thread through a handle and emerge through each mouth to give the appearance of charge in an otherwise charge free spacetime.

Each mode of the field of a quantum harmonic oscillator is associated with the quantum cavity dynamics of the spacetime topology as it undergoes its continuous transitions.

$$E_n = (n + \frac{1}{2})\hbar\omega \qquad (7)$$

E is the state of energy for n photons. For $n = 0$ the oscillator is in the ground state, but a finite energy $1/2\hbar\omega$ of the ground state, called the zero-point energy, is still present in the region of the cavity. According to equation (7) of the quantum harmonic oscillator the field energy of the photons undergo periodic annihilation and recreation in the periodic noetic spacetime [37].

5 MECHANISM OF PROTEIN CONFORMATION IN PRION PROPAGATION

Fatal neurodegenerative disorders known as transmissible spongiform encephalopathies (TSE'S) have been shown to spread by a proteinaceous infectious particle or prion [19,20,38,39]. According to Prusiner's definition these prion elements propagate conformational variation leading to replication by a mechanism not well understood until now [20]. Two conversion hypotheses have been proposed:

- The *template-assisted conversion model* [40] where a putative cellular chaperone called protein X assists conformational transition by altering the thermodynamic equilibrium of a kinetic barrier in favor of transition state protein formation.
- The *nucleation-polymerization model* where highly ordered aggregates of the infectious element form. This also shifts thermodynamic equilibrium allowing this nucleus to act as a seed for further prion propagation. Protein folding thus appears in both cases to be the primary autocatalytic mechanism propagating prion diseases.

According to Prusiner [39]:

"Nascent prions are created either spontaneously by mutation of a host protein or by exposure to an exogenous source. Prions are composed largely, if not entirely, of a modified form of the prion protein (PrP) designated PrPSc. Like other infectious pathogens, they multiply but prions do not have a nucleic acid genome to direct the synthesis of their progeny. A post-translational, conformational change features in the conversion of cellular PrP (PrPC) into PrPSc during which alpha-helices are transformed into beta-sheets. Since this structural transition in PrP underlies both the replication of prions and the pathogenesis of the CNS degeneration, much of the effort in the laboratory is devoted to elucidating the molecular events responsible for this process. Indeed, prion diseases seem to be disorders of protein conformation."

And further relative to the theory of propagation proposed here:

"During prion replication, an as yet to be identified factor that we have provisionally designated protein X binds to PrPC. The PrPC/protein X complex then binds PrPSc; by an unknown process, PrPC is transformed into a second molecule of PrPSc [39]."

A Postulated 3D X-bundle structure of the PrPC was chosen by Prusiner from four penultimate PrPC models reduced from ~300,000 possible configurations by both theoretical and experimental constraints. These four choices correlated best with human prion mutations. A Conceptual model of the orientation of the four helices of the X-bundle model looks like two X's nearly superimposed on each other. Since prions have no nucleic acid based genome to direct their propagation. Noetic theory proposes that prion replication is directed by fundamental mechanisms of complexity theory and that the action principles driving this complexity are a more fundamental form of mechanism (stated in 4) than that perceived currently by the philosophical basis of mechanism in biology.

6 PHYSICAL COSMOLOGY OF THE FUNDAMENTAL LEAST UNIT

The Fundamental Cosmological Least Unit is introduced in the context of an advanced form of Einstein's model of a static universe, called the Continuous State Conscious Universe (CSCU) [9]. The new cosmology is based on principles of the Wheeler-Feynman absorber theory of radiation [41] extended to the topology of a periodic 12D spacetime. The fundamental *least unit* is shown to be a scale invariant complex cosmological system. The translating boundary conditions of a spin exchange *continuous state* dimensional reduction compactification process are inherent in the Dirac polarized vacuum. The topology is derived by coupling superluminal Lorentz boosts with noncompactified Kaluza-Klein theory [42] in the context of an energy dependent spacetime metric (eq. 12).

6.1 Euclidian / Minkowski Geometry As The Basis For Reality

The Euclidian line is assumed to be the real line [43] because it is what is observed. Logical reasons from supersymmetry and supergravity suggest there are a number of additional unobserved dimensions [42] leaving the

issue of dimensionality as an open question. Euclidian space in classical Newtonian terms is a continuous 3D absolute space with time an independent parameter often considered irrelevant.

Einstein's theories of relativity provided a discrete 3(4)D transmutable relational spacetime manifold. The debate between absolute space or substantivism and relational space still continues. Utilizing the standard definition of a straight line as the intersection of two rigid planes, measurements could be taken to observe whether the angles of a triangle add up to $180°$; but settling the question definitively would require astronomical scale measurements where it appears physically impossible to apply the concept of a rigid body or to define a straight line in terms of a light ray by stellar parallax because of the effects of general relativity. Therefore all physics knows with certainty at the present time is that observed space is approximately Euclidian as is Minkowski space [42,43].

According to the proof of Schoenflies theorem [44] there can be no topological knots in a plane. Therefore there can be no topological torsion in a 2D reality; thus the real line must be at least 3D Euclidian where the standard Pythagorean line element is

$$ds^2 = dx_1^2 + dx_2^2 + dx_3^2 \qquad (8)$$

This assumption that the Euclidian line is the real line is intuitive. Currently there is no known method of empirical proof; and since the Euclidian line is what the Human mind apprehends it remains the formal basis for all empirical scientific fact [43,45]. But this assumption remains profoundly problematical with issues stemming from both the foundations of mathematics and the nature of physical theory itself concerning the fundamental basis for sets, discreteness versus continuity, geometry and topology, and the relationship of real numbers to rational numbers for example [43].

In general, the class of theories unifying gauge and gravitational fields by utilizing extra dimensions is called Kaluza-Klein theories. In these theories spontaneous symmetry breaking by coordinate transformation in five dimensions is a product of the standard four-dimensional transformation and a local U(1) gauge group arising in basic form in a general relativistic framework of five dimensions described according to the Einstein-Hilbert action

$$A = \int d^5x\sqrt{g}R. \qquad (9)$$

Where instead of postulating a five-dimensional Minkowski space M^5 as the ground state, the ground state is taken to be the product $M^4 \times S^1$ where the circle S^1 is a U(1) group of rotations [42]. In conventional supersymmetry models the radius of circle S^1 is considered to be microscopically small on the order of the Planck scale $(10^{-33}cm, 10^{-43}s)$, very short and very fast, explaining why these extra dimensions are not observed. This will be discussed in more detail below where Planck's constant is recalculated utilizing the Larmor radius of the hydrogen atom as it relates to non-compactified Kaluza-Klein theory [42] in the 12D Wheeler-Feynman context [9,41].

An SU(3) x SU(2) x U(1) gauge symmetry group can be used to describe all known particle interactions. Following Witten, [43] the *minimum* number of dimensions of a manifold with this symmetry is seven. In this SU(3) x SU(2) x U(1) symmetry group gauge fields arise in the gravitational field as components of more than four dimensions. This yields a dimensionality for our reality of at least four non-compact and seven compact spacetime dimensions, $M^4 \times S^7 = 11D$, which Witten [42] calls a remarkable numerical coincidence since this eleven dimensional maximum for supergravity is the minimum for SU(3) x SU(2) x U(1) symmetry which also for symmetry reasons observed in nature is in practicality the largest group one could obtain from Kaluza-Klein theories in seven additional dimensions.

This gauge group for gravitational field components is insufficient to describe nature; for a complete theory quarks and leptons plus a Higgs type mechanism triggering symmetry breaking must be added to the Kaluza-Klein framework. In attempting to complete the theory, the gauge coupling constants are determined by calculating the Einstein action over the compact dimensions. This scales at a high power of $1/(M_pR)$, where M_p is the Planck length and R is the radius of the extra dimensions showing that R must actually be in the $10^{-33}cm$ range for these standard model gauge theories. If one adds the Lagrangian of a cosmological constant Witten finds one can form a reasonable theory [42].

Noetic Cosmology relies heavily on the 11(12)D symmetry described by Witten with a different view of compactification because the Einstein gauge is both classical and incomplete. Noetic cosmology like any new theory must however bear correspondence to the established Einstein gauge. The existing derivation of Planck's constant represents classical mathematical limits that are not real physical limits in CSCU cosmology.   Since the Higg's mechanism also arises from the Einstein gauge it is also called into question and replaced by a different symmetry breaking mechanism in the noncompactified form of Kaluza-Klein theory is utilized in Noetic Cosmology.

6.2 Overview Of The Formalism For Noetic Cosmology

Noetic CSCU Cosmology is cast in a 12D harmonic superspace $S_N = S_0 + S_1 + S_2$ in the context of an extended Wheeler/Feynman absorber theory [9,41] where standard Minkowski space M_4 is a *standing wave* of the future-past. This takes the general form

$$R_{symM_4}^{S_{N0}} = \frac{1}{2}\left[R_{retC_4}^{S_{N1}} + R_{advC_4}^{S_{N2}} \right]$$

(10)

or simplistically stated the 12D noetic superspace S_N represents a complex Minkowski metric $M_4 + C_8$ (or $\pm C_4$). S_N thus combines the standard M_4 four *real* dimensions (D) plus 8 imaginary D representing a *retarded* and *advanced* complex hyperspace topology which adapts the complex ($M_4 + C_8$) Minkowski metric from the standard stationary form to a periodic form. $S_0 = M_4$ represents the noetic 3(4)D *standing wave* Minkowski 'present' spacetime; $S_1 = -C_{4(ret)}$ represents the past component and $S_2 = +C_{4(adv)}$ represents the future for complex correspondence to the standard 4 real dimensions utilizing 8 imaginary dimensions. The 8 imaginary dimensions, while not manifest generally (locally) on the visible Euclidean real line, are nevertheless 'physical' in the CSCU and can be represented by complex coordinates

$$X = \pm(x + i\xi), Y = \pm(y + i\eta), Z = \pm(z + i\zeta) \quad \text{and} \quad t = \pm(t + i\tau)$$

(11)

designating correspondence to real and retarded/advanced continuous spacetime transformations. For symmetry reasons the standard Minkowski line element metric $ds^2 = g_{ij}dx^i dx^j$ is expanded into periodic *retarded* and *advanced* topological elements fundamental to the 'extension' of relational space giving Noetic Superspace S_N its continuous state dimensional reduction standing wave periodicity. This is illustrated conceptually in Fig. 1 below.

The Kaluza-Klein model utilized is set in a noncompactified D = 12 harmonic Noetic Superspace S_N and is the foundation of a conscious universe. For symmetry reasons shown in the text this superspace is comprised of an 11D hypersurface in a 12D universe, giving it theoretical correspondence to 10D superstring theory and 11D supergravity and providing a context to solve the disparity between them. The appeal of Kaluza-Klein models is that physics seems simplified in HD, especially integration of the electromagnetic (EM) and gravitational field [46,47].

Periodic Noetic superspace S_N entails a continuous state of dimensional reduction that operates under transformations beyond the Poincaré / Lorentz where spatial dimensions D_S through superluminal boosts are transformed in to temporal dimensions D_t and further in terms of a noncompactified Kaluza-Klein model [42,47] into energy dimensions D_E by $D_S \rightarrow D_t \rightarrow D_E$. This requires the properties of an energy dependent spacetime metric first developed by Einstein. Standard Minkowski space M_4 becomes instead a topologically invariant homeomorphic manifold of an energy dependent spacetime metric $\hat{M}_4$

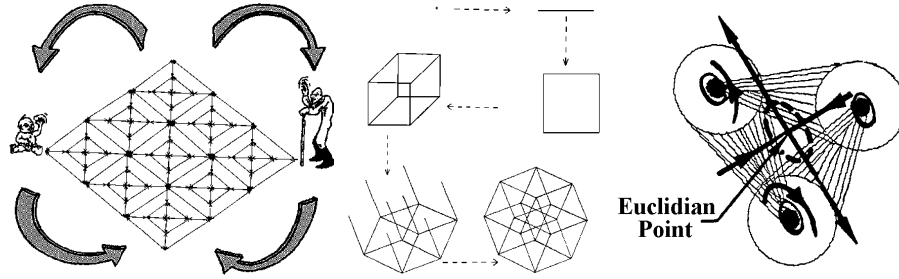$$f : M_4 \rightarrow \hat{M}_4$$

(12

Figure 1. Basic topological premises of Noetic Cosmology shown by three conceptual views representing the least cosmological unit: a) Baby and old man represent the *relational* periodic basis of spacetime by applying extended Wheeler/Feynman absorber theory where the present is a standing wave of the future/past. b) The 12D harmonic superspace translates in a continuous state dimensional reduction compactification process. c) A 3-torus illustrating a virtual standing wave 'creation' of a discrete virtual Euclidian point (P_E); a different view of figure 1a and 1b. This Noetic 'least unit' represents a Wheeler/Feynman future/past periodicity and continuous cycling of *classical* $\rightarrow$ *quantum stochasticity* $\rightarrow$ *fundamental unitary* ($R_C \rightarrow R_Q \rightarrow R_U$) in the D reduction compactification $D_s \rightarrow D_t \rightarrow D_E$ transformation process, where $P_E \rightarrow \hbar$ [9].
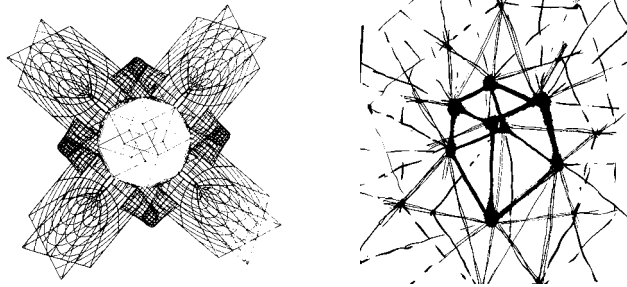

Figure 2. Two additional conceptual views of Fig. 1. a) Snapshot in time. The central hypersphere represents the atemporal hidden supra-HD covering of the standing wave present. The larger peripheral spacetime tubes represent open orientation toward the future; and the narrower coupled tube forming a square represents a phase of recessional compactification $P_E \rightarrow \hbar$ toward the past, the final phase of which would end up like Fig. 1c – a virtual Planck scale singularity. The figure hints why the Planck constant needs to be recalculated. Standard measurements are past oriented; the Planck constant apples as usual. In the *eternal now*, the Planck constant takes the form of the Larmor atomic radius and is an unbounded component of the unitary field in the future orientation. Fig. 2. b) conceptualizes the relational nature of Minkowski space emerging from the polarized vacuum.

According to the principle of relativity a spacetime region which is a 'perfect vacuum' (no matter and no fields) must be isotropic and covariant in the Lorentz sense [43]. The deformed region $\hat{M}_4$ of S_N and the symmetry of S_N itself reduce to the Einstein relativistic metric and are assumed compatible with a polarized Dirac vacuum [48].

6.3 Transformation Of Space Into Time

It is well known that Superluminal Lorentz Transformations (SLT) change real quantities into imaginary ones. Following Cole [49] and Rauscher [50] we illustrate the transformation of complex spatial dimensions into temporal dimensions by orthogonal superluminal boosts (SLB). For example an SLB in the *x* direction with velocity $v_x \pm \infty$ the SLT is $x' = \pm t,\ y' = -iy,\ z' = -iz,\ t' = x$. In complex Minkowski space the coordinates are $z^u = x_{Re}^u + ix_{Im}^u$ where *z* is complex and x_{Re} and x_{Im} are real and index *u* runs over 0,1,2,3. Using classical notation for simplicity

$$t = t_{Re} + it_{Im},\ x = x_{Re} + ix_{Im},\ y = y_{Re} + iy_{Im},\ z = z_{Re} + iz_{Im}. \qquad (13)$$

To clarify the meaning of imaginary quantities in an SLT it is helpful to represent time as a 3D vector $t_x,\ t_y,\ t_z$; therefore time is defined as $t = t_x\hat{x} + t_y\hat{y} + t_z\hat{z}$ where

$$t_x = t_{x\,\mathrm{Re}} + it_{x\,\mathrm{Im}}, \ t_y = t_{y\,\mathrm{Re}} + it_{y\,\mathrm{Im}}, \ t_z = t_{z\,\mathrm{Re}} + it_{z\,\mathrm{Im}} \tag{14}$$

Finally for the SLB for velocity $v_x \pm \infty$ along x the transformations are

$$x'_{\mathrm{Re}} + ix'_{\mathrm{Im}} = t_{x\,\mathrm{Re}} + it_{x\,\mathrm{Im}}, \ y'_{\mathrm{Re}} + iy'_{\mathrm{Im}} = y_{\mathrm{Im}} - iy_{\mathrm{Re}}, \ z'_{\mathrm{Re}} + iz'_{\mathrm{Im}} = z_{\mathrm{Im}} - iz_{\mathrm{Re}}$$
$$t'_{x\,\mathrm{Re}} + it'_{x\,\mathrm{Im}} = x_{\mathrm{Re}} + ix_{\mathrm{Im}}, \ t'_{y\,\mathrm{Re}} + it'_{y\,\mathrm{Im}} = t_{y\,\mathrm{Im}} - it_{y\,\mathrm{Re}}, \ t'_{z\,\mathrm{Re}} + it'_{z\,\mathrm{Im}} = t_{z\,\mathrm{Im}} - it_{z\,\mathrm{Re}} \tag{15}$$

where the SLT in x of M_4 spacetime transforms real components into imaginary and imaginary complex quantities into real quantities as one major property of the periodic nature of Noetic CSCU spacetime [49,50].

6.4 Energy Dependent Spacetime Metric

Einstein originated the concept of an energy dependent spacetime for explaining temporal rate change in the presence of a gravitational field by generalizing the special relativistic line element (compare equation 2)

$$ds^2 = (1 + 2\phi/c^2)c^2 dt^2 - dx^2 - dy^2 - dz^2 \tag{16}$$

with the introduction of time curvature [51,52] where ϕ is the Newtonian gravitational potential. This utilizes the deformed Minkowski metric $\hat{M}_4$ (introduced above by eq. 5) which is imbedded in the periodic HD Noetic space chosen axiomatically for CSCU cosmology to take the form of a noncompactified Kaluza-Klein theory [42,47].

Kaluza's initial demonstration of gravity in 5D, $^5G_{AB} = 0$ with AB running $0,1,2,3,4$ contained 4D General Relativity with an EM field $^4G_{\alpha\beta} = {}^4T_{\alpha\beta}^{EM}$, with α, β running $0,1,2,3$ [47]. The currently less common non-compactified Kaluza-Klein model is utilized by Noetic Cosmology where also dependence on the extra D is required; this yields the same result for Einstein's equations $^5R_{AB} = 0$ except that the *EM* energy momentum tensor $^4T_{\alpha\beta}^{EM}$ is replaced by a general one $^4T_{\alpha\beta}$ instead [47]. Sections 6 & 7 demonstrate the feasibility of an energy domain pervading HD spacetime with properties similar to Wheeler's Geon [53]. In a generalized deformed spacetime metric $\hat{M}_4$, spacetime is fixed by the energy and has the metric

$$\eta(E) = diag.(a(E), \ -b(E), \ -c(E), \ -d(E)). \tag{17}$$

Skipping the mathematics for brevity; in the same manner that space is transformed into time by SLT, complex time may be boosted again by the noetic transformation into HD an energy covering of each least cosmological unit.

7 DIRAC SPHERICAL ROTATION INHERENT TO THE TRANSFORMATION OF THE FUNDAMENTAL LEAST UNIT

Typically the Dirac dual (2π) spinor rotation applies to the observation that an electron undergoes $720°$ of rotation (not the usual $360°$) before returning to the initial orientation. Traditional thinking has assumed this to be some property of matter. But the discovery of the complex structure of spacetime has shown that this is not a property fundamental to the electron; but rather to the superspace the electron is imbedded in and part of. Dirac spherical rotation as it is also called, is more fundamentally a primary property of space than of matter. This is revealed in the complex hierarchical structure of the least unit discussed in the paper.

7.1 The Dirac String Trick

Tie the four corners of a square to another larger square by loose string, (alternatively, tie the initial square to the four corners of a room). Now rotate the small square by 360 degrees about a vertical axis, that is, in a horizontal plane. The strings will become somewhat tangled, and it is not possible to untangle them without rotating the square.

If we rotate through another 360 degrees, for a total of 720 degrees; it is now possible to untangle the string without further rotation of the square by simply allowing enough space for the strings to be looped over the top of the square! It's hard to believe unless you try it. Use clips to attach the ribbons to the squares, so it can be undone easily if it gets too tangled. A similar idea works for a rotation through 720 degrees about any axis [54].

Another version of the Dirac string trick is called the Philippine wine dance. A glass of water held in the hand can be rotated continuously through 720 degrees without spilling any water. These geometrical demonstrations are related to the physical fact that an electron has spin ½! A particle with spin 1/2 is something like a ball attached to its surroundings with string. Its amplitude changes under a 360 degrees (2π) rotation and is restored by rotation of 720 degrees (4π). The formal description of such complex phenomena typically requires sophisticated mathematics (algebra, group theory, topology, quaternions...) since they are not part of everyday experience.

8 THE NOETIC SPACETIME TRANSFORMATION

Noetic CSCU cosmology implies that so-called 'real space' is a relational standing wave 4D subspace of an absolute HD space, where a continuous state dimensional reduction compactification process is central to the scale invariant periodic geometric structure. It is useful to initiate the description by introducing a toy model of the lower D space and build it up to the actual HD space.

Maintaining the extended Wheeler-Feynman property of the present as a function of the future-past (Figs. 1&2; equation 4) we begin by describing a discrete Einstein type point in the relational spacetime manifold. Since points are defined as singularities where dimensionality breaks down, a dimensionless point cannot be 'covered'. This property will be shown to be a valuable criteria as a 'hole' for oriented orthogonal superluminal boosts in the noetic transformation. This also contrasts the nature of continuity (Absolute space) with discreteness (relational space); points are not absolute because the universe as now well known is not a Newtonian continuum.

8.1 The 1D Case

Therefore beginning the construction of dimensionality with the 1D scalar case. Assuming an arbitrary, discrete, infinitesimal, oriented least unit $h = \Delta x$, an entourage of additional HD's are required to 'cover' or confine each subspace level. Usually the entourage has one more D than its subspace. The least unit h on coordinate x can be covered by a 2-torus when the orthogonal generating circle A, of radius r is located at distance $R > h_{\Delta x}$ from x_0 and not on h, is rotated through dimension y into a plane x, y. Thus a 2D flat torus covers the least unit $h_{\Delta x}$ with an x, y plane. The rotation through y (of growing importance later) may occur in counterpropagating directions. Finally the 1D case utilizes a $\pm 2D$ covering for the $h = \Delta x$ unit of extension which may wink in and out of existence since it is a complementarity of 0D and 1D.
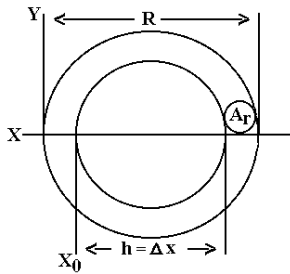

Figure 3. The 2-torus appearing as a donut slice acts as a covering of an infinitesimal 1D topological least unit $h = \Delta x$. A point of $h = 0$ is dimensionless and cannot be covered (or confined). But $h = \Delta x$, acting as a transient 1D unit of extension, may be covered by a 2-torus. One additional dimension is required to cover the next lower D space.

8.2 The 2D Case

Covering the least unit of a plane $h = \Delta x, \Delta y$ uses a method similar to the 1D case except that two modes of covering are allowed:

Type 1. Energy –Time. An intermediate covering of region h by a $\pm 2D$ flat torus in the plane x, y as in the 1D case which leaves room for access of a 3rd energy or time coordinate utilizing either the spin exchange dimensional reduction process or superluminal boost into HD.

Type 2. Spatial. Region $h = \Delta x, \Delta y$ is completely covered by a 3-torus. This occurs by rotating a generating circle orthogonal to x, y through the z direction. This covering represents the lower limit of standard M_4 space with the addition of time.

There is no utility in developing the toy model further at present as it sufficiently illustrates pertinent aspects of the noetic transformation that show how boundary conditions transform the dimensionality of space and time along

with the energy covering of the unified field by $D_S \rightarrow D_t \rightarrow D_e$. The unified field governing gravitation, and the quantum potential guides the action of translation along certain allowed pathways. For example if either *l, w* or *h* is removed from a cube the object collapses to a plane. Removing a dimension from the plane causes compactification to a line and so on. The released space is not initially empty. At the first stage of D reduction space transforms into time; and at the second stage into the energy that couples with the energy governing it as compactification is completed for that particular unit.

8.3 The Permutation Of Dimensions In The Noetic Transformation

Only certain pathways for parallel transport by spin exchange dimensional reduction (*D* down scaling) and superluminal boosting (*D* up scaling) are allowed by the Noetic extension of the Wheeler-Feynman symmetry breaking relations in the continuous maintenance of the CSU cosmology of a standing wave present.

It is useful to clarify the utility of the dual covering modes in terms of parallel transport and the Regge equations relation to the Bianchi identity of a boundary of a boundary being equal to zero $(\partial \circ \partial \equiv 0)$ [54,55,56].
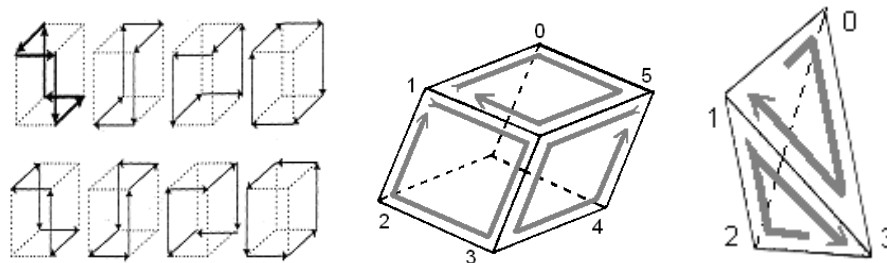

Figure 4. The figure (a) shows the four possible counter-propagating (top & bottom for each case) circular permutations of the vertices of a cube representing parallel transport about each diagonal. These allowed paths and orientations constrict the dimensional reduction process of the entourage of associated spaces into symmetry breaking pathways according to strict rules. Ordering the vertices as shown in (b) induces an orientation on the cubes two dimensional boundary, which consists of six oriented squares by $\partial(012345)$. For illustration taking the simpler case of a tetrahedron (b) consisting of four oriented triangles by $\partial(0123) =$ (012) - (013) + (023) - (123). This in turn induces an orientation on the edges of the one dimensional boundaries $\partial(012) =$ (01) - (02) + (12). Summing the dimensional boundaries cancels them in pairs [(01) - (01) = 0]. This is the Bianchi identity $\partial \circ \partial = 0$ described by the Regge equations for parallel transport where the boundary of a boundary is zero. Or suggesting the cube is edgeless because the 1D boundary of the 2D boundary of the 2D region is zero [54,55].

9 DEVELOPING THE LINE ELEMENT FOR NOETIC SUPERSPACE

The real parameters for the line element in standard Einstein-Minkowski space M_4 (compare 8) is

$$dS_0^2 = dx_1^2 + dx_2^2 + dx_3^2 - dt^2 \tag{18}$$

to which noetic superspace must make physical correspondence to be a viable theory. We begin by developing the associated eight dimensional complex space of the future-past following work initiated by Amoroso [9,10], Rauscher [50,57], Cole [49] and Hansen and Newman [58] on complex Minkowski space [59].
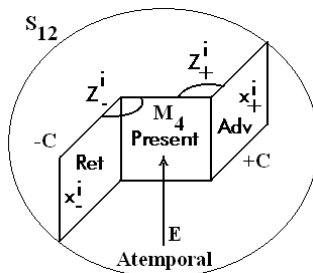

Figure 5. 2D representation of the three four-dimensional spacetime packages of the periodic 12D noetic superspace static universe. M_4 is the Euclidian based Minkowski / Riemann standing-wave present with two higher dimensional complex spacetime packages $\mp C$ representing the four retarded and four advanced dimensions respectively that put certain constraints on the description of the noetic line element.

156

For $X^j_{\text{Re}} + iX^j_{\text{Im}}$ with $j = 1,4$ and $X^k_{\text{Re}} + iX^k_{\text{Im}}$ also with $k = 1,4$ we set up the complex relation

$$Z^{jk} = [X^j_{\text{Re}} + iX^k_{\text{Im}}], \ [\overline{X}^j_{ret} + \overline{X}^k_{adv}] \tag{19}$$

again with $j, k = 1,4$ yielding $(1, 1, 1, -1)$. Then for complex advanced space $+C_4$ we have the general relation

$$Z^{jk}_{adv} = X^{jk}_{\text{Re}(adv)} + iX^{jk}_{\text{Im}(adv)}, \ \ \overline{X}^{jk}_{\text{Re}(adv)} + \overline{X}^{jk}_{\text{Im}(adv)} \text{ with } j = 1, 4. \text{ For complex retarded space } -C_4 \text{ the relation is}$$

$$Z^{jk}_{ret} = X^{jk}_{\text{Re}(ret)} + iX^{jk}_{\text{Im}(ret)}, \ \ \overline{X}^{jk}_{\text{Re}(ret)} + \overline{X}^{jk}_{\text{Im}(ret)} \text{ with } k = 1, 4. \text{ Then the line element is}$$

$$\Delta S^2 = \eta_{jk} dZ^{jk}_{adv} Z^{jk}_{ret} \tag{20}$$

with the further condition satisfied that $\eta_{jk} = \alpha_{jk} + i\beta_{jk}$ where

$$\alpha_{jk}(dx^j_- dx^k_p + dx^j_p dx^k_+) + \beta_{jk}(dx^j_- dx^k_+ - dx^j_p dx^k_p) = 0 \tag{21}$$
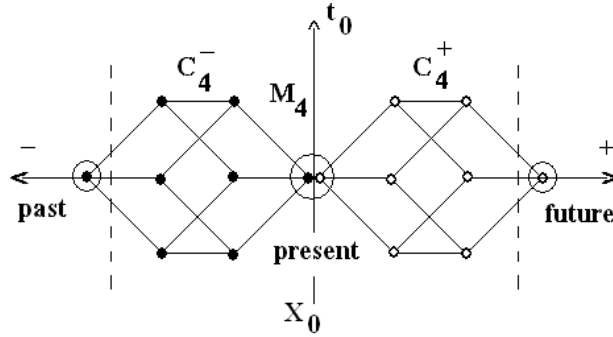

Figure 6. Conceptual view of the symmetry of a least unit in Noetic Superspace showing the relationship of its twelve dimensions here depicted as points. The larger circle in the center represents the Minkowski M_4 present comprised of the smaller circles at each end representing future/past components that comprise it. The twelve points labeled C_4 symbolize a conceptualization of the twelve dimensions comprising a fundamental least unit. The dimensionality and asymmetry of the complex plane is suppressed for simplicity. The twelve HD C_4 points create and annihilate $\hat{M}_4$ (the three small circles).

This action directly creates boundary conditions separating the fundamental reversible aspects of microscopic natural law into the perceptual macroscopia and an additional HD physical realm not perceived by neurophysiology [9,52,53]. Noetic cosmology proposes that this temporal asymmetry is completely observer related and the ensuing boundary conditions delete essentially half of the systems information cosmology. Bohr stated from the beginning that the Copenhagen interpretation did not describe biological systems; therefore a full physical description must utilize extended de Broglie/Bohm ontological forms of quantum theory without state reduction and therefore loss of systems information. The big question then is what is the utility of the unobserved parameters of this cosmology.

Here is where the main utility of the Noetic least unit transform enters in. The complementary superluminal boosting of the 'standing wave' eternal present

$$D_s \to D_t \to D_E \ : \ R_U \to R_Q \to R_C \tag{22}$$

produces and maintains the perceptual macroscopic amplification of microscopic phenomena. The Noetic boosts reduce the flux of all physical fields at the boundary by absolute parallelism $\partial \circ \partial = 0$ where the boundary of a boundary equals zero facilitating this whole cosmological process. We begin with the description of the electromagnetic field. Following Kafatos and his collaborators [60] suggesting the importance of $\dot{R} \equiv C$ for universal boundary conditions which are also relevant to the velocity required for the observers mind to escape microphysics and become coupled to a macroscopia for EM by

$$\vec{c} = \frac{2\vec{E} \times \vec{B}}{\vec{E}^2 + \vec{B}^2} \tag{23}$$

where, according to Wheeler [36], velocity $\vec{c} = \vec{n}\tanh\alpha$ and the numerator is the Poynting flux and the denominator the energy density. This boost equation describes the reduction of the EM field to mutual parallelism which according to the Bianchi identity describes how the boundary of a boundary equals zero. Allowing half the information of the universe to cancel into the resultant standing wave covering. The covering is piloted by the de Broglie wave-particle energy. Application of the Huygen's principle of wave addition produces the smooth feel of reality we observe by *surfing* as it were on the face of the discrete elements of atemporal microphysics [61,62,63]!

ACKNOWLEDGEMENTS

REFERENCES

1. Varela, F.G., Maturana, H.R. & Uribe, R., 1974, Autopoiesis: The organization of living systems, its characterization and a model, BioSystems, 5, 187-196.
2. Jantsch, E., 1984, The Self-Organizing Universe, New York: Pergamon.
3. Maturana, H. R., 1970, Biology of cognition, Report BCL 9.0 Urbana: Biological Computer Laboratory, Univ. of Illinois.
4. Drăgănescu, M., 1997, On the structural phenomenological theories of consciousness, Noetic Journal, 1:1, 28-33.
5. von Neumann, J., 1966,   The theory of self-reproducing automata, in A. Burks (ed.) Urbana: Univ. of Illinois Press.
6. Zhabotinsky, A.M., 1974, Self-oscillating Concentrations, Moscow: Nauka
7. Haldane, J.S., 1923, Mechanism, Life and Personality, New York.
8. Beckner, M.O., 1972, Mechanism in biology, in P. Edwards (ed.) The Encyclopedia of Philosophy, Vol. 5, pp 250-2, New York: Collier Macmillan.
9. 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.
10. Amoroso R.L., 2003, Awareness: physical cosmology of the fundamental least unit, Noetic Journal 4:1, 1-15; Amoroso R.L., 2003, What is Consciousness, Introducing the Cosmology of Being, in *Romanian* N. Bulz et al trans. (in Press); Amoroso R.L., 2003, in The Complementarity Of Mind And Body: Essay's Honoring The Centenary Of Nobelist Sir John Eccles*, R. L. Amoroso, B. J. Hiley & K. H. Pribram (eds.) In press.
11. Amoroso, R.L. 2000, The parameters of temporal correspondence in a continuous state conscious universe, in R. Buccheri & M. Saniga (eds.) Studies in the Structure of Time: From Physics to Psycho(patho)logy, Dordrecht Kluwer Academic.
12. Amoroso, R.L. 2003, The Fundamental Limit and Origin of Biological Systems, Noetic Journal 4:1; 24-32.
13. Goldberg, J.N., 1981, Spacetime, in Encyclopedia of Physics, R.L. Lerner & G.L. Trigg (eds.) Reading: Addison-Wesley.
14. Messiah, A., 1999, Quantum Mechanics, Mineola: Dover.
15. Prigogine, I., 1973, Irreveresability as a symmetry breaking factor, Nature, 248: 67-71.
16. Prigogine, I., Nicolis, G. & Babloyantz, A., 1972, Thermodynamics of evolution, Physics Today, 25: 23-28 & 38-44.
17. Chalmers, D.J., 2002, The puzzle of conscious experience, Scientific American Special, 12:1, 90-100.
18. Searle, J. R., 2002, Consciousness, Review Roumaine de Philosophie, Tome 46:1-2, pp.87-108.
19. Prusiner, S.B. 1982, Science, 216,p. 136-144.
20. Prusiner, S.B. 1998, Proc Nat. Acad. Sci, USA, 95, p. 13363-13383.
21. Amoroso, R.L. 2004, The primary mechanism initiating protein conformation in prion propagation, preprint.
22. Gould, L.I., 1995, Quantum dynamics and neural dynamics: Analogies between the formalisms of Bohm and Pribram, in J. King & K.H. Pribram, (eds.) Scale in Conscious Experience: Is the Brain Too Important to be Left to Specialists to Study? 339-348, Mahwah: Lawrence Earlbaum.
23. Pribram, K.H., 1991, Brain and Perception: Holonomy and Structure in Figural Processing, Mahwah: Lawrence Earlbaum; Eccles, J.C., 1986, Do mental events cause neural events analogously to the probability fields of quantum mechanics?, Proc. Royal Soc. London B227, pp. 411-428.
24. Jibu, M. & K. Yasue, 1995, Quantum Brain Dynamics and Consciousness, Amsterdam: John Benjamins.
25. Brillouin, L., 1949, Life, thermodynamics and cybernetics, American Scientist, 37: 554-568.
26. Chalmers, D. 1996, The Conscious Mind, Oxford: Oxford University Press.
27. Schrodinger, E., 1945, What is Life? London: Cambridge University Press. Bohr, N., 1961, Atomic Theory and the Description of Nature, Cambridge: Cambridge University Press.
28. Amoroso, R.L., 2002, The Physical Basis of Consciousness: A Fundamental Formalism, Part 1 Noesis, XXVI, Romanian Academy; Amoroso, R.L, 2000, Derivation of the fundamental equation of consciousness, Part I, Boundary conditions, Noetic Journal 3:1, pp. 91-99.

29. Amoroso, R.L, 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 and the Primacy of Consciousness, 2000, Orinda: The Noetic Press; Amoroso, R.L, An introduction to noetic field theory: The quantization of mind, The Noetic Journal 2:1, pp. 28-37 (1999). Amoroso, R.L, 2000, Derivation of the fundamental equation of consciousness, Part I, Boundary conditions, Noetic Journal 3:1, pp. 91-99.
30. Wegner, P., 1998, Interactive foundations of computing, Theoretical Computer Science, 192, 315-351.
31. Schutz, B. 1999, Geometrical Methods of Mathematical Physics, Cambridge: Cambridge University Press.
32. Frohlich, H., 1968, Long-range coherence and energy storage in biological systems, Int. J. Quantum Chem. 2:641-649.
33. Hagelin, J.S., 1988, Is consciousness the unified field? A field theorist's perspective. Preprint.
34. Ciubotariu, C & Ciubotariu, C. , 2002, A chaotic-stochastic model of an atom, 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.
35. Argyris, J. & Ciubotariu, C., 1999, A new physical effect modeled by an Ikeda map depending on a monotonically time-varying parameter, Int. J. Bif. Chaos, 9:1111-1120.
36. Wheeler, J.A. 1977, Gravitational and Electromagnetic wave flux compared and contrasted, Phys. Rev. D, 16:12, 3384-3389.
37. Loudon, R. 1994, The Quantum Theory of Light, Oxford: Clarrendon Press.
38. Pruisiner, S.B., 2002, Research Summary, www.ucsf.edu/neurosc/faculty/neuro-prusiner.html.
39. 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.
40. Kurschner, C. & Morgan, J.I. 1996, Mol. Brain Res. 37, pp. 249-258.
41. Wheeler, J.A., & Feynman, R., 1945, Rev. Mod. Physics, 17, 157; Chu, S-Y, 1993, Physical Rev. L. , 71, 2847.
42. Witten, E., 1981, Search for a realistic Kaluza-Klein theory, Nuclear Physics B186, 412-428.
43. Sen, R.N., 1999, Why is the Euclidian line the real line?, Found. Physics, 12:4,328-345.
44. Hocking, & Young, 1988, Topology, New York: Dover.
45. Barrow, J.D. & Tipler, F.J., 1988, The Anthropic Principle, Oxford: Oxford Univ. Press.
46. Vigier, J-P & Amoroso, R.L. 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, 2002, Dordrecht: Kluwer Academic.
47. Overduin, J.M. & Wesson, P.S., 1997, Kaluza-Klein gravity, Physics Reports, 283, pp. 303-378.
48. Dirac, P.A.M., 1952, Nature (London), 169, 702; Petroni, C. & Vigier, J-P, 1983, Found. Phys. 13, 253; Vigier, J-P, 1980, Lett. Nuovo Cim. 29, 467.
49. Cole, E.A.B., 1977, Il Nuovo Cimento, 40:2, 171-180.
50. Rauscher, E., 2002, Non-Abelian guage 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.
51. Burns, J.E. (1998) Entropy and vacuum radiation, *Found. Phys.* 28 (7), 1191-1207; 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, 2002, Dordrecht: Kluwer Academic.
52. Zeh, H.-D. (1989) *The Physical Basis of the Direction of Time*, Springer-Verlag, New York; Franck, G. 2000, Time and presence, in Science and The Primacy of Consciousness, R.L. Amoroso et al, (eds.) Orinda: Noetic Press.
53. Wheeler, J.A. 1955, Geons, Physical Review, 97:2, 511-536.
54. Misner, C.W., Thorne, K. & Wheeler, J.A. 1973, Gravitation, San Francisco: Freeman.
55. Miller, W.A. 1986, Found. Phys. 16:2, 143-169.
56. Gondran, M. 2002, A trajectory model for a particle in the Schrodinger approximation, preprint.
57. Rauscher, E. A. , 1983, Electromagnetic Phenomena in Complex Geometries and Nonlinear Phenomena, Non –Hertzian Waves and Magnetic Monopoles, Millbrae: Tesla Books.
58. Hansen, R.O. & Newman, E.T., 1975, General Relativity and Gravitation 6:21.
59. 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.
60. 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.
61. 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.
62. Lichtenberg, A.J. & Liebrman, M.A., 1983, Regular And Stochastic Motion, Berlin: Springer.
63. D'Humieres, D., Beasley, M.R., Huberman, B.A. & Libchaber, A., 1982, Chaotic states and routes to chaos in the forced penduluum, Physical Rev A, 26:6, 3483-34.