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MODELING OF GAGE DISCONTINUITY DISSIPATIVE PHYSICS

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ABSTRACT

Gleaning through the merits of novel PDP circuit assembly model advanced as extensions of electromagnetic gaging point dissipative physics model of the Iyer-Markoulakis formalism in the Helmholtz Hamiltonian gage formalism of Iyer-O'Neill-Malaver, we have progressed discontinuity dissipative physics modeling Integrated Model (IM). Integrated Model grand unifies point dissipative dynamics evolutionary Iyer-Markoulakis-O'Neill-Malaver formalism with emergent discontinuum Scalar Theory of Everything (STOE) Hodge model. Effectively, IM has capacity to explain all the four force fields of electromagnetism, gravity, strong force, and the weak force. Currently, it has been initiated only in the form of algorithm equation based on pure mathematical tensor metrics properties with observable physics formalisms. Quantum density matrix with scalar potential matrix and the wavefunction inner product and connecting functional algorithmic equation is gaged to vacuum solutions of magnetic hod Plenum* PDP assemblage. This has achievement by equating Integrated Model quantum cosmological algorithm vacuum gage fields equation of magnetic tensor action on electric tensor fields point gradient vortex discontinuity dissipative physics. Mesoscopic observable examples have been successfully analogized by applying developed theoretical algorithm. We extend presently Integrated Model to explain the primordial progenitor mechanism of prime factorization of superfluid of noisy signals vacuum Superluminal quanta generating ordered energy signals forming magnetic Hod Plenum* PDP assemblages. Subsequently, emergent "curdling" process of "hod photons" to electron-positron particles promotes building up of protons, neutrons, atoms, with gluonic links to quantum, mesoscopic to astrophysical spiral elliptical galaxies' source-sink mechanism manifesting cyclic universe.

Quantum Mechanics applies where gravitation is insignificant, and the dimensions are very small. There are many observations that remain poorly explained by the standard model. The strength of the Scalar Theory of Everything (STOE) is its ability to describe an extremely wide range of observations and to predict observations. Each of the STOE axioms has been used in the development of models of observations in the big and the small. The axioms that replace Quantum Mechanics are: (1) The universe is causative and three dimensional. (2) The diameter of the hods is the same throughout the universe. (3) The distance between hods is related to plenum density, ρ. Higher ρ reduces the distance between hods. (4) The speed of photons and hods (light) is the greatest of any matter in each environment. (5) The speed of the plenum wave is much faster than the speed of the hods. The STOE is a major paradigm shift.

Keywords: Quantum density matrix gage fields, dissipative, discontinuity, wave functions, point dynamics, scalar theory, hod, PDP circuit, source-sink mechanism, cyclic universe, Special Relativity, STOE.

INTRODUCTION TO OBSERVABLES DISCONTINUUM DISSIPATIVE PHYSICS

Quantum Mechanics (QM) was developed from consideration of Young's Experiment on the interference of light, the apparent quantum nature of black body radiation and the photoelectric effect, and the development of the Schrödinger Equation. There have

been many "interpretations" of QM which reduce to the Schrödinger Equation. Indeed, a proposed interpretation should reduce to the Schrödinger Equation is taken as an axiom. Most interpretations consider the wave function $\Psi(\mathbf{R}, t)$ to represent the probabilistic representation of the state of particles. These versions of QM are not causative, and they do not include gravity. De Broglie and later D. Bohm suggested a particle has a definite position and

momentum at all time domains. The probabilistic nature of QM was introduced as a measurement uncertainty. The attempt to reduce this model to the Schrödinger Equation proved difficult. The Scalar Theory of Everything (STOE) was developed to model cosmological problems (Hodge, 2016c, 2020). In (Hodge, Changing universe model with applications. http://www.arxiv.org/abs/astro-ph/0409765 v1) Hodge posited the universe was composed of two components and their interaction. The STOE is causative, Machian, and fractal (self-similar). The STOE application to QM started with Newton's speculations about corpuscular nature of light (Hodge, 2012, 2020). The STOE considers particles to be assemblies of hods that are the most elementary particles. The hods are magnets, with N and S poles, which warps the (magnetic) field of the plenum (Hodge, 2019d). Like Bohm, particles always have a definite position and momentum Unlike Bohm and QM in general, the STOE posits a plenum that is continuous, supports wave action, and without gravity causing particle (NOT a "superfluid"). Positing that the photon causes waves in the plenum that interfere and that direct the particle overcomes many issues with which Bohm struggled. That is, the photon is not represented as a wave function. The wave function represents waves in the plenum caused by the passing of the hods. This photon model and a toy simulation program were developed to yield a diffraction pattern after random particle photons moved a large distance that simulated the development of coherence of light (Hodge, 2012). Passing the photons through a slit and matching the screen pattern to a Fraunhofer pattern demonstrated coherence. Other observations suggest the photon distribution in a laser beam and explain the Afshar Experiment (Ashar, 2005) and the Transparent Mask experiment (Hodge, 2019a) that rejects the wave models of light. Iyer *et al*. (2020) suggested a Pauli-Dira-Plank-quantum circuit-assembly-gage model. This model suggested in Figure 10 shown in the paper by Iyer *et al*. (2020) that the moving magnetic field has causality in the generation of positive and negative field characteristics. This paper explores how the STOE applies to the Pauli-Dira-Plank-quantum circuit-assembly-gage model.

Original Iyer-Markoulakis formalism (Iyer and Markoulakis, 2021) is dissipative as well as evolutionary model since gradient and the vortex actions are incorporated onto the model to show how real universe may evolve out of vacuum superluminous quanta. Physical observables that appear with this formalism are real-time magneton observations (Markoulakis *et al*., 2019). These were observationally demonstrated by measurements with the Ferrolens {Commercially known as a Ferrocell. Ferrocell®USA Trademark. US Patent 8246356 "Magnetic flux viewer"; Website: https://www.ferrocell.us} of quantum magnet fields showing that mesoscopic observed "magneton" consists of two opposite magnetic monopole charges. So, the two

joint counter rotating magnetic flux monopole vortices jointed together to form a magnetic dipole or else a magnetic flux dipole vortex (Iyer and Markoulakis, 2021). This theory exposits conjecturally dipole magnetons exist only as dipoles. But in the superluminous energy phase of vacuum space, the magnetons exist only as monopole energy vortices vibrating at super luminous speed and are like the pixels and elementary quanta of discrete vacuum space occupying each point of it (Iyer and Markoulakis, 2021). Pure mathematical tensor analysis with problem solving having partial differential equations of point motion fields aspects energy of zero point and microblackhole point dynamics has been brought out in a recent paper (Iyer, 2021a). In this paper, expressions of complex interaction quantification of zero-point source gradient to microblackhole sink vortex looping dissipative mechanism alongside exemplified problem solving has been achieved as well (Iyer, 2021a).

Pure mathematical generalized formalism solutions have been also proved to link inner product to outer product such that scalars/tensors micro macro connectivity quantifiability physics algebraic matrices are graphically relatable (Iyer and Malaver, 2021). Further, gaging mechanics to electromagnetic theory helps to pull out observables. Parameters that effectively would define quantum density matrix operator eigenfunctions having general energy fields, E, functional commutator, F^E_t. with density matrix, $\rho(t)$, influencing time event process are explained quite thoroughly (Iyer and Malaver, 2021; Iyer, 2021b, 2021c). Quantum results obtained by such fundamental formalisms with Iyer-Markoulakis (Iyer and Markoulakis, 2021) have been applied to dark energy star astrophysics (Malaver *et al*., 2021). Ansatz Helmholtz Hamiltonian mechanics of gravity metric potential, anisotropy, interior energy density, and other related physical properties of such stars have been discussed by Malaver *et al*. (2021).

A novel model Pauli-Dirac-Planck-quantum-circuit, i.e. PDP circuit assembly-gage, consisting of the monopole quasiparticles and electron-positron particle fields, demonstrates power of Iyer-Markoulakis-Helmholtz Hamiltonian mechanics with transformed metrics to Coulomb gage (Iyer *et al*., 2020). There are many scenarios graphically analyzed for the PDP circuit assembly (Iyer *et al*., 2020). Figure 10 in the paper by Iyer *et al*. (2020) will likely give best scenario for finite element modeling analysis via computer programming followed by simulation theoretical validation. Electric tensors of adjacent assemblies, per Figure 10 of (Iyer *et al*., 2020) can act as spherical cells – elements, while dipole magnetism can act as nodes of such Finite Element Modeling (F.E.M.) program. One of the predictors from theoretical analysis of PDP model (Iyer *et al*., 2020) is an evaluator property of expected compression of quantum space-time surfaces. At quantum level, PDP assembly is

expected to stabilize energy generation perpetually, whereas at higher relativistic level, particle real formations would be stabilizing energy generation universally. We currently have procedure to develop computer programming of Hamiltonian algebra energy geometry providing algorithm simulation programs. However, these are beyond the scope of our current paper. However, in this paper, we will emphasize on pulling out physical observables from theoretical modeling sequences, which appear in earlier papers procedurally (Iyer and Markoulakis, 2021; Iyer, 2021a, 2021b, 2021c; Iyer and Malaver, 2021).

Proof observable physics: Figure 10 in (Iyer *et al.*, 2020) has north-south monopoles attractive (unlike) and electric tensors parallel (like) hence repulsive since magnetic field at each charged particle exerts force on each other. Symmetries rule action of attractive balancing repelling to keep apart, generating inductively electric tensor out of magnetic tensor fields, which are deemed to be the primordial progenitors of genesis forces, outlined below.

We can ansatz unify dissipative action with mathematically quantifiable observable discontinuum physics (Appendix I) that proves observability of logically derived metrics equations of proof physics formalisms (Iyer and Malaver, 2021; Iyer, 2021b, 2021c). Discontinuum emergent theory more explicitly Hodge's Scalar Theory of Everything (STOE) shows how a discontinuum physics has potential capability to explain all the known phenomena from quantum to mesoscopic to astrophysical levels. These include particularly photons, particles, atoms, gravitational mass, strong forces with gluonic binding, inertial mass, spiral galaxies as sources and elliptical galaxies as sinks, forming feedback loop mechanism of a cyclic universe (Hodge, 2016a, 2020). One may advance Iyer-Markoulakis model formalism to be originally evolutionary theory, while Hodge's STOE model to be an emergent theory. With dissipative explanatory physical capabilities with Iyer-Markoulakis model combined to "hod" moving on Plenum theory of a discontinuum explanatory capabilities of Hodge model, it is possible to have integrated model explaining dissipative discontinuum physics. Complex aspects with observables will get examined by simulation programming that Christopher O'Neill has started already with ongoing development models. We will have demonstration below of how unification of dissipative evolutionary model of vacuum superluminous quanta noisy signals Plenum may give rise to discontinuous emergent model of hod Plenum PDP magneto-electric gage fields.

The sections of this paper discuss the aspects of the models: Physics conjecture of the vacuum quantum density energy matrix with highlights of magnetic hod STOE PDP point assemblage, ongoing finite element modeling, computer simulation programming, as well as results and discussions on the STOE point physics with conclusions.

Physics conjecture of the vacuum quantum density energy matrix

As noted in earlier papers (Iyer and Malaver, 2021; Iyer, 2021b, 2021c), quantum wavefunction while having gaging with dissipative discontinuum energy will need to be gaged towards vacuum solutions. Equation (1) here provides relationship of functional F^E_t, wavefunction inner product ($<\Psi_\mu(t)|\Psi^\mu(t)>$), quantum density matrix $\rho(t)$, and scalar potential **V**, originally formalized per proof and physics formalisms (Iyer and Malaver, 2021; Iyer, 2021b, 2021c) to be:

$$F^E_t = \rho(t) \, (<\Psi_\mu(t)|\Psi^\mu(t)>)^{-1} \, \mathbf{V} \tag{1}$$

Highlights of magnetic hod STOE PDP point assemblage

The STOE considers the energy density matrix to be the ρ which is the energy density of the plenum. The F^E_t is the gradient of the scalar field ρ. The movement of the hods produces vortices in the plenum which are the charges - cyclone type and ring type (Hodge, 2018d). Because the charges and the coulomb field are plenum effects the velocity of coulomb effects are much faster than light as experiment has confirmed (de Sangro *et al.*, 2015). The Ψ are real waves in the plenum. Therefore, the equation also applies to gravity. The hods being magnets also suggests the structure of particles and atoms are magnetic but not electric. Thus, the nucleus of atoms may be held together by magnetic forces, though there may be interactive effects via quantized circular currents. The scalar ρ depends on all the masses, Sources and Sinks in the universe. The gradient ~ ρ gives the "gravity" and Mach's Principle. The STOE Relativity considers that the accelerated frame to be indistinguishable from the inertial frame. This aspect has already been used to calculate the galaxy redshift and the Pioneer Anomaly; further, this gives the Poisson Equation. The STOE extends into General Relativity scales by considering the changes in position of the masses, Sources, and Sinks which will yield the d'Alembert's Equation without the complexity of tensor General Relativity that involves the conversion to geometry and the inverse conversion to gain physical observations. The STOE calculates all physical quantities as invariant under velocity except as specifically calculated or as caused by changes in ρ. Therefore, the laws of nature are scale invariant; thereby, relation of gravity and scale invariance becomes clear.

The dipole magnetic tensor of Figure 10 in (Iyer *et al.*, 2020) may be modeled as "hod" (Hodge references) that can generate electric tensor with rotational effect of "permanent magnet" like hod plenum field. Such magneto-electric interactive Plenum quanta fields will lead to electromagnetic light photons. Planck frequencies

are extremely high, via $\hbar\omega$ = unitary as shown in Appendix II, metrically having the frequency of typically 10^{33} [Hz], zillions of magnitudes higher than a gamma ray radiation. These frequencies are self-similar to possibly the energy density of the universal space having a value of Planck energy density (Šorli et al., 2022). Photons, which are assemblage of hods moving on Plenum*, {Plenum*: Plenum Superluminal Vacuum Quanta} possessing such high intensity can generate chain like quasi-particle "curdling" action elsewhere explained (Iyer, 2021b, 2021c). These are like high energy photons splitting onto electron positron particles. Hence one physics conjecture possibly is that "curdling" of the milky way particles with "galaxy" having high signal profile of superluminal velocity will constitute plasmatic quagmire (Iyer, 2021b, 2021c). Physical conjecture that we advance of Plenum Superluminal Vacuum Quanta to effectively be noisy superfluid having random fluctuations. With perpetual oscillations, Plenum Superluminal Vacuum Quanta will undergo primordial mechanism of key prime factorization processes generating ordered prime signals entangling to form hod assemblages within the Plenum*. These fundamental processes lead to formation of PDP circuit cell functor assemblies, that are shown in Figure 10 schematics of (Iyer et al., 2020), constituting magnetic tensor (monopoles) matrixing with electric tensor (particles). At high energies Planckian level, possibly splitting of electric tensor photons by "curdling action" to electrons positrons pairs, analogously magnetic tensors to monopoles will constitute essentially perpetual generators operating in essence like universal quantum ticking clocks (Šorli et al., 2022). These are also understood to be within the context luminiforus ether, experimentally the speed of gravity, and how obstacle surface affects speed of the light (Michelson and Morley, 1987; van-Flanden, 1998; Verdad, 2021).

PDP circuit model is modified below, having sections on "Dissipative Discontinuum Physics: Quantum Vacuum Gravity" and Hodge's Scalar Theory of Everything (STOE) adapted to PDP model circuit of Iyer-O'Neill-Malaver. Justifiability, these well corroborate original evolutionary theoretical model having Iyer-Markoulakis formalism with dissipative point gradient vortex action fields. Explanation of PDP circuit may effectively be modified by applying Hodge's Scalar Theory of Everything (STOE), which would suggest that at high energy regions near Planck scale "hods", which are like permanent rigid magnets constitute packed assembly forming photons. High energy photons, via "curdling" action (Iyer, 2021b, 2021c) may split onto positrons and electrons, producing those electric fields, that correspond to scenario per Figure 10 of (Iyer et al., 2020). This may mean that "hods" that have dipolar magnetic fields can produce these particles; conceivably, by splitting of dipoles onto monopoles are analogously possible at these Planck scale high unitary frequency regions (Appendix

II). These processes are possible even at 10^{-26} [m] that are several orders of magnitude higher than Planck scale, at which the PDP circuits exist (Iyer et al., 2020). Essentially, this will indicate an inverse mechanism of PDP circuit formation, modifying sequence that will confirm to scenario per Figure 10 of originally proposed model by Iyer et al. (2020). We know per quantum field theory that electron positron particles can be generated out of high energy photons with chain like "curdling" action, as explained per physics literature (Iyer, 2021b, 2021c).

Similarity to physics procedures (Iyer et al., 2020) and Appendix I, we will have to gage Equation (1), noting equivalent STOE (Hodge, 2017a, 2017b, 2017c, 2018a, 2018c) Plenum* gradient functional of $F^E_t = [G_g]_{Pg}$, gage wavefunction inner product of the electric and magnetic tensor fields $(<\Psi_\mu(t_g)|\Psi^\mu(t_g)>) = (<[\Psi_E(t_g)]|[\Psi^M(t_g)]>)$, gage Plenum* quantum density matrix $\rho(t) = [\rho_P(t_g)]$ corresponding to hod STOE model (Hodge, 2017a, 2018b, 2019b, 2019c) and gage time, t_g (Appendix I), gage scalar potential, $[V(\mathbf{r}_{GR})]$, which is a function of $\mathbf{r}_{GR}$: gaged distance of hod moving on Plenum*. Further, we may note "hod" is conceived to be moving at velocity near speed of light, provable as per calculations with argumentation shown in Appendix II.

Hence, Equation (1) we can essentially write to be:

$$[G_g]_{Pg} = [\rho_P(t_g)] \, (<[\Psi_E(t_g)]|[\Psi^M(t_g)]>)^{-1} \, [V(\mathbf{r}_{GR})] \qquad (2)$$

Only $V(\mathbf{r}_{GR})$ is function of space $\mathbf{R}$, while $\{[G_g]_{Pg}, [\rho_P(t_g)]\} \neq f(\mathbf{R})$, and the wavefunctions $\{[\Psi_E(t_g)], [\Psi^M(t_g)]\}$ have $(e^{-ikr_{GR}})$ form. Hence, gaging Equation (2) w.r.t. $\mathbf{R}$ will produce $[V(\mathbf{r}_{GR})] => [\mathfrak{E}_{GR}]$ and $(<[\Psi_E(t_g)]|[\Psi^M(t_g)]>)$ will give a coefficient of $(-k^2)$, due to $[\Psi_E]$ and $[\Psi^M]$, each having differentiation particularly of $(e^{-ikr_{GR}})$ form w.r.t. $\mathbf{r}_{GR}$. Here, $\mathbf{k}$, which is the wave vector of quantum-mechanical wavefunction and $\mathbf{r}_{GR,}$ which is the gage distance of quantum wave particle motion, act like planar waves due to non-thickness "hod" quanta. We thus deduce that $\mathbf{k}$ points to wave propagation direction. To compute gage, we rearrange Equation (2) to have all the variables $\{[G_g]_{Pg}, [\rho_P(t_g)], (<[\Psi_E(t_g)]|[\Psi^M(t_g)]>)\}$ on L.H.S. and only $[V(\mathbf{r}_{GR})]$ on R.H.S. Thereby we can arrive to the following algorithmic resulting equation form:

$$[G_g]_{Pg} = [\rho_P(t_g)] \, (<[\Psi_E(t_g)]|[\Psi^M(t_g)]>)^{-1} \, [\mathfrak{E}_{GR}] \qquad (3)$$

where $[\mathfrak{E}_{GR}]$ stands for the quantum gage fields, typically consisting of gradient and the vortex actions, as scalar unitarized potential systems gage units.

Key to Plenum* gage time, t_g is $[\rho_P(t_g)]$, which is the charge density per unit area, noticing STOE "hod" having no thickness, i.e., only surface area. Gage field $[\mathfrak{E}_{GR}]$

being potential per path unit, $\|[\boldsymbol{\rho}_P(t_g)]*[\boldsymbol{\mathfrak{E}}_{GR}]\|$ is the charge density per unit area * scalar potential per unit length. This has effectively equivalence to scalar energy density. By virtue with Physics literature (Iyer and O'Neill, 2021. Youtube video: "Gage Discontinuity, Teknet Earth Global Ep.2.01".https://www.youtube.com/watch?v=jFA8Im3V Kzc; O'Neill and Iyer discuss this proposed paper in the time window 25:45 to 44:55) and (Hossenfelder, 2021. Youtube video: "Physicist Despairs over Vacuum Energy" providing information of vacuum cosmological energy constant in the time window 3:45 to 5:48. https://www.youtube.com/watch?v=bl_wGRfbc3w) that vacuum energy density is equivalent to cosmological constant Λ, it can be equated to $\|[\boldsymbol{\rho}_P(t_g)]*[\boldsymbol{\mathfrak{E}}_{GR}]\|$. This is possible only after gaging Λ giving Λ_{gv}: the gage vacuum energy density cosmological constant, evaluated thus as the vacuum solutions with transformation of Equation (3).

Multiplying both sides of Equation (3) by $[\boldsymbol{\mathfrak{E}}_{GR}]^{-1}$, manipulating matrix simplifying, we get:

$$[\mathbf{G}_g]_{Pg}[\boldsymbol{\mathfrak{E}}_{GR}]^{-1} = [\boldsymbol{\rho}_P(t_g)] \, (<[\boldsymbol{\Psi}_E(t_g)]|[\boldsymbol{\Psi}^M(t_g)]>)^{-1}$$

Multiplying both sides by $(<[\boldsymbol{\Psi}_E(t_g)]|[\boldsymbol{\Psi}^M(t_g)]>)$ $[\boldsymbol{\mathfrak{E}}_{GR}]$, noting $\|[\boldsymbol{\rho}_P(t_g)]*[\boldsymbol{\mathfrak{E}}_{GR}]\| = \Lambda_{gv}$, we transform to vacuum solutions:

$$\|[\mathbf{G}_g]_{Pg}[\boldsymbol{\mathfrak{E}}_{GR}]^{-1}(<[\boldsymbol{\Psi}_E(t_g)]|[\boldsymbol{\Psi}^M(t_g)]>)[\boldsymbol{\mathfrak{E}}_{GR}]\|= \quad (4)$$
$$\|[\boldsymbol{\rho}_P(t_g)]*[\boldsymbol{\mathfrak{E}}_{GR}]\| = \Lambda_{gv}$$

with $[\boldsymbol{\mathfrak{E}}_{GR}]$, quantum gage fields, also maybe written as $[\boldsymbol{\mathfrak{E}}_{GR}] = [\boldsymbol{\mathfrak{E}}_{GR}]_{gv}$, typically consisting of gradient (g) and the vortex (v) actions, as scalar unitarized potential systems gage units.

Results and discussions on the STOE point physics

The list of problematical observations that the STOE explains continues to grow with an improved understanding of the universe (Hodge, 2016a, 2016c, 2020). The STOE rejects the notion of spacetime because of the arrow-of-time. The STOE arrives at the Equivalence Principle by a particle structure argument (Hodge, 2016b). Therefore, geometric gravity and spacetime are unnecessary. Each of the STOE axioms has been used in the development of models of observations in the big and the small. The strength of the Scalar Theory of Everything (STOE) is its ability to describe an extremely wide range of observations and to predict observations. The STOE is a major paradigm shift.

Point Physics PDP Circuit Model of Iyer-Markoulakis-O'Neill-Malaver integrated to STOE model has advantage of Equation (4) in that it is expressed as the wavefunction inner products, and a function of the Plenum* gage fields of the hods, that are amenable to be modelled on to be computer programmable simulations. Quantum density matrix with gage fields is expressed by Equations (3) and

(4). Equation (1) maybe widely applied to pull out physical observables even with mesoscopic examples, like in the enumeration (Appendix III) of one-to-one correspondence of algorithmic equation with observable formula of the expanded functional linking sound and light, wavefunction, density population pattern matrix, and the equivalent gage fields, such as temperature and pressure variables.

Appendix I quantitatively derives observables transforming Equation (1) to gage velocity, $\mathbf{v}_g$ in terms of number $\mathbf{n}(t)$ of discontinuum lengths (DL), angular momentum, and gaged gap length $g[\mathbf{r}_g(t)]$ of the discontinuum length (DL). Therefore, $\mathbf{v}_g = \mathbf{n}(t) \, \omega_P(t) \, g[\mathbf{r}_g(t)]$, with $g[\mathbf{r}_g(t)]$ as a "gage trajectory". We can also write observable "$\tau_{energy} \, \boldsymbol{\Psi}_{fields}$" to be "$\tau_{\mathbf{H}(t)} \, \boldsymbol{\Psi}_{\boldsymbol{\mathfrak{E}}(t)}$" because energy can be written in terms of kinetic energy, $P^2/2m$, and potential energy, V(r), having both $\mathbf{H}(t)$ and $\boldsymbol{\mathfrak{E}}(t)$ observables quantum mathematically. We emphasize $\tau_{energy} \, \boldsymbol{\Psi}_{fields} = \mathbf{V(r)}\boldsymbol{\rho}(t) = \mathbf{V} \, \mathbf{i}$ = power density δP, that are observable in the form of mechanical motor action or photon light action as physically observables, as explained in Appendix I.

Signal/noise equation unitarized energy generalizing Spectral Plenum hod PHYSICS conjecture relation by equating broken telephone network example of information transmissions algorithm:

$$\sum_{i=1}^{n} \sum_{j=1}^{m} \Gamma_{ij} = 1 \quad (5)$$

Γ_{ij}: the signal/noise ratio of i, j element of information transmission line matrix quantitatively is explaining typical mathematical equivalence form Appendix II.

Solving with spectral pattern signal/noise point gradient vortex, having $[\mathbf{G}_g]_{fns}$: functional linking fibrational noisy signals, while $[\boldsymbol{\rho}_{sp}(t_g)]$: spectral population pattern density signal/noise ratio having Equation (5) as given above, $<[\boldsymbol{\Psi}_{noise}(t_g)]|[\boldsymbol{\Psi}^{signal}(t_g)]>$: the wavefunction inner product matrix of the signal/noise gage time, and $[\boldsymbol{\mathfrak{E}}_{gR}]_{gv}$: the gage space gradient vortex fields, per Iyer-Markoulakis formalism theoretical modeling, we obtain transformed equation of algorithm:

$$[\mathbf{G}_g]_{fns} [\boldsymbol{\rho}_{sp}(t_g)]^{-1}(<[\boldsymbol{\Psi}_{noise}(t_g)]|[\boldsymbol{\Psi}^{signal}(t_g)]>) = [\boldsymbol{\mathfrak{E}}_{gR}]_{gv}$$
[Appendix II],

where general gage velocity of a hod moving on Plenum* has speed of light.

Plenum Superluminal Vacuum Quanta, per Point Dissipative STOE Gage Modeling itself has possibility of velocity higher than that of the speed of light, as brought

out by computing gage unitarizing with physics form modeling [Appendix II].

Notes on how life may exist in a superfluid frictional vacuum

PDP circuit assemblies (Iyer *et al*., 2020) provide way to creation of perpetual genesis process with energy of superluminous universe generated out of weak frictional vacuum (Zhang, 2021a, 2021b, 2021c, 2021d), increasing entropy emergently. Superfluidity with observables of real world may thus happen in this eternal cycle of entropy and energy transference of wave matter quanta. Life may have to exist within this entropy region of universal space to rejuvenate entropy to energy, creating eternal "perpetual motion machine" like cyclic universe!

Future investigations

Above Integrated Model explains major aspects with the grand unified field theories, especially STOE model of our ansatz Integrated Model has predicted already electromagnetism, strong force, and the gravitational force. These have knowhow to understanding of photons, gluons, and neutrons well within the scheme of hods moving on Plenum*, The dissipative point dynamics model extending Iyer-Markoulakis formalism to Helmholtz Hamiltonian gage has advanced novel PDP quantum circuit model. In an upcoming paper, PDP circuit strings are analyzed to extend the physics of the quantum field theory, vectorizing with multiple lattice quasi-particle assemblies. Vectorized strings of particles, of the sort: $(S{\rightarrow}e^-{\rightarrow}S{\rightarrow}e^-{\rightarrow}S{\rightarrow}e^-{\rightarrow}S{\rightarrow}e^-{\rightarrow}S...)$ as well as the inverse: $(N{\rightarrow}e^+{\rightarrow}N{\rightarrow}e^+{\rightarrow}N{\rightarrow}e^+{\rightarrow}N{\rightarrow}e^+{\rightarrow}...)$ are like strings of magnetic and the electric charges seen in Maxwell's equations and electromagnetic waves of light. This may explain how the weak theory might generate entities, like schemes of "hod" assemblies with the STOE component with Integrated Model. We believe hod PDP assemblies will help towards grand unifying known quantum fields force merging with the classical mechanics, observable magnetons and deductive magnetic hod structures forming the fundamental building blocks of the universe. Further, the photon-photon Feynman diagram and multiple quasi-particle assemblies extending throughout space of extended PDP Circuits can be arranged into vectors and matrices of different sizes and dimensions, like the $S{\rightarrow}e^-$ vector chain, $N{\rightarrow}e^+$ vector chain, the inverse PDP Circuit centered on 'S' and e^+, for example. The asymmetry with south magnetic pole w.r.t. north magnetic pole has been experimentally observed by Hodge, reported also elsewhere in the context with PDP analysis of SUSY field metrics (Iyer *et al*., 2020), and hence such central tendency of the south magnetic pole will be quite expected. Putting together all these aspects, the primordial progenitor may very well be mechanism of prime factorization of superluminal vacuum quanta of random noisy signals to ordered energy signals. These form magnetic Hod Plenum* PDP assemblages, with

emergent "curdling" of "hod photons" to electron-positron particles setting stage for creation of host of massive particles, conforming to Standard Model. We hope having explanatory expositive analysis to appear in our upcoming paper.

We have reasons to believe that it possible to have observables pulled out of theoretically derivable algorithm equations model, signal/noise equation with unitarized energy generalizing spectral Plenum* hod point PHYSICS. These aspects will be examined further in sequel paper in preparation currently. Typical observable mesoscopic analogy of quantum aspects has been exemplified further quantitatively within [Appendix III].

CONCLUSION

We have progressed discontinuity dissipative physics modeling Integrated Model (IM). IM has aim towards grand unifying point dissipative dynamics evolutionary Iyer-Markoulakis-O'Neill-Malaver formalism with emergent discontinuum Scalar Theory of Everything (STOE) Hodge model. Such a model has potency to explain all the four force fields of electromagnetism, gravity, strong force, and the weak force. So far this has been initiated currently from algorithm equation based on pure mathematical tensor metrics properties quantitative formalism enabling us to pull out observable physics measurables.

Proof formalism equation relates quantum density matrix with scalar potential matrix and the wavefunction inner product as well as connecting functional, i.e., $F^E_t = \rho(t) (\langle\Psi_\mu(t)|\Psi^\mu(t)\rangle)^{-1}$ **V**. This algorithm gaged to vacuum solutions of magnetic hod Plenum* PDP assemblage transforms giving Integrated Model quantum cosmological algorithm vacuum gage fields equation, like $\|[\mathbf{G_g}]_{Pg}[\mathbf{\mathcal{E}}_{GR}]^{-1}(\langle[\mathbf{\Psi_E}(t_g)]|[\mathbf{\Psi^M}(t_g)]\rangle)[\mathbf{\mathcal{E}}_{GR}]\|$
$= \|[\mathbf{\rho_P}(t_g)]^*[\mathbf{\mathcal{E}}_{GR}]\| = \Lambda_{gv}$. This formula will describe magnetic tensor action on electric tensor fields point gradient vortex discontinuity dissipative physics. Key examples successfully have analogized mesoscopic observables.

We have progress with extending Integrated Model to explain the primordial progenitor mechanism of prime factorization of noisy signals of superfluid of vacuum Superluminal quanta. We conjecture generation of ordered energy signals forming magnetic Hod Plenum* PDP assemblages. With emergent "curdling" process having "hod photons" to electrons-positrons pairs, upscales then build up protons, neutrons, and atoms, with gluonic links. Globalizing these to mesoscopic and astrophysical spiral elliptical galaxies' source-sink mechanism will enunciate concept of a cyclic universe.

Presently our efforts with multi-projects propose observables physics that are demonstrable at mesoscopic levels having proof observatory validation justifying ably theoretical physics with advancement of the grand unifying point Integrated Model to explain natural mechanisms.

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Appendix I.
Observable quantum physics discontinuity computing
Generalizing abstract physics

Referring (Iyer and Malaver, 2021) and applying Equation of algorithm with that functional, $F^E_t = \rho(t)(<\Psi_\mu(t)|\Psi^\mu(t)>)^{-1}\mathbf{V}$, we can set the following discontinuum mathematical formulations.

Rewriting above equation by multiplying both sides by $(<\Psi_\mu(t)|\Psi^\mu(t)>)$, we get:

$$F^E_t (<\Psi_\mu(t)|\Psi^\mu(t)>) = \rho(t) \mathbf{V} \qquad (AI.1)$$

where $\rho(t)$ is the quantum density matrix; $\Psi_\mu(t)$ and $\Psi^\mu(t)$ are the upper and lower indices of the wavefunctions actions, and $\mathbf{V}$ is the scalar potential representing vortex as well as gradient fields; F^E_t: scalar functional that may also have tensor characteristics depending on conditions of situations within physical mathematical modeling of theoretical observable exactly (Iyer and Malaver, 2021; Iyer, 2021b, 2021c).

Let $F^E_t = \tau_{energy}$ and $(<\Psi_\mu(t)|\Psi^\mu(t)>) = \Psi_{fields}$. Then, substituting these values to Equation (AI.1):

$$\tau_{energy} \Psi_{fields} = \mathbf{V} \rho(t) \qquad (AI.2)$$

Physics conjecture: Per Iyer: "$\tau_{energy} \Psi_{fields}$" $\Rrightarrow$: $:\Lleftarrow$ observable.

Proof: Physically analyzing Equation (AI.2), we see that $\tau_{energy} \Psi_{fields} = \mathbf{V} \rho(t)$.

Interpreting $\rho(t)$ = energy quantum density form of charge, i.e., $\mathbf{i}$: current density, we easily obtain that $\mathbf{V} \rho(t) = \mathbf{V} \mathbf{i}$ = power density δP; τ_{energy} is then equivalent to δP, the power density, having energy = $\hbar(\tau)^{-1}$ and time differential change in geometry/topology.

We can set $\{(\delta P)(geometry)\}$ = output in the form of electrical energy transformable to mechanical motor action or photon light action really! Here, geometry will refer to {area, volume) multiplicity to transform power density to energy form.

Since mechanical motor action or photon light action are physically observable, we have proved that "$\tau_{energy} \Psi_{fields}$" $\Rrightarrow$: $:\Lleftarrow$ observable. Hence, Equation (AI.2) is a valuable logical algorithm mathematical physics formula.

Lemma:
Observable Physics "$\tau_{energy} \Psi_{fields}$" may also represent "discontinuum line" physical mathematical "algebra". This is since τ_{energy} which may be thought like continuum is multiplied by quantum non-continuum eigen Ψ_{fields} wavefunction.

Inferential Physics

The classical mechanics equivalence of potential is velocity, $\mathbf{v}$ {https://lpsa.swarthmore.edu/Analogs/ElectricalMechanicalAnalogs.html} and that of a wavefunction is trajectory, $\mathbf{r}(t)$ {https://www.quora.com/What-is-the-analogy-of-a-wave-function-in-classical-mechanics}. Parametrically defining that $\rho(t)$. $n(t) = o_{n\rho}$ and $o_{n\rho}.DL = 1$, per unitary principle having quantum density matrix $\rho(t)$ to be inversely proportional to number $\mathbf{n}(t)$ of discontinuum lengths, DL.

One may argue proportionality constant of $o_{n\rho}$ will have a unitary proportionality with the DL. Analog equivalence, per above would allow us to replace scalar potential $\mathbf{V}$ with velocity $\mathbf{v}$, wavefunction Ψ with trajectory $\mathbf{r}(t)$, as well as the quantum density matrix $\rho(t)$ with inverse of number $\mathbf{n}(t)$ of discontinuum lengths DL, a constant in gaging operations. Thus, we will get proper observable relationships from Equation (AI.1) substitutions of these values.

i.e. $F^E_t (<\Psi_\mu(t)|\Psi^\mu(t)>) = \rho(t) \mathbf{V}$ will become:

$$F^E_t (<\mathbf{r}_\mu(t)|\mathbf{r}^\mu(t)>) = \{\mathbf{n}(t)/o_{n\rho}\}^{-1} \mathbf{v} \qquad (AI.3)$$

Self-similarity with Equation (AI.1) of $F^E_t = \tau_{energy}$ and $(<\Psi_\mu(t)|\Psi^\mu(t)>) = \Psi_{fields}$, Equation (AI.3) will have that $F^E_t = \omega_{momentuam}$ and $(<\mathbf{r}_\mu(t)|\mathbf{r}^\mu(t)>) = \mathbf{r}_{discontinuum\_energy\text{-}fields}(t) = \mathbf{r}_{DEF}$; then we get:

$$\omega_{momentuam} \mathbf{r}_{DEF}(t) = \{\mathbf{n}(t)/o_{n\rho}\}^{-1} \mathbf{v} \qquad (AI.4)$$

We can also calculate $\mathbf{r}_{DEF}(t) = \mathbf{n}(t). DL + \mathbf{r}_g(t)$, with $\mathbf{r}_g(t)$: gap length of discontinuum length DL. Further gaging will be helpful to compare theoretical platforms. Thereby, we gage transform to:

$$g[\mathbf{r}_{DEF}(t)] = g[\mathbf{n}(t). DL] + g[\mathbf{r}_g(t)] = g[\mathbf{n}(t)].g[DL] + g[\mathbf{r}_g(t)] = g[\mathbf{r}_g(t)] \qquad (AI.5)$$

Reason: the gage (g) is a differential length and DL a constant will make $g[DL] = 0$ in the Equation (AI.5). Similarly, velocity $\mathbf{v}$ will become gage velocity $\mathbf{v}_g$; let that $\omega_{momentuam} = \omega_P(t)$.

We can therefore get the following results, per Equations (AI.4) and (AI.5):

$$\omega_P(t) g[\mathbf{r}_g(t)] = \{\mathbf{n}(t)/o_{n\rho}\}^{-1} \mathbf{v}_g \qquad (AI.6)$$

Rearranging Equation (AI.6), we obtain that

$$\mathbf{v}_g = \{\mathbf{n}(t)/o_{n\rho}\} \omega_P(t) g[\mathbf{r}_g(t)] \qquad (AI.7)$$

We note that $g[\mathbf{r}_g(t)]$ is a "gage trajectory".

Since we have proved that in Equation (AI.2) "τ_{energy} Ψ_{fields}" is observable, we write observable "τ_{energy} Ψ_{fields}" with "$\tau_{H(t)}$ $\Psi_{\mathfrak{E}(t)}$" since energy can be written in terms of kinetic energy, $P^2/2m$ and potential energy, V(r). Both $\mathbf{H}(t)$ and $\mathfrak{E}(t)$ are observables {Quantum Physics literature}!

$\mathfrak{E}(t)$ is essential to have charge, whereas parity will be key to quantum $\mathbf{H}(t)$ metrix, which may have quantum time reversal aspects. We can ask: "Is the time flipping possible and then if so, will it too be imaginary or real exactly?"

One may envision characterizing discontinuum length DL and the gap length $\mathbf{r}_g(t)$ by binary matrix since these variables logically are discrete parameters. $\mathbf{r}_g(t)$ has then countability with quantum density matrix $\boldsymbol{\rho}(t)$ linked to $\mathbf{n}(t)$ physics, via code 1….0….1….1….0….1, like in a matrix form may be also quantifiable as binary to decode time space sense!

Appendix II
Signal/noise equation with unitarized energy
Generalizing of the Spectral Plenum hod PHYSICS
Equating broken telephone network and information transmissions: Equation (5) with Γ_{ij}: the signal/noise ratio of i, j element of information transmission line matrix, we can advance model to Point dynamics PHYSICS dissipative theory Iyer-Markoulakis formalisms. Point to point information energy transmissions tend to have self-activations with vortex gradient process. However, transformations energy -> entropy with continual conversion of potential energy to kinetic energy with such transmissions are naturally possible. Increase in entropy will be associated to emergent temperature rises, per Third Law of Thermodynamics transformations! Rationally, broken telephone network may be conjectured to change due to modons {which are dipole eddy pairs (Hughes and Miller, 2017)} fluid dynamical like communication strings actions transforming noise to signals via "$\Phi_{proofing}$" hypothesis. Advancing further preliminary physics conjecture: Modons quantum level may be entangled linking typically of Diracian south monopole to that of north monopole Dirac strings! Similarly, observable mesoscopic levels may originate, as an example, "OH$^-$" string attaching to "H$^+$" strings within the water molecules!

More with pure mathematics algorithmic equations of Equations (1) to (3) above, we have the following relations:

$$[\mathbf{G}_g]_{Pg} = [\boldsymbol{\rho}_P(t_g)] \, (<[\boldsymbol{\Psi}_E(t_g)]|[\boldsymbol{\Psi}^M(t_g)]>)^{-1} \, [\mathfrak{E}_{GR}] \qquad \text{(AII.1)}$$

Solving with spectral pattern signal/noise point gradient vortex action fields, we can arrive to:

$$[\mathbf{G}_g]_{fns} = [\boldsymbol{\rho}_{sp}(t_g)](<[\boldsymbol{\Psi}_{noise}(t_g)]|[\boldsymbol{\Psi}^{signal}(t_g)]>)^{-1} \, [\mathfrak{E}_{gR}]_{gv} \text{ (AII.2)}$$

where $[\mathbf{G}_g]_{fns}$: typical functional linking fibrational noisy signals; $[\boldsymbol{\rho}_{sp}(t_g)]$: spectral population pattern density signal/noise ratio satisfying transmission equation having: Equation (5) with Γ_{ij}: the signal/noise ratio of i, j element of information transmission line matrix; $<[\boldsymbol{\Psi}_{noise}(t_g)]|[\boldsymbol{\Psi}^{signal}(t_g)]>$: wavefunction inner product matrix of signal/noise gage time; $[\mathfrak{E}_{gR}]_{gv}$: gage space gradient vortex fields, per Iyer-Markoulakis formalism theoretical modeling per (Iyer and Markoulakis, 2021).

Gage unitarization physics having a form modeling
Per Iyer Markoulakis formalism argumentation (Iyer and Markoulakis, 2021; Iyer, 2000, 2021b, 2021c; Iyer *et al.*, 2021), unitarized energy = $\hbar\omega = 1 = f$(noise) = i$\boldsymbol{\Psi}$ = signal = E/mc^2. We derive then DeBroglie equivalence (de Haas, 2004) with $E = \hbar\omega$ to give $\hbar\omega/mc^2 = 1$, or $mc^2 = 1$ for the unitarized energy.

Thereby, substituting value of relativistic mass, $m = m_o/(1-v^2/c^2)^{1/2}$, we get $m_o/(1-v^2/c^2)^{1/2} \, c^2 = 1$. With electron rest mass, $m_o \approx 10^{-30}$ [kg] and $c^2 \approx 10^{17}$ [m^2/s^2], we can get $(1-v^2/c^2)^{1/2} = 10^{-13}$ or $(1 - v^2/c^2) = 10^{-26}$; or we have $1 - v^2/c^2 + v^2/c^2 = 10^{-26} + v^2/c^2$, i.e., $1 = 10^{-26} + v^2/c^2$.

Therefore, $v^2/c^2 = 1 - 10^{-26} \approx 1$; correspondingly, $v \approx c$, which will then be velocity of hod moving on Plenum Superluminal Vacuum Quanta, per Point Dissipative STOE Gage Modeling. We note Plenum itself may have velocity higher than that of the speed of light.

Gage unitarizing energy matter fields
We can show quantum wavefunctions having automatic gaging results. Quantitatively deriving here, see also in Appendix I, the vacuum solution quantum gaging gravity cosmology with observable universe analysis has been modeled to have an infinite point matrix. That will get reduced to [3 × 3] quantum density matrix switches' states (pixels) having {0, off, on] modes.

We deduce the following: Equating proof formalism results with PHYSICS formalism (Iyer and Malaver, 2021) with appropriate expansion of "bra", "ket", "gage", "potential", and the associated coefficient and the vector matrix forms, we propose mathematical logically to achieve 21 variables, having 11 equations. This topology will have to consider magic square formations {Iyer and O'Neill you tube TEGS videos: https://www.youtube.com/channel/UCdU-nenH0oEFiSxivgVqLYw}, having column, row, and diagonal cross diagonal elements adding to same value that is the property of magic square matrices.

Additionally, fundamental prime factorizations, especially with <0, Π> =>: :<= ><{0, Π/2, Π}>< representing zero mode {dielectric, inductor, resistor}, Π/2 mode as:

electric tensor, Π mode as magnetic tensor is proposed as progenitor mechanism. With these argumentations, we arrive at $0 <$" Ψ(off)" < 0.1, and $0 <$ "Ψ(on)" < 0.28 estimations. These are then linked to PDP circuitry scenario, Figure 10 in (Iyer *et al.*, 2020), perhaps providing answer to why observables will exist, specifically based on the argument of point state "Ψ(on)" > "Ψ(off)". Eventually, "Ψ" values are comparable to [Theory of Everything] values after inputting these conditions of switches' states. Thereafter, experimental work with cleverly designed appropriate experimental observations will verify this proposal alongside measurements. We may also note PDP circuitry model assemblies have simulation programming results coming in the year 2022.

Appendix III
Example of applied problem-solving physics
Observable mesoscopic analogy quantum aspects

Let a lake has ducks-swans population pattern swimming. One may envision the ducks are moving in a row (famous adage to get all ducks on a row!), in Equation (1) configuring given these:

$\Psi_\mu = \Psi_d = \Psi_{ducks}$ and then $\Psi^\mu = \Psi^s = \Psi^{swans}$, which are probability functions quantifying population pattern with swans/ducks, observing swans go together in a direction of the swimming, while ducks may be in different orientations swimming.

ρ_{ds} = ducks swans population density pattern; $[G_g]_{\Gamma ij}$: the functional, G_g having Γ_{ij}, signal/noise ratio of sound (Γ_{ij}^ξ), light(Γ_{ij}^l), and modon strings $\{[d]=>::<=[s]\}$ of G_g that will modulate swans/ducks movements as well; $\mathbf{\mathcal{E}}_{GR} = (\mathbf{\mathcal{E}}_{GR})_{gv}$: the gage fields that are mechanics equivalently [g, v]{gradient, vortex} up and down pressure and temperature. If we set gradient = temperature, then pressure = vortex fields.

We will <u>algorithmically formulate observables with expansion matrix</u> equating:

$<\Psi ducks(tg)| = (\Psi_{d1}, \Psi_{d2})$ "ducks on a row";
$|\Psi swans(tg)> = (\Psi_{s1}, \Psi_{s2})$ "swans on arrow"   (AIII.1)

The gradient fields are up/down temperature. The vortex fields are anticlockwise-clockwise pressure. Equation (4) will give configurations of above schema, substituting data of situations:

$[G_g] \Gamma_{ij} [(\mathbf{\mathcal{E}}_{GR})_{gv}]^{-1}(<[\Psi_d(t_g)]|[\Psi^s(t_g)]>)[(\mathbf{\mathcal{E}}_{GR})_{gv}]$
$= [\rho_{ds}(t_g)]*[(\mathbf{\mathcal{E}}_{GR})_{gv}]$ (AIII.2)

On expanding the value matrices:

$$\begin{pmatrix} [Gg]\Gamma_{ij}^l \\ [Gg]\Gamma_{ij}^\xi \end{pmatrix} \begin{pmatrix} \varepsilon_{GR,v} & \varepsilon_{GR}^g \\ \varepsilon_{GR,g} & \varepsilon_{GR}^v \end{pmatrix}^{-1} \begin{pmatrix} \Psi_{d1} & \Psi_{d2} \end{pmatrix}$$
$$\times \begin{pmatrix} \Psi_{s1} \\ \Psi_{s2} \end{pmatrix} \begin{pmatrix} \varepsilon_{GR,v} & \varepsilon_{GR}^g \\ \varepsilon_{GR,g} & \varepsilon_{GR}^v \end{pmatrix} \qquad \text{(AIII.3)}$$
$$= \begin{pmatrix} \Gamma_{ij}^{d1} & \Gamma_{ij}^{s2} \\ \Gamma_{ij}^{s1} & \Gamma_{ij}^{d2} \end{pmatrix} \begin{pmatrix} \varepsilon_{GR,v} & \varepsilon_{GR}^g \\ \varepsilon_{GR,g} & \varepsilon_{GR}^v \end{pmatrix}$$

We permutate population pattern sequel to get simulation algorithmic equation of the moving population greater than $[2 \times 2]$ matrix of the above-mentioned example.

Physics conjecture applying discontinuity dissipative models

Above developed may estimate speed profiles of photon in a vacuum, c; however, graviton may have speeds to c^4, while superluminal vacuum quanta may possess speeds more than c^4 but less than ∞.

Measurement of scalar potential matrix operational profile

Above Equation (1) algorithm will require knowledge of scalar potential matrix. We will have to conduct standardized experiment with controlled flow-pressure measurements to simulate analogically mechanics. This will augment construction of standard analog equivalent circuit that will help to translate to current-potential profiles. Statistically, for given population pattern, modulating scalar potential quantum density matrix with dynamic speeds profile will then facilitate computations of evolving observable energy density matrix explicitly. Thereby, power density profile computing of the quanta is possible.