Quantum Astrophysics General Formalisms Theoretical to Experimental Gaging

*Rajan Iyer**

Environmental Materials Theoretical Physicist, Department of Physical Mathematics Sciences Engineering Project Technologies, Engineeringinc International Operational Teknet Earth Global, Tempe, Arizona, United States of America. ORCID ID#:0000-0002-5729-1393. Corresponding Author Email: engginc@msn.com

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ABSTRACT

Galileo's gravitational theory equation of object motion, Newoton's mechanics of the universal gravitational theory, Conservation Laws of Thermodynamics, Maxwell's electromagnetic light mathematical field theory, Bohr-Schrödinger-Planck quantum mechanics, Einstein's special and the general relativity theory, Heisenberg Uncertainty Principle, Hawkings time blackhole theoretical Physics, Higgs Particle Physics, Penrose cosmological theories, Standard Model, String theories, Symmetry Groups matrices, Grand Unified Theories, and M-theory amongst other theoretical and experimental physics form the basis to advance natural pure and applied physics with paradigm shifts future progressiveness. Overall references with literature surveys appear towards the end of this review Chapter. With IT developments progressing physics towards the future of paradigm shifting processes the grand physical mathematical unification verifiable simulations with experimental investigative proofs satisfying philosophy will help to transform transitional physics to normal physics. Technologically satisfying general physics, algorithm graphical real approach input, throughput, output using particle physics generators as well as annihilators having interactive energy matter environmental processes will surely transform society from informational constitutions. Characterizing physical mathematical aspects emphasized precisely at each step will help algorithmic meaningful progression to rational consummation of earth as well as beyond earth missions.

The author has summarized the PHYSICS gist of advances made in the last decade having back to the blackboard examination of the inconsistencies within major branches, especially quantum and relativistic mechanics quantifying quantum astrophysical nature with physical process mechanism operating universe or universes concomitantly. Most of the PHYSICS formalisms theoretical mathematical modeling results the author has peer-published highlights have been emphasized providing wide variety of graphics to conceptualize as well as establish explanations on a broader basis. Specifically, original Helmholtz point decomposition fields modeling Iyer Markoulakis matrix formalisms that have been thereby successfully gaged having "Stringmetrics" formulation to explain fermionic fields gradient working conjunction with particle vortex fields to proceed problem solving mechanics. The author has advanced further to identify mechanisms that operate at the Planck quantum level such as Hod-PDP

rotational circuit "perpetual motion machine" like assembly to generate particles from Superluminal turbulent "Superfluids" quagmire universal noisy Plenum having perhaps monopole activated energies. Space-time surfaces compressed quantum with dipole magnetism forming to show electric tensors keeping the space fields quanta that are measurable with Poynting vectors have been graphically demonstrated. Algorithm Graphics PHYSICS matrix operationally quantifiable formulae have been thoroughly derived basically out from first principles quantifying Hamiltonian Hermitian Higgs Coulomb gaging to arrive wavefunction, eigen spinors, signal/noise point-to-point metrics correlating with PHYSICS literature observational measurements results. Numerical achievements with operational mechanisms that are applicable for ongoing analytical modeling experimental parameters practically tabulations well discussed to take PHYSICS directionally to proper perspectives with unifying concepts having gage unitarization normalization procedures have been expounded to greater detail. The author has ansatz model introduced switches-states metrics to classify, observe, measure, analyze, and extend Standard Model metrics of charge, spin, parity, color, flavor, mass gage, and the coupling parameters to particle PHYSICS dynamic characterizations.

Progressively, the author has devised techniques with methodology to demonstrate analogous transform theoretical to macroscopic simple examples of applied problem-solving physics normal observables experimentation measurement schema. Quantum Gravity Modified Newtonian Dynamics PHYSICS Discontinuum Modeling of Nonlinear Time Rotational Space Gauge Fields Algorithm Numeration Matrix that are computer simulation programmable metrics have been originally developed by general transforms having Lagrange, Hamiltonian, Laplace, Legendre, Fourier, and Jacobian mathematical transforms have been incorporated to generalize universal observer physics black-box nature.

Prototype set-ups, figures, variable measuring instrumentation systems feasible Experimental Designs sketch graphical blueprint engineering technological advances that the author has achieved have been layout explained. PHYSICS results from computer programming of matrix value numerical Algorithm IT coding with short discussions that the author has accumulated over these years are highlighted. Strong gravity versus weak gravity thesis PHYSICS quantifying gravitational physics dense fibers transforms propositions with synthesis of strong and the weak interactive particle spectra of vacuum baryons, quark-gluon-plasma, with gravitonic mesons evolution processes as well as Planck Quantum Point PHYSICS Vortex Gradient Fields Structures have been extended to explain how unifying field particle theories may be achieved eventually.

INTRODUCTION

We will start briefly elucidating the history of PHYSICS, specifically the role of PHYSICS, particularly theoretical practically deriving experimentally provable verifiable observables. Since that is extensive thesis having large number of references, listing literature surveys are given at the end and no referential aspects like a paper article will be attempted here to make it like review editorial that will help reader to understand material without having to *constantly refer every paragraph. Here, the chapter thesis represents a very short compilation of key PHYSICS progressively advanced by scientists, especially physicists who are Nobel Laureates. History of physics summarized here spans over three centuries of careful theoretical and experimental scientific physics works with in-depth thought, philosophy, logic, practical sense, painstakingly keen observations objectively, clever instrumentation measurements with precision and extreme accuracies, as well as hypothetical testing, proof, verifications, with mathematical abstractness, as well as physical clarity.*

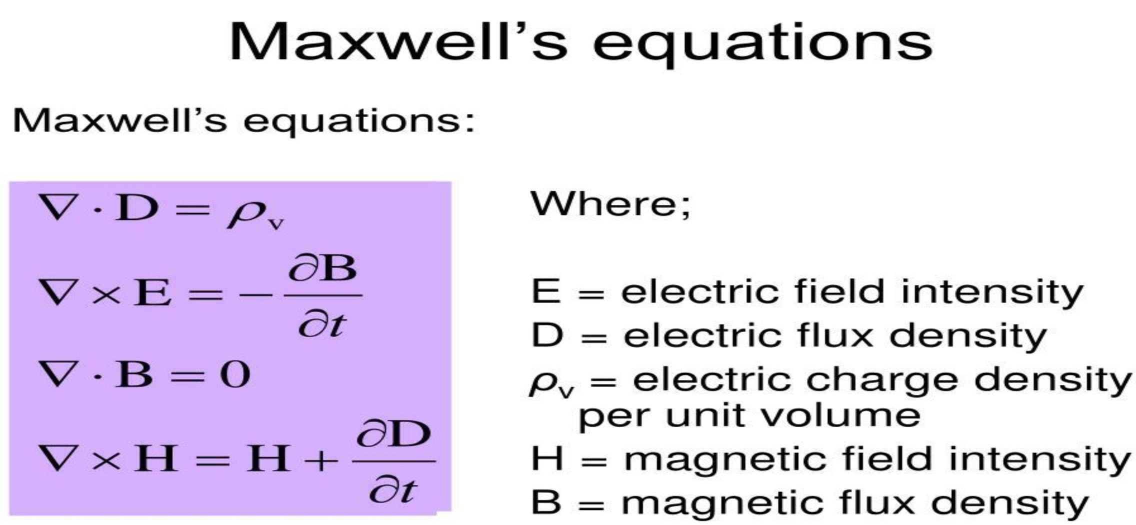
*Galileo's gravitational theory equation of object motion is an expression that describes how an object falls under the influence of gravity, neglecting any air resistance or other forces. Galileo deduced this equation by performing experiments with balls rolling down inclined planes and observing their distances and times. Galileo deduced the equation s = 1/2 * g * t^2 where s is the distance traveled by the object, g is the acceleration due to gravity (9.8 m/s^2 on Earth), and t is elapsed time geometrically, using the Merton rule, which is a mean speed theorem of uniform acceleration. Discovered by Oxford Calculators of the Merton College, and proved by Nicole Oresme, it states that a uniformly accelerated body starting from rest travels the same distance as a body with uniform speed whose speed is half the final velocity of the accelerated body. Galileo realized that the same equation applied to objects falling vertically if they were in a vacuum. This equation is one of the basic equations of kinematics, which describes the motion of objects without considering the causes of their motion. It can be used to calculate the distance, velocity, or time of a free-falling object, given any two of these quantities. Galileo's equation also paved the way for Newton's laws of motion, which generalized and extended Galileo's findings to all kinds of forces and motions. Newton's second law of motion states that the acceleration of an object is proportional to the net force acting on it and inversely proportional to its mass. This law is written as: F = m * a, where F is the net force, m is the mass, and a is the acceleration. Using Newton's second law, Galileo's equation for free-fall becomes the F = m*a = W = m * g, with a = g and solving for s = 1/2 * a * t^2 = 1/2 * g * t^2.*

*Newton's mechanics of universal gravitational theory is a framework that explains how gravity works in the universe. Newton's theory states that every object in the universe attracts every other object with a force that is proportional to the product of their masses and inversely proportional to the square of the distance between them. The equation for Newton's law of universal gravitation is F = G * m_1 * m_2 / r^2, where F is the gravitational force, G is the gravitational constant (6.67 x 10^-11 m^3/kg s^2), m_1 and m_2 are the masses of the objects, while r is the distance between them. Newton's theory also implies that gravity is a universal force that acts on all matter, regardless of its state or composition. Gravity affects not only solid objects, but also fluids, gases, light, and even time; it follows the principle of superposition, which means that the net gravitational force on an object is the vector sum of the individual gravitational forces exerted by other objects. Newton's theory of gravity was very successful in explaining many phenomena, such as the motion of planets, moons, comets, and tides. However, it also had some limitations and inconsistencies, such as the inability to account for the precession of Mercury's orbit, the bending of light by massive objects, or the equivalence of inertial and gravitational mass. These problems were later resolved by Einstein's theory of general relativity, which replaced Newton's theory as a more accurate and comprehensive description of gravity.*

Overall, conservation gist laws of thermodynamics are a set of principles that describe how energy and entropy behave in thermodynamic systems. Thermodynamics is a branch of physics that deals with heat, work, temperature, and their relation to energy and matter. There are four main conservation laws of thermodynamics: (I) The zeroth law of thermodynamics states that if two systems are in thermal equilibrium with a third system, then they are also in thermal equilibrium with each other. This law establishes the concept of temperature as a measure of the average kinetic energy of the particles in a system. (II) The first law of thermodynamics states that the change in internal energy of a system is equal to the heat added to the system minus the work done by the system. This law expresses the conservation of energy principle for thermodynamic processes and implies that energy can be transformed from one form to another, but not created or destroyed. The equation for the first law is: $\Delta U = Q - W$, *where* ΔU *is the change in internal energy,* Q *is the heat added to the system, and* W *is the work done by the system. (III) The second law of thermodynamics states that the entropy of an isolated system always increases or remains constant in a spontaneous process. This law implies that there is a natural tendency for disorder to increase in the universe and that some forms of energy are more useful than others. The second law also defines the concept of a heat engine, which is a device that converts heat into work, and establishes its limitations. (IV) The third law of thermodynamics states that the entropy of a pure crystalline substance at absolute zero temperature is zero. This law implies that absolute zero temperature is impossible to reach by any physical means and that it is impossible to remove all the disorder from a system.*

Entropy is a concept that measures the degree of disorder or randomness in a system. It is also related to the unavailability of energy for doing useful work in a system. Entropy is an important concept in physics, chemistry, biology, information theory, and other fields. Entropy is a state function that depends only on the current state of the system, not on how it got there. It is defined as the ratio of the heat transfer into or out of a system to the absolute temperature of the system The equation for entropy change is: $\Delta S = Q / T$, *where* ΔS *is the change in entropy,* Q *is the heat transfer, and* T *is the absolute temperature. According to the second law of thermodynamics, the entropy of an isolated system never decreases in a spontaneous process. This means that isolated systems tend to reach a state of maximum entropy, or thermodynamic equilibrium, where no more work can be extracted from them. This also implies that some forms of energy are more useful than others, and that energy conversion always involves some loss of useful energy. In statistical mechanics, entropy is related to the number of microscopic configurations or states that are compatible with the macroscopic state of the system. The more states there are, the higher the entropy. The equation for entropy in statistical mechanics is* $S = k * \ln W$, *where* S *is the entropy,* k *is the Boltzmann constant,* $\ln$ *is the natural logarithm, and* W *is the number of microstates. This equation shows that entropy is a measure of uncertainty or information content of a system. The higher the entropy, the less information we have about the exact state of the system. Entropy can also be seen as a measure of information loss or noise in a communication process.*

Maxwell's electromagnetic light mathematical field theory is a set of equations that describe how electric and magnetic fields are generated and interact with each other and with electric charges and currents. The theory also predicts that light is an electromagnetic wave, a *disturbance of electric and magnetic fields that travels through space at a constant speed. The theory was developed by James Clerk Maxwell, a Scottish physicist and mathematician, in the 1860s. He unified the existing laws of electricity and magnetism, discovered by scientists such as Coulomb, Ampère, Faraday, and Gauss, and added his own insights and corrections. He published his first paper on the subject in 1864, titled "A Dynamical Theory of the Electromagnetic Field", where he derived an electromagnetic wave equation with a velocity for light in close agreement with experimental measurements[3]. He later published his full theory in his book Electricity and Magnetism in 1873. Maxwell's equations can be written in different forms, depending on the choice of variables and notation. The most common form is the differential form, which uses partial differential equations to relate the electric field E, the magnetic field B, the electric charge density \\rho, and the electric current density J at each point in space and time. The equations are:*



The first equation is Gauss's law for electricity, which states that the electric flux through any closed surface is proportional to the net electric charge enclosed by the surface. The second equation is Faraday's law of induction, which states that a changing magnetic field induces an electric field that circulates around it. The third equation is Gauss's law for magnetism, which states that there are no magnetic monopoles or isolated magnetic charges. The fourth equation is Ampère's law with Maxwell's correction, which states that a changing electric field or an electric current induces a magnetic field that curls around it. By combining these equations, Maxwell showed that electromagnetic waves can propagate in free space without any source or medium. He also calculated the speed of these waves as: $c = 1/\sqrt{\mu 0 \varepsilon o}$ *, which is equal to the speed of light measured by experiments, with* μ_0*: permeability of free space and* ε_o*: permittivity of free space. He concluded that light is an electromagnetic wave of a certain frequency and wavelength. Maxwell's theory was confirmed by experiments conducted by Heinrich Hertz in 1887, who generated and detected electromagnetic waves using electric circuits. Hertz also showed that these waves have the same properties as light, such as reflection, refraction,* *polarization, interference, and diffraction. Maxwell's theory also explained other phenomena involving light as well as electromagnetism, such as the Doppler effect, the Zeeman effect, the photoelectric effect, and the Compton effect. Maxwell's theory is one of the great achievements of physics and mathematics. It laid the foundation for modern physics and technology, such as radio, television, radar, lasers, fiber optics, wireless communication, etc. It also inspired Albert Einstein to develop his theories of special and general relativity.*

Quantum Mechanics has been developed by many 20th century physicists, such as Max Planck, Albert Einstein indirectly, Niels Bohr, Erwin Schrödinger, Werner Heisenberg, Wolfgang Pauli, and Paul Dirac. These physicists made groundbreaking contributions to the understanding of the nature of matter and radiation at the atomic and subatomic scales. Quantum mechanics is a branch of physics that describes the behavior of physical systems that are governed by the laws of quantum physics, which differ from the laws of classical physics. Quantum physics reveals that physical quantities, such as energy, momentum, angular momentum, electric charge, etc., can only take discrete values, called quanta. Quantum physics also introduces the concepts of wave-particle duality, uncertainty principle, superposition principle, entanglement, and many others that challenge the commonsense notions of reality. The origins of quantum mechanics can be traced back to the discovery of black body radiation; the term was introduced by Gustav Kirchhoff in 1860 [From (Kirchhoff, 1860) (Annalen der Physik und Chemie), p. 277. Planck proposed that the energy of electromagnetic radiation is quantized in units of hf, where h is Planck's constant, and f is the frequency of the radiation. This explained the observed distribution of radiation emitted by a hot object, which could not be accounted for by classical physics.

In 1905, Einstein extended Planck's idea to explain the photoelectric effect, which is the emission of electrons from a metal surface when exposed to light. Einstein proposed that light itself is composed of quanta, called photons, which have energy hf and momentum hf/c, where c is the speed of light. He showed that the kinetic energy of the emitted electrons depends on the frequency of the incident light, not on its intensity. In 1913, Bohr developed a model of the hydrogen atom that incorporated both classical and quantum physics. He assumed that electrons orbit around the nucleus in circular orbits with fixed radii and energies. He also postulated that electrons could be jumping from one orbit to another by absorbing or emitting photons with energy equal to the difference between the orbital energies. He derived a formula for the energy levels of the hydrogen atom that agreed with experimental observations. In 1925-1926, Schrödinger and Heisenberg independently formulated two equivalent versions of quantum mechanics: wave mechanics and matrix mechanics. Schrödinger introduced a wave equation that describes how the quantum state of a system evolves in time and space. He interpreted the square of the wave function as the probability density of finding a particle in each region. He also showed that his equation can reproduce Bohr's formula for the hydrogen atom. Heisenberg introduced a matrix representation of physical observables and their commutation relations. He also formulated an uncertainty principle that states that there is a fundamental limit to how precisely one can measure two incompatible observables, such as position and momentum. In 1926-1927, Pauli and Dirac made further advances in quantum mechanics. Pauli proposed an exclusion principle that states that no two identical fermions (particles with half-integer spin) *can occupy the same quantum state in a system. This explained the structure of the periodic table and the stability of atoms. Dirac combined quantum mechanics with special relativity to obtain a relativistic wave equation for electrons. He also predicted the existence of antimatter and explained the origin of electron spin processes.*

The uncertainty principle was formulated by Werner Heisenberg in 1927, based on his analysis of the quantum nature of light and matter. Heisenberg realized that to measure the position or momentum of a particle, one must use another particle, such as a photon, to interact with it, with uncertainty equation: $\Delta x.\Delta p \geq h/4\pi$, having change in position, Δx multiplied by change in momentum, Δp measurements with uncertainty greater than or equal to Planck's constant, h divided by 4π. However, this interaction inevitably disturbs the particle and changes its state in an unpredictable way. Therefore, there is a trade-off between the accuracy of the measurement and the disturbance caused by the measurement[1]. The uncertainty principle can be expressed mathematically as an inequality that relates the standard deviations of the measurements of two complementary quantities, such as position x and momentum The formal inequality relating the standard deviation of position σ_x and the standard deviation of momentum σ_p was derived by Weyl and Kennard as $\sigma_x \sigma_p \geq \hbar/2$, where σ_x and σ_p are the standard deviations of x and p, respectively, and $\hbar$ is the reduced Planck's constant (about value 1.05 x 10^-34 J s). This equation means that the product of the uncertainties in position and momentum is always greater than or equal to a constant value. The uncertainty principle does not imply that the measurements are affected by errors or limitations of the instruments. Rather, it reflects a fundamental property of quantum systems that arises from their wave-particle duality. Quantum systems, such as electrons or photons, can behave as both waves and particles, depending on how they are observed. However, these two aspects are incompatible and cannot be simultaneously observed with arbitrary precision. Thereby, it sets a limit to how much one can know about both aspects at once. It has profound implications for quantum physics and our understanding of reality. It implies that quantum systems are inherently probabilistic and indeterministic, meaning that their outcomes cannot be predicted with certainty, but only with probabilities. It also implies that there is a fundamental limit to how much information one can extract from a quantum system, and that some information is irretrievably lost in the process of measurement.

Einstein's special and general relativity theory is a set of physical theories that describe how space, time, matter, and energy interact in the universe. The theory consists of two parts: special relativity and general relativity. Special relativity is a theory of the structure of space and time. It was proposed by Einstein in 1905, based on the principle that the laws of physics are the same for all observers who are moving at constant velocities, and that the speed of light is constant in a vacuum[34]. Special relativity shows that space and time are not absolute, but relative to the state of motion of the observer. It also shows that mass and energy are equivalent, according to the famous equation E = mc^2, where E is energy, m is mass, and c is speed of the light. Special relativity applies to all physical phenomena in the absence of gravity. General relativity is a theory of gravity. It was developed by Einstein between 1907 and 1915, based on the principle that gravity is not a force, but a consequence of the curvature of space and time *caused by the presence of mass and energy. General relativity shows that the effects of gravity are equivalent to the effects of acceleration, and that light can bend, redshift, or blueshift when passing near massive objects. It also predicts new phenomena, such as gravitational waves, gravitational lensing, black holes, and gravitational time dilation. General relativity applies to the cosmological and astrophysical realm, where gravity is strong and cannot be neglected. Einstein's theory of relativity revolutionized physics and astronomy in the 20th century. It explained many phenomena that could not be accounted for by classical physics, such as the precession of Mercury's orbit, the deflection of starlight by the Sun, the expansion of the universe, and the existence of cosmic microwave background radiation. It also inspired new fields of research, such as quantum mechanics, nuclear physics, relativistic astrophysics, and cosmology.*

One of the consequences of Einstein's General Theory of Relativity is predicting presence of black holes as extreme regions of gravity. They have a boundary called the event horizon, which marks the point of no return for anything that crosses it. The size of the event horizon depends on the mass of the black hole. The more mass a black hole has, the larger its event horizon is. The event horizon is also the surface from which black holes emit Hawking radiation, a faint stream of particles and radiation that results from quantum effects near the horizon. Black holes are invisible to the naked eye, because they do not reflect or emit any light. However, they can be detected by their effects on the surrounding matter and light. For example, black holes can form accretion disks, which are swirling rings of hot gas and dust that orbit around them. The accretion disks can emit intense radiation, such as X-rays and gamma rays, that can be observed by telescopes. Black holes can also distort the light from distant stars and galaxies, creating a phenomenon called gravitational lensing. Black holes can vary in size and mass, depending on how they are formed and how they evolve. There are three main types of black holes: (I) Primordial black holes: These are hypothetical black holes that may have formed in the early universe, when density fluctuations caused some regions of space to collapse under their own gravity. They could have masses ranging from a fraction of a gram to thousands of times that of the Sun. (II) Stellar black holes: These are black holes that form when massive stars run out of fuel and explode as supernovas, leaving behind a dense core that collapses under its own gravity. They typically have masses between 5 and 100 times that of the Sun. The first black hole ever discovered was Cygnus X-1, a stellar black hole that orbits a blue supergiant star. (III) Supermassive black holes: These are black holes that have masses millions or billions of times that of the Sun. They are thought to exist at the centers of most galaxies, including our own Milky Way. They may have formed from the collapse of large gas clouds or from the mergers of smaller black holes in the early universe. They play a crucial role in the evolution of galaxies and the formation of quasars, which are extremely bright objects powered by accretion disks around supermassive black holes. The first image of a supermassive black hole was taken in 2019 by the Event Horizon Telescope, a network of radio telescopes around the world. The image shows the shadow of the black hole at the center of Messier 87, a giant elliptical galaxy about 55 million light-years away.

Hawking radiation is the theoretical phenomenon of black holes emitting thermal radiation, which reduces their mass and energy over time. It was proposed by Stephen Hawking *in 1974, based on the combination of quantum mechanics and general relativity. Hawking radiation arises from the quantum fluctuations of the vacuum near the event horizon of a black hole. According to quantum theory, the vacuum is not empty, but filled with virtual particles that pop in and out of existence in pairs. Normally, these particles annihilate each other quickly and have no observable effects. However, near the event horizon, one of the particles can fall into the black hole, while the other can escape to infinity. The escaping particle becomes real and carries away some energy from the black hole. The falling particle has negative energy, as measured by an observer at infinity, and reduces the mass of the black hole. Hawking radiation has a black body spectrum, which means that it depends only on the temperature of the black hole. The temperature of a black hole is inversely proportional to its mass, so smaller black holes are hotter and emit more radiation than larger ones. The equation for the temperature of a black hole is:* $T_{\mathrm{H}} = \frac{\hbar c^3}{8\pi G M k_{\mathrm{B}}}$ *where* T_H *is the Hawking radiation temperature,* $\hbar$ *is the reduced Planck's constant, c is the speed of light, G is the gravitational constant, M is the mass of the black hole, and* k_B *is the Boltzmann constant. Hawking radiation implies that black holes are not completely black, but glow with a faint radiation that can be detected by an observer far away from the black hole. However, this radiation is extremely weak and difficult to observe in practice. For a typical stellar black hole with a mass of 10 solar masses, the temperature would be about 0.00006 kelvins, which is much colder than the cosmic microwave background radiation. Therefore, such a black hole would absorb more radiation than it emits and would not evaporate. However, for very small black holes, such as primordial black holes that may have formed in the early universe, Hawking radiation could be significant and cause them to lose mass faster than they gain it. As a black hole loses mass, its temperature increases and it emits more radiation, creating a positive feedback loop that accelerates its evaporation. Eventually, the black hole would reach a critical mass and explode in a burst of radiation. Hawking radiation is one of the most important discoveries in theoretical physics, as it reveals a deep connection between quantum theory, gravity, thermodynamics, and information theory. It also poses profound puzzles for our understanding of black holes and their role in the universe.*

What is known, black holes are very difficult to detect directly because they do not emit or reflect any light. However, scientists can infer their presence and properties by observing their effects on the surrounding matter and light. There are several methods to detect black holes, such as: (1) Accretion disks: Black holes can be surrounded by disks of gas and dust that are attracted by their gravity. As the matter in the disk spirals inward, it gets heated up by friction and emits radiation across the electromagnetic spectrum, especially in X-rays. By measuring the brightness, temperature, and spectrum of the radiation from the accretion disk, scientists can estimate the mass and spin of the black hole. (2) Stellar orbits: Black holes may also be detected by observing the orbits of stars around them. By applying Kepler's laws of planetary motion, scientists can calculate the mass of the object that the stars are orbiting. If the mass is very large and concentrated in a small region, it is likely to be a black hole. This method was used to confirm the existence of a supermassive black hole at the center of our galaxy, Sagittarius A, by tracking the orbits of several stars near it. (3) Gravitational lensing: Black holes can also bend the light from distant objects behind them, creating a phenomenon called* *gravitational lensing. This can produce multiple or distorted images of the background object, or a bright ring of light around the black hole, called an Einstein ring. By analyzing the shape and brightness of the lensed images, scientists can infer the mass and location of the black hole. (4) Gravitational waves: Black holes can also emit gravitational waves, which are ripples in space-time caused by accelerating masses. Gravitational waves are produced when two black holes merge, or when a black hole collides with another compact object, such as a neutron star. By detecting and analyzing the gravitational waves from these events, scientists can measure the masses and spins of the black holes involved, as well as their distance and orientation.*

The event horizon is the spherical outer boundary of a black hole, loosely considered to be its "surface". It is the point where the gravitational pull of the black hole becomes so strong that nothing, not even light, can escape from it. The event horizon is not a physical barrier, but a region of space-time where the escape velocity equals the speed of light. Anything that crosses the event horizon is doomed to fall into the black hole's singularity, a point of infinite density and zero volume. However, an observer outside the event horizon would never see anything cross it, because of time dilation and gravitational redshift. Instead, they would see the object appear to slow down and fade away as it approaches the horizon. The size of the event horizon depends on the mass of the black hole. The more mass a black hole has, the larger its event horizon is. The radius of the event horizon is called the Schwarzschild radius, and it is given by the formula: $Rs = 2GM/c^2$ *where Rs is the Schwarzschild radius, G is the gravitational constant, M is the mass of the black hole, and c is the speed of light. The event horizon is also affected by the spin and charge of the black hole. A rotating black hole has an oblate event horizon that is smaller at the poles and larger at the equator. A charged black hole has a smaller event horizon than a neutral one of the same mass and spin. The event horizon is one of the most mysterious and fascinating features of a black hole. It marks the boundary between what we can observe and what we cannot. It also raises many questions about what happens inside a black hole, such as whether there are other types of horizons, whether there are wormholes or other universes beyond them, and whether information is lost or preserved inside them.*

Microblackholes are hypothetical black holes that have very small masses and sizes, possibly as small as the Planck scale (about 10^{-35} *meters and* 10^{-8} *kilograms). According to some theories, microblackholes could have been created in the early universe or by high-energy collisions of particles, such as those that occur in particle accelerators or cosmic rays. Zero-point vacuum field theory is a term that refers to the application of quantum field theory to the vacuum state, which is the lowest energy state of a quantum system. According to quantum field theory, the vacuum state is not empty, but filled with fluctuating fields and virtual particles that pop in and out of existence. These fluctuations give rise to a zero-point energy, which is the minimum energy that a quantum system can have. There is a possible connection between microblackholes and zero-point vacuum field theory. Some physicists have speculated that microblackholes could be created by the fluctuations of the=zero-point fields, or that they could be sources or sinks of zero-point energy. However, these ideas are highly speculative and not well supported by experimental evidence or theoretical consistency.*

Theoretical PHYSICS, a branch of physics that employs mathematical models encompassing observational abstractions of physical objects and systems to have capability to predict rationally explaining natural phenomena. Some examples of real-life applications of theoretical physics are:

- ✓ *Simple mechanical devices: The principles of mechanics, such as force, torque, energy, and momentum, can be applied to understand and design simple mechanical devices, such as levers, pulleys, wheels, gears, springs, and other machine components. These devices are commonly used in everyday life for various purposes, such as lifting heavy objects, cutting food, opening doors, as well as machineries and human support systems towards manufacturing, assembly, and distribution of products and life systems.*

- ✓ *Medical equipment and treatment: Particle physics, which studies the fundamental constituents of matter and their interactions, has led to many improvements in the medical machinery, such as sterilizing instruments, producing medical imaging, detecting tumors, and treating cancer. Many hospitals employ physicists who operate and maintain the particle accelerators that are used for these purposes.*

- ✓ *Electronics and communication: The theories of electricity and magnetism, quantum mechanics, and solid-state physics have enabled the development of various useful electronic devices and systems that are essential for modern life, such as computers, smartphones, televisions, radios, lasers, as well as control physical systems aside robots and drones. These devices and systems rely on the operational principles and the properties of manipulatable electric currents, magnetic fields, semiconductors, photons, as well as field effect transistors.*

The difference between theoretical and experimental physics is that they use different approaches to study the physical phenomena in the universe. Foregoing explanations with Theoretical Physics may be contrasted to Experimental physics that uses methods to make observations and experiments applying tools in experimentations to study these physical phenomena. It is also involved in testing the predictions generated by theoretical physics by devising appropriate experiments. Theoretical physics and experimental physics are not mutually exclusive, but rather complementary. The advancement of science generally depends on the interplay between theory and experiment. Some theories produced by theoretical physics were tested under experimental physics, such as Einstein's general theory of relativity and the prediction of gravitational waves. Conversely, some results of experimental physics have led to the development of new theories, such as quantum mechanics and the discovery of subatomic particles.

Some examples of experimental physics are:

- ✓ *Particle physics experiments: These are experiments that study the fundamental constituents of matter and their interactions, using advanced tools such as particle accelerators and detectors. Some examples of prominent particle physics experiments are: Relativistic Heavy Ion Collider (RHIC), which collides heavy ions such as gold ions* *and protons, located at Brookhaven National Laboratory, USA; Large Hadron Collider (LHC), which collides protons and lead ions, located at CERN, Switzerland; Belle II experiment, which studies the properties of B mesons and other particles, located at KEK, Japan, Asia.*

- ✓ *Optics experiments: These are experiments that study the properties and behavior of light and its interaction with matter, using tools such as lasers, lenses, mirrors, prisms, etc. Some examples of famous optics experiments are Young's double-slit experiment, which demonstrates the wave nature of light and the phenomenon of interference; Michelson-Morley experiment, which tests the existence of a luminiferous ether and the constancy of the speed of light; Polarization experiments, which show how light can be filtered or rotated by certain materials or devices.*

- ✓ *Gravitational wave experiments: These are experiments that detect and measure the ripples in space-time caused by massive accelerating objects, such as black holes or neutron stars. These experiments test the predictions of general relativity and provide new information about the sources of gravitational waves. Some examples of gravitational wave experiments are Laser Interferometer Gravitational-Wave Observatory (LIGO), which consists of two detectors in USA; Virgo, which is also a detector in Italy; KAGRA, which is also a detector in Japan devices.*

The difference between particle physics and nuclear physics is that they deal with different levels of matter and their interactions. Particle physics studies the fundamental particles such as quarks and leptons, and their interactions mediated by force carriers, such as photons and gluons. Particle physics explores the elementary building blocks of matter and radiation, and the unification of forces. Nuclear physics focuses on the nuclei of atoms, composed of protons and neutrons, and their reactions involving nuclear forces, such as fission and fusion. Nuclear physics has many applications in various fields, such as medicine, engineering, and biology.

Quarks are the building blocks of hadrons, such as protons and neutrons, which are the components of atomic nuclei. Quarks possess fractional electric charges, either +2/3 or -1/3 and interact with all four fundamental forces, especially the strong nuclear force that binds them together. Quarks also have a property called color charge, which is related to the strong force and comes in three types: red, green, and blue. Leptons are a group of particles that include the electron, the muon, the tau, and their corresponding neutrinos. Typically, leptons have integer electric charges, either 0 or -1, and do not interact with the strong nuclear force. Leptons can exist as individual particles in nature and mainly interact with the electromagnetic and the weak nuclear forces.

The weak action nuclear force, also called the weak interaction, is one of the four fundamental forces of nature, along with gravity, electromagnetism, and the strong nuclear force. The weak force is responsible for some forms of radioactivity, such as beta decay, in which a neutron turns into a proton or vice versa, emitting an electron or a positron and a *neutrino or an antineutrino. The weak force also plays a role in the nuclear fusion reaction that powers the Sun and other stars, by allowing protons to change into neutrons and overcome the electrostatic repulsion between them. The weak force is mediated by three types of bosons, which are particles that carry energy and momentum between other particles. These bosons are called W+, W−, and Z0; they have very large masses compared to other particles. This makes the weak force to be very short ranged, as the bosons can only travel a very small distance before decaying. The weak force also has unique property of violating parity symmetry, which means that it does not behave the same way under mirror reflections.*

The Standard Model is the best theory we have to describe the fundamental particles and-forces of nature. It is based on the principles of quantum mechanics and special relativity, and it has been tested and confirmed by many experiments over the past decades. The Standard Model consists of two main components: the matter particles and the force particles. The matter particles are the basic building blocks of matter, and they belong to two groups: quarks and leptons. There are six types of quarks (up, down, charm, strange, top, and the bottom) and six types of leptons (electron, muon, tau, and their corresponding neutrinos). Quarks and leptons come in three generations, with increasing mass and decreasing stability. Quarks also have a property called color charge, that determines how they interact with strong nuclear force. The force particles are the carriers of the four fundamental forces: the electromagnetic force, the strong nuclear force, the weak nuclear force, and gravity. The electromagnetic force is mediated by light photons, which are massless and have no electric charge. Strong nuclear force is mediated by gluons, which are also massless and have no electric charge, but have color charge. The weak nuclear force is mediated by W and Z bosons, which are massive and can be electrically charged or neutral. Gravity is not fully incorporated in the Standard Model, but it is assumed to be mediated by a hypothetical particle called the graviton, which is massless and has no charge. The Standard Model also includes a special particle called the Higgs boson, which is associated with the Higgs field. The Higgs field is a quantum field that fills all of space and gives mass to other particles through its interactions with them. The Higgs boson was predicted by the Standard Model in 1964, but it was only discovered in 2012 by the Large Hadron Collider at CERN. The Standard Model is a very successful theory that explains almost all experimental results and precisely predicts a wide variety of phenomena. However, it is not a complete theory of everything, as it leaves some questions unanswered or unexplained. For example, it does not account for dark matter, dark energy, neutrino masses, baryon asymmetry, or quantum gravity. It also has some theoretical problems, such as the hierarchy problem or the strong CP problem. Therefore, physicists are looking for new physics beyond the Standard Model that could solve these puzzles and reveal new aspects of nature.

Theory of the Higgs field and the Higgs boson, which are essential components of the Standard Model of particle physics, has been the best theory we have till now to describe the fundamental particles and forces of nature. The Higgs field is a quantum field that pervades all of space and gives mass to other elementary particles, such as quarks and leptons, through its interactions with them. The Higgs field was first proposed in 1964 by several physicists, including Peter Higgs, who gave it its name. The Higgs field is responsible for breaking the symmetry between the electromagnetic force and the weak nuclear force, which are unified at *high energies. It also explains why the carriers of the weak force, the W and Z bosons, are massive, while the carrier of the electromagnetic force, the photon, is massless. The Higgs boson is the elementary particle that is associated with the Higgs field, because of wave-particle duality. It is a scalar boson, meaning that it has zero spin and no electric charge. It has a mass of about 125 billion electron volts (GeV), which is about 133 times heavier than a proton. The Higgs boson was predicted by the Standard Model, but it was very difficult to produce and detect experimentally. It was finally discovered in 2012 by two experiments, ATLAS, and CMS, at the Large Hadron Collider (LHC) at CERN, the European laboratory for particle physics near Geneva, Switzerland@. The discovery of the Higgs boson was a major achievement for particle physics, as it confirmed the existence of the Higgs field and the mechanism that gives rise to mass in elementary particles. It also completed the Standard Model, which had been missing this crucial piece for decades. However, there are still many open questions about the nature of the Higgs field and the Higgs boson, such as how they relate to gravity, dark matter, and other phenomena beyond the Standard Model.*

PHYSICS proposed by Roger Penrose, British Mathematical Physicist:

(1) Conformal cyclic cosmology: This is a cosmological model that suggests that the universe undergoes infinite cycles of expansion and contraction, with each cycle ending with a Big Bang and beginning with a Big Crunch. Penrose argues that the transition between cycles is smooth and conformally invariant, meaning that the geometry of space-time is preserved up to a change of scale. He also claims that there is observational evidence for this model in the form of concentric circles of low temperature in the cosmic microwave background. (2) Penrose interpretation: This is an interpretation of quantum mechanics that attempts to explain the collapse of the wave function because of gravity. Penrose proposes that the superposition of quantum states cannot be maintained beyond a certain threshold of energy difference, which he estimates to be about one Planck mass. He argues that when this threshold is reached, gravity becomes unstable and causes a spontaneous reduction of the wave function to one of the possible outcomes. He also speculates that this process may be related to consciousness and free will. (3) Penrose process: This is a mechanism that allows an observer to extract energy from a rotating black hole. Penrose showed that if an object falls into the ergo sphere of a black hole, which is a region outside the event horizon where space-time is dragged by the black hole's rotation, it can split into two parts: one-part falls into the black hole, while the other part escapes to infinity with more energy than the original object. The net result is that the black hole loses some of its mass and angular momentum, while the observer gains some energy.

According to Penrose's Conformal cyclic cosmology (CCC), the transition between cycles is smooth and conformally invariant, meaning that the geometry of space-time is preserved up to a change of scale. Penrose argues that future time-like infinity of each cycle, where the universe becomes infinitely large and cold, can be identified with the Big Bang singularity of the next cycle, where the universe becomes infinitely small and hot. He also claims that there is observational evidence for this model in the form of concentric circles at low temperature in the cosmic microwave background. CCC has some implications for particle physics and black hole physics. Penrose assumes that all massive particles eventually decay or *lose their mass in each cycle, leaving behind only massless particles, such as photons and gravitons. These particles obey the laws of conformally invariant quantum theory, which means that they will behave in the same way in the rescaled cycles as in their original ones. For such particles, the boundary between cycles is not a boundary at all, but just a spacelike surface that can be crossed like any other. However, fermions, such as electrons and quarks, remain confined to a given cycle, thus providing a possible solution to the black hole information paradox. Penrose suggests that fermions must be irreversibly converted into radiation during black hole evaporation, to preserve the smoothness of the boundary existing between cycles.*

According to Giorgio Parisi, Italian Physicist, a spin glass is a type of magnetic material that exhibits complex and unpredictable behavior due to the random arrangement and interactions of its magnetic atoms. Unlike a ferromagnet, where all the magnetic atoms (called spins) align in the same direction, a spin glass has spins that point in different directions and can change their orientation over time. Spin glass can be made by mixing a small number of magnetic atoms, such as iron, into a non-magnetic metal, such as copper. The magnetic atoms are randomly distributed in the metal lattice, and they interact with each other through both ferromagnetic and antiferromagnetic bonds. A ferromagnetic bond tends to align the spins in the same direction, while an antiferromagnetic bond tends to align them in opposite directions. The result is a frustrated system, where the spins cannot find a stable configuration that minimizes their energy. A spin glass has some interesting properties that make it different from other magnetic materials. For example, it does not have a well-defined Curie temperature, which is the temperature above which a ferromagnet loses its magnetization. Instead, it has a freezing temperature, below which the spins become frozen in a random pattern that depends on the history of the material. The spin glass also exhibits memory and aging effects, meaning that its response to an external magnetic field depends on how long and how often it has been exposed to it. Spin glass is an example of a complex system, where many simple components interact in a nonlinear and disordered way, leading to emergent phenomena that are difficult to predict or understand. Spin glasses have been used as models for studying other complex systems, such as neural networks, optimization problems, biological evolution, and social networks.

Highlights of Ansatz Iyer Markoulakis PHYSICS

Iyer Markoulakis point Helmholtz decomposed field theoretical modeling is a complex and advanced topic in physics and mathematics that involves the use of Helmholtz Hamiltonian mechanics to describe the dynamics of electromagnetic fields and particles. It is based on the idea that any vector field can be decomposed into a curl-free component and a divergence-free component, which are called the gradient field and the rotation field, respectively. The gradient field is a field that points in the direction of the maximum increase of a scalar function, such as the potential energy or the temperature. The vortex field is a field that has zero divergence and nonzero curl, meaning that it has no sources or sinks, but it has rotation or circulation. This is known as the Helmholtz decomposition or Helmholtz representation. Ansatz Iyer Markoulakis formalism uses the Helmholtz decomposition or Helmholtz representation to express any vector field as a sum of a gradient field and a vortex field. It also uses a 2x2 eigen tensor matrix to describe the dynamics of these fields and their interactions with point vortices and gradient fields, which can model the behavior of monopoles, electrons, positrons, and other quantum phenomena. The Iyer Markoulakis formalism is a mathematical framework that aims to unify the four fundamental forces of nature: gravity, electromagnetism, strong nuclear force, and weak nuclear force. The formalism extends the Coulomb-Hilbert gauge, which is a way of choosing the electric potential and the magnetic potential to simplify the Maxwell equations, to include the Higgs mass field, which is a scalar field that gives mass to elementary particles. The formalism also uses asymmetric string metrics, which are mathematical objects that describe how distances and angles are measured in curved spacetime, to account for the asymmetrical forces between magnetic poles. However, it is still a developing and challenging field that requires further research and proof observational experimental verification correlating measurements.

The Iyer Markoulakis formalism has potential applications for quantum supercomputing, quantum astrophysics, and grand unification theories. Quantum computing application of this theory is potentially using monopoles as qubits, which are the basic units of quantum information. Qubits can exist in a superposition of two states, usually denoted as |0> and |1>, which can represent binary digits or bits. Qubits can also interact with each other through quantum entanglement, which means that their states are correlated even when they are separated by large distances. Qubits can be implemented using various physical systems, such as photons, electrons, atoms, or superconducting circuits utilizing principles of quantum mechanics, such as superposition and entanglement, to perform computations that are faster or more efficient than classical computers. Monopoles, if they exist, could be used as qubits because they have two possible states: north or south. These states could be manipulated by applying electric or magnetic fields, or by exchanging photons with other monopoles. Monopoles could also be entangled with each other through their magnetic interactions. Monopoles could offer some advantages over other qubit implementations, such as longer coherence times, higher scalability, and lower noise.

However, there are also many challenges and limitations to using monopoles as qubits. First of all, monopoles have not been experimentally observed yet, despite many attempts to detect them. Their existence is still a matter of speculation and controversy. Second, even if monopoles exist, they might be very rare and difficult to isolate and control. Third, the Iyer Markoulakis formalism is still a developing theory that needs more rigorous mathematical and physical analysis making it compatible with the Standard Model of Particle PHYSICS, leading to breakthroughs with these and/or the existing quantum computing models.

Highlights of Ansatz IMMOHZT HodPDP PHYSICS

Iyer Markoulakis Malaver O'Neill Hodge Zhang Taylor gage discontinuity dissipative "Stringmetrics"Hod PDP Helmholtz decomposed point fields PHYSICS is a theoretical framework that tries to unify the four fundamental forces of nature using Helmholtz decomposition and asymmetric string metrics. It also involves the concept of monopoles, which are hypothetical particles that have only one magnetic pole, unlike the usual magnets that have two poles.The framework extends original Iyer Markoulakis point Helmholtz decomposed field *theoretical modeling with the Coulomb-Hilbert gauge, which is a way of choosing the electric potential and the magnetic potential to simplify the Maxwell equations, to include the Higgs mass field, which is a scalar field that gives mass to elementary particles. The framework also uses asymmetric string metrics, which are mathematical objects that describe how distances and angles are measured in curved spacetime, to account for the asymmetrical forces between magnetic poles.*

The Hod-PDP mechanism is a theoretical model that tries to explain the origin and nature of elementary particles, such as electrons, positrons, photons, and monopoles. It is based on the idea that these particles are composed of two types of point-like entities: Hods and PDPs. Hods are hypothetical particles that have only one magnetic pole, either north or south, and no electric charge. PDPs are hypothetical particles that have only one electric pole, either positive or negative, and no magnetic charge. The Hod-PDP mechanism proposes that these particles can form stable or unstable combinations, such as dipolar pairs, loops, strings, or bundles, depending on their relative orientations and distances. Emergent quantum Hod-PDP mechanism is a very advanced and complex topic in physics and mathematics that requires further research and verification. Potentially it proposes applications for quantum supercomputing, quantum astrophysics, and grand unification theories.

Statement of the problem

While quantum mechanics quantum field theory tries to link micro to macro physics, special general theory of relativity posits macro micro physics. However, discrepancies arise with evaluating parametrically quantum mechanics with relativity theory, especially at the vacuum energy solutions, leading to vacuum as well as ultraviolet catastrophes. These inconsistencies within major branches, especially quantum and relativistic mechanics quantifying quantum astrophysical nature with physical process mechanism operating universe or universes would necessitate ansatz novel approaches to problem solving PHYSICS. Space variables of the distance metrics tend to be discontinuous, hence no monotonic functionality may exist. The mass factor has always been a problem, especially with the well-defined Yang–Mills existence and mass gap situation, that is still an unsolved problem in mathematical physics pointing to mathematics.

Solution of the problem

The author elucidates here sections with roadmaps to address the solution of the problem. Observer physics has been advanced to emphasize the role of conscious observer perspectives playing the key role determining observations measurements wholly. Essentially putting together {timeline, worldline, state-of-the-clock, environment, consciousness} operator with input, dynamic system quaternion imaginary throughput, Boolean binary output process nature is quite conceivable. Perhaps, this is how computer perceives like matrix theoretical *physics synthesis of point universal pattern lattice emergence evolving!! Starting off with micro "Quantum Gage Point Tensor Field Theory" on imaginary quaternion aspects, real formalisms having gage physical transformations that will involve fields sense-time-space five dimensional aspects, the following physics formalisms have been expertly peer published already. In this Chapter, this will be in gist discussed briefly.*

- ✓ ***Ansatz Iyer Markoulakis PHYSICS FORMALISM:*** $\begin{pmatrix} \hat{\boldsymbol{\varepsilon}}_{r,\mu\nu} & \hat{\boldsymbol{\varepsilon}}_{g}^{\mu\nu} \\ \hat{\boldsymbol{\varepsilon}}_{g,\mu\nu} & \hat{\boldsymbol{\varepsilon}}_{r}^{\mu\nu} \end{pmatrix}$ ***(1)***

  Helmholtz decomposed point S2 matrix, having {gradient, vortex} space parity fields.

  To get eigenvalues of characteristic field matrix above, we equate $|A-\lambda I| = 0$; hence

$\begin{pmatrix} \mathcal{E}r,\mu\nu - \lambda & \mathcal{E}_{g}^{\mu\nu} \\ \mathcal{E}g,\mu\nu & \mathcal{E}_{r}^{\mu\nu} - \lambda \end{pmatrix}$ *= 0 & solving quadratic equation in λ:*

i.e. $(\mathcal{E}_{r,\mu\nu} - \lambda)(\mathcal{E}_r^{\mu\nu} - \lambda) - \mathcal{E}_{g,\mu\nu}\,\mathcal{E}_g^{\mu\nu} = 0$ *having*

$$\lambda^2 - (\mathcal{E}_{r,\mu\nu} + \mathcal{E}_r^{\mu\nu})\lambda + (\mathcal{E}_{r,\mu\nu}\mathcal{E}_r^{\mu\nu} - \mathcal{E}_{g,\mu\nu}\,\mathcal{E}_g^{\mu\nu}) = 0 \qquad \textbf{(2)}$$

eigenvalues will have characteristic eigenvalue solutions.

The author has shown signal/noise graphing using the above Iyer Markoulakis Physics fields point formalism to problem solving vortex energy function for attractive-repulsive energy fields to get graphic following plots.

Figures 1 and 2 specifically reveal the effect that the vortex fields have on the sinusoidal type of vacuum fluctuations. Localization of the nonlinear high energy density signal output, shown by these figures, quite likely is a result of the reflection at the boundary of superluminal super-fluids with hydrodynamic like vortex fields that will have sufficient rotational energy to sustain Hamiltonian oscillators capable of generating pulses, fading with the damped oscillations evident in a nonlinear sinusoidal bunching in Figure 1. Interpreting Figure 2, as brought above, it is possible to identify regions of superluminal wave velocities, acting like super-fluids, exhibiting behavior of frictionless motion, with zero viscous flow characteristics. One may expect this superfluidity aspect to then transform eventually to a damped oscillator laminar flow type situations with inertial conditions to subluminal viscous or diffusional flow, characterized by typical Fickian-like error function-form signals that are characteristic of a space and time varying divergent flow.

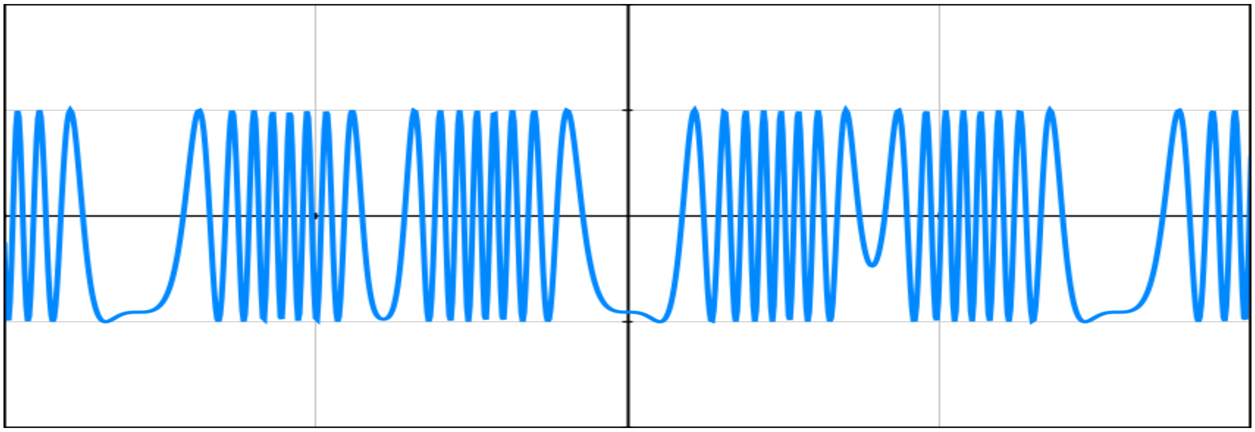


Figure 1: *Graphing vortex generating sinusoidal pulsed signal output. Input X: function vortex; Y: sinusoidal (function of X) having output signals, with input per theoretical analyses modeling using especially vortex form and the google templates.*

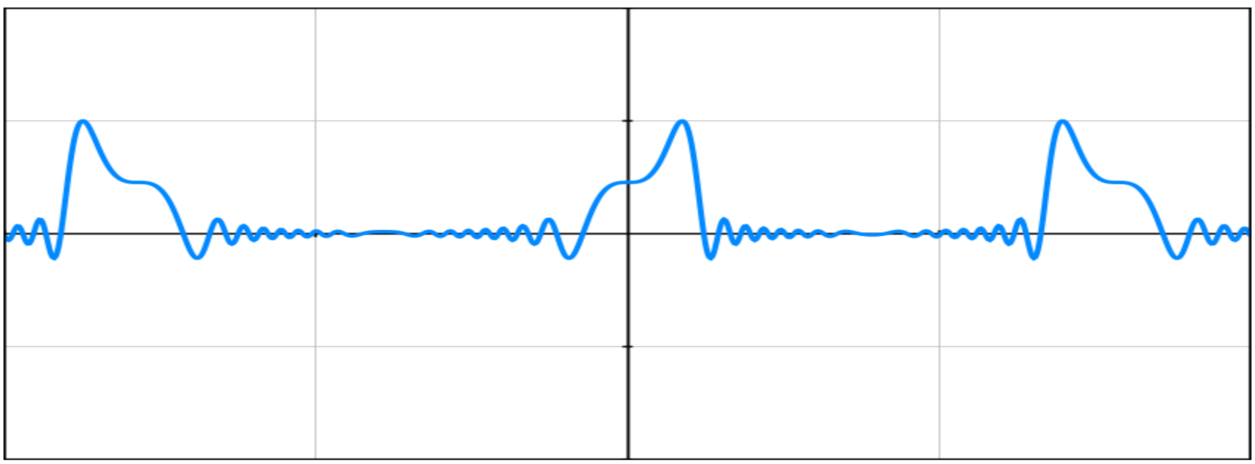


Figure 2: *Analytically graphing the value of "r" & distribution profile of typical equivalent wave velocity in vacuum space vortex quanta, using values of the electric constant = $8.85418782 \times 10^{-12}$ m^{-3} kg^{-1} s^{4} A^{2}, and magnetic constant = $1.25663706 \times 10^{-6}$ m kg s^{-2} A^{-2}, applied to the Figure 1 signals, per theoretical analyses, utilizing google templates.*

<u>Wavefunction collapse through the micro-wormhole</u>*: It makes sense, from the foregoing formalisms that quantum manifolds may extend to global vacuum space quantum to relativistic macro astrophysics. The micro macro linkage possibly occurs through the microwormhole. Extending beyond microblackhole, one may speculate resulting micro-whitehole after-effect, in turn related to microwormhole events. These are possible due to collapsing wavefunction that are indicated by the simulated signal output of equivalent wave velocity in vortex quagmire, appearing in Figure 2. The author is providing these extensions, perhaps speculative, presently to open possibilities to explore how those transmissions of such disturbances or perturbations create ever* *changing time-fields. These aspects will then be analyzed further in the author's upcoming papers, addressing relativistic real-time and proper-time efflux situations.*

The author has shown per matrix property analysis mathematically that the following inner product and outer product relationship hold, per Hilbert space to equivalent wavefunction energy functional general forms.

<E|T> = <E|U|T>(|E><T|)$^{-1}$|E>) ^{T}|T>U^{-1}. Substituting, E = $\Psi_\mu(t)$; T = $\Psi^\mu(t)$; U = V; |E><T| = ρ(t); <E|T> = $^{\Psi_\mu}\delta^{\Psi_\mu}$; <(E|U|T> = $^{\Psi_\mu}\delta^{\Psi_\mu}$. F^E, we get result $F^{E}{}_{t}$ = ρ(t)(<$\Psi_\mu(t)$|$\Psi^\mu(t)$>)$^{-1}$V.

- ✓ ***Gauging Coulomb Higgs gauge to "string-metrics", with diagonal terms Higgs gravity like mass factor, while cross-diagonal terms are like fermionic gauge coupling given by $\hat{G}$ = (<$\Psi_\mu(t)$|$\Psi^\mu(t)$>)$^{-1}$ ||∇ $E_g^{\mu\nu}$|| ρ(t) = f,ρ(t), where $\hat{G}$ is the functional mathematics.***

- $$\left(\begin{matrix} \left(\begin{matrix} \left(\begin{matrix} \left(\begin{matrix} \overset{\frown}{0} & \hat{G} \\ \hat{G}^{-1} & \hat{M} \end{matrix}\right) & \overset{\frown}{\hat{G}} \\ G^{-1} & \hat{M} \end{matrix}\right) & \overset{\frown}{\hat{G}} \\ G^{-1} & \hat{M} \end{matrix}\right) & \hat{G} \\ G^{-1} & \hat{M} \end{matrix}\right) \quad (3)$$

<$\Psi_\mu(t)$|$\Psi^\mu(t)$> gives the inner product of the lower, $\Psi_\mu(t)$ and the upper, $\Psi^\mu(t)$ wave functions as a function of time with observables gaging having **V** = ||∇$\mathbf{E}_g^{\mu\nu}$||, giving scalar potential, working with ρ(t) = quantum density matrix, typically representing pure state like coupling constant with general relativity…. f is the function operator transforming micro to macro parametrically **ρ**(t) to $\hat{\mathbf{G}}$, that is quantifiable like equation: f = ($\mathbf{\Psi}_\mu$(t)|$\mathbf{\Psi}^\mu$(t)>) $^{-1}$ ||∇$\mathbf{E}_g^{\mu\nu}$||, thereby $\hat{\mathbf{G}}$ = f.**ρ**(t)**.**

At a given {latitude, longitude, mode of switches…0, off, on} there are multiplicity of events possible with differing signal/noise ratio, Γ constituting probability addition or multiplication to satisfy unitary equation permuted over Γ_{ij}, where point (i, j) at latitude, i and longitude, j summing:

$$\sum_{i=1}^{n}\sum_{j=1}^{m}\Gamma_{ij} = 1 \quad (4)$$

*having example, Γ_{ij} = **[Γ] {Ψ_{11} Ψ_{12} Ψ_{13} ……. Ψ_{21} Ψ_{22} Ψ_{23} ……...}** that is summed over the values of i and j, acting as nodes of finite element model network circuitry assemblage, like Hod-Plenum* Pauli Dirac Planck (PDP) circuit model. One may surmise that therefore quantum gravity will have action via innately effect with modon strings communicating like typical charge couple entanglement satisfying above requirements.*

Gage time gage space fields probability signal matrix

$\begin{pmatrix}\varepsilon_\tau\\ \varepsilon_x\\ \varepsilon_y\\ \varepsilon_z\end{pmatrix}\begin{pmatrix}\psi_{\Gamma^{\dagger}_{\circlearrowright}} & \psi_{\Gamma^{-}_{\vartheta}} & \psi_{\Gamma^{+}_{\vartheta}} & \psi_{\Gamma^{-}_{\circlearrowright}}\end{pmatrix}$ *gauge field sense where:* $\begin{pmatrix}\varepsilon_\tau\\ \varepsilon_x\\ \varepsilon_y\\ \varepsilon_z\end{pmatrix}$ *represent time space gauge fields of the 4D time space{t, X, Y, Z} creations;* $\begin{pmatrix}\psi_{\Gamma^{\dagger}_{\circlearrowright}} & \psi_{\Gamma^{-}_{\vartheta}} & \psi_{\Gamma^{+}_{\vartheta}} & \psi_{\Gamma^{-}_{\circlearrowright}}\end{pmatrix}$ *represent probability functions quantifying distributions of signal/noise sense {*$\psi_{\Gamma^{\dagger}_{\circlearrowright}}$ *clockwise positive,* $\psi_{\Gamma^{-}_{\vartheta}}$ *anticlockwise negative,* $\psi_{\Gamma^{+}_{\vartheta}}$*anticlockwise positive, and* $\psi_{\Gamma^{-}_{\circlearrowright}}$ *clockwise negative}.*

Thereby, matrix $\begin{pmatrix}\Gamma_t^{-} & \Gamma_X^{\circlearrowright} & \Gamma_Y^{-} & \Gamma_Z^{\circlearrowright}\\ \Gamma_t^{\vartheta} & \Gamma_X^{+} & \Gamma_Y^{\vartheta} & \Gamma_Z^{+}\\ \Gamma_t^{+} & \Gamma_X^{\vartheta} & \Gamma_Y^{+} & \Gamma_Z^{\vartheta}\\ \Gamma_t^{\circlearrowright} & \Gamma_X^{-} & \Gamma_Y^{\circlearrowright} & \Gamma_Z^{-}\end{pmatrix}$ *expands to a 4D time-space*

with matrix of points signal/noise distributed over Γ with {t, X, Y, Z} {- negative, + positive, ϑ anticlockwise, $\circlearrowright$ *clockwise}. Each 2x2 pan-diagonal submatrices work like PDP circuit cell assemblies like molecular crystallographic observable unit cells, that are presently known to be like time crystals. Permutations to generate dynamically expanding time space sense consider {gradient, vortex} gage fields, that are attributable to real gage fields of pressure and temperature - Appendix III [6]. Observables are hence extractable by solutions with the PHYSICAL ALGORITHMS, derived here. There exists, therefore, direct relationships between theoretical and experimental observables that are measurable quantitatively in terms of observations at quantum, mesoscopic, astrophysical, and universal levels. We may, however, consider quaternion algebra to get real time computer simulation programming.*

Critical (Γ, ρ) matrix electromagnetic gravity keying parametrically:

Per gage physics, [Γ]: matrix of signal/noise ratio determines existence of matter, while [ρ]: point density matrix pattern determines property of gravity, derived here above. Magic square symmetry prime factorization will eventually differentiate charged and neutral matter per above schema.

If [Γ] > [Γ_{cr}*], then multiple phases matrices mix, or combine. Otherwise, if [Γ] < [*Γ_{cr}*], then it will differentiate or split-separate onto multiple phases matrices. Mesoscopic examples having low Γ nebular plasmatic gases will tend to split-separate onto multiple liquids-solids phases matrices, or plasma to gases, or mixed gases to elemental gases like hydrogen, or multiphase liquids to elemental liquids and/or solids phases matrices. Similarly, high Γ phases will combine or mix into appropriate forms. These are evidenced physically in real living universe proof verifying with observations of theoretically derived observables, that are measurable in natural physics. Mathematically, they will correlate to "Gage time gage space fields probability signal matrix", given in the equations:*

$$\begin{pmatrix} \varepsilon_\tau \\ \varepsilon_x \\ \varepsilon_y \\ \varepsilon_z \end{pmatrix} \begin{pmatrix} \psi_{\Gamma^{\dagger}_{\Leftrightarrow}} & \psi_{\Gamma^{-}_{\vartheta}} & \psi_{\Gamma^{+}_{\vartheta}} & \psi_{\Gamma^{-}_{\Leftrightarrow}} \end{pmatrix} =>::<= \begin{pmatrix} \Gamma_t^{-} & \Gamma_X^{\Leftrightarrow} & \Gamma_Y^{-} & \Gamma_Z^{\Leftrightarrow} \\ \Gamma_t^{\vartheta} & \Gamma_X^{+} & \Gamma_Y^{\vartheta} & \Gamma_Z^{+} \\ \Gamma_t^{+} & \Gamma_X^{\vartheta} & \Gamma_Y^{+} & \Gamma_Z^{\vartheta} \\ \Gamma_t^{\Leftrightarrow} & \Gamma_X^{-} & \Gamma_Y^{\Leftrightarrow} & \Gamma_Z^{-} \end{pmatrix} \qquad (5)$$

or compactly, $[\Gamma_{XYZ}] =>::<= [\Gamma_{X'Y'Z'}] [\Gamma_{X''Y''Z''}]$ ***………….., with*** $\{\Gamma_{X'Y'Z'}, \Gamma_{X''Y''Z''}\} > [\Gamma_{XYZ}]$,

since $\sum_{i=1}^{n} \sum_{j=1}^{m} \Gamma_{ij} = 1$***, given in Equation (4).***

If $[\rho_{object}] > [\rho_{cr}]$*, then object will sink or fall in relational gravitational inertial environment. Otherwise, if* $[\rho_{object}] < [\rho_{cr}]$*, then object will levitate or float in that environment. These were explained by having the proposition and observable physics with real measurable observations.*

Schematic of matrix Pauli Dirac Planck circuit

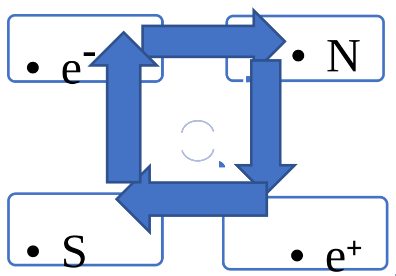


Figure 3*: Modeling Pauli Dirac Planck circuit assembly matrix with* e^-*: electron, and* e^+*: positron particles; N: north, and S: south monopoles – flow of arrow shows gradient vortex matrix circuit.*

Equation for this PDP circuit having $\hat{\varepsilon}_n = \hat{\varepsilon}$ *and* $\hat{\varepsilon}_s = \hat{\varepsilon}^*$*, can be given as the eigenvector matrix:*

$$[\lambda_{PauliDiracPlanckcircuitgaging}] = [\lambda_{PDPcg}] = \begin{pmatrix} 1 & \mathcal{E} \\ \mathcal{E}* & 1 \end{pmatrix} \qquad (6)$$

with $[\lambda_{PauliDiracPlanckcircuitgaging}]$*: combinatorial eigenvector bundle matrix,* $\mathcal{E}$*: scalar value of south and north monopole field, and* $\mathcal{E}*$*: conjugate value of* $\mathcal{E}$ *fields.*

Equation (6) is like SUSY, having Hermitian quantum matrix. With electron-positron annihilation alongside monopoles north and south collapsing to dipolar "stable" magnetism, that is like stringmetrics gage Equation (3); however, in this case it will be like electromagnetic gaging fields.

Recent experiments with John Hodge show that forces of south poles are slightly stronger than the north poles; that will mean in our context $\hat{\varepsilon}_s > \hat{\varepsilon}_n$ *slightly. Therefore,* $[\lambda_{PDPcg}]$ *will have asymmetry metrics, thereby asymmetric\strings\gage\metrics, having non-Hermitian* *quantum matrix. This will point to anisotropic asymmetric eccentric precession with electromagnetic gaging fields. Together with "Stringmetrics" gravity it will then constitute electromagnetic gravity.*

Graphical Scenarios Analysis with PDP Circuit Assembly

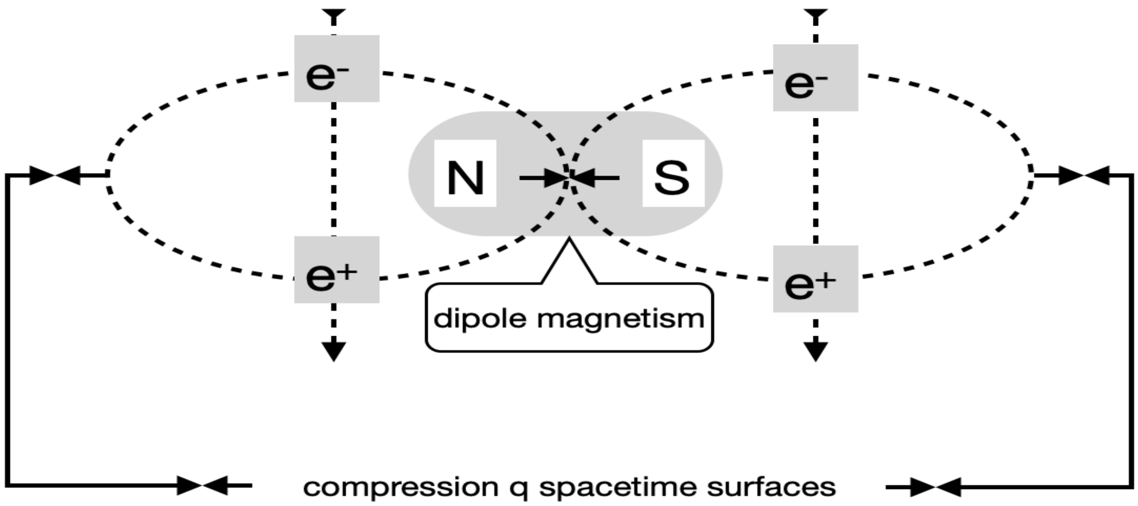


Figure 4: *Space-time surfaces compressed quantum with dipole magnetism forming to show electric tensors keeping the space fields quanta as well.*

Figure 4 above will likely be the best scenario for a finite element modeling analysis with computer programming followed by simulation theoretical validation. Electric tensors of adjacent assemblies can act as cells – elements, while dipole magnetism as nodes of such F.E.M. program. One evaluator will be compression of quantum space-time surfaces, one of the predictors from theoretical analysis with PDP model. We will proceed to computer programming with Hamiltonian algebra energy geometry providing algorithm to simulate quanta energy with relativistic fields stabilization of quasi-particles to particles to photon phonon real universe.

*To understand structural geometry formed from vacuum quanta out of point fields' quantitative theory, it is presently required to grapple symmetry, structure, and formation of real space with knowledge of symmetry inherently naturally originating with mechanism characteristics also permutating fundamental processes of prime numbers' factorization. We will examine this extensively in subsequent papers. Physics formalism paper [5] brings out aspects with importance of diagonal terms of the gage matrix showing Hilbert Higgs metrics 0 -> **M^**, signifying action to matter inertia effectively operating with gravitational field moving from vacuum to matter, **M**. In general, that will represent characterization of Helmholtz transformation symplectics to Higgs field, having subsequent Higgs mechanism to originate God particle giving flavor mass particle Higgs Boson system.*

Poynting vector maybe utilized to measure electric and magnetic effect fields at each point. The Poynting vector is a quantity that describes how much energy is carried by an electromagnetic wave, such as light or radio waves. It is named after John Henry Poynting, an English physicist who introduced it in 1884. The Poynting vector is calculated by taking the cross product of the electric field and the magnetic field of the wave, divided by the permeability of the medium that the wave travels through. The direction of the Poynting vector is the same as the direction of the wave propagation, and its magnitude is proportional to the intensity of the wave. The unit of the Poynting vector is watt per square meter, which means power per unit area, formula $S = (E \times B) / \mu 0$ *can be used to calculate Poynting vector at any point in space.*

Numerical achievements with operational mechanism with related Table and earlier graphs

Typical numerical values with Iyer Markoulakis general formalism theory paper and problem solving vacuum quanta fields gives zero-point gradient energy, Eg, per numerical values $[(2\text{-}ic\hbar)/ic\hbar] \approx 10^{26}$ *metric unit energy value order of magnitude, and quasi-particles having sizes, with value of* 10^{-26} *m (this is a correction on earlier value) or even less, generated especially by microblackhole compressing monopole mass to* 10^{-11} *kg; after propagation of these quasi-particles, radius sizes expand to higher values, having reduced monopole mass, closer to* 10^{-47} *kg per equation in attractive-repulsive force fields of entity size,* $r_e \approx 10^{-32} /(Mm)^{1/2}$ *meter (this is a correction on earlier value), especially due to microblackhole mechanism compressing monopole mass from* 10^{-47} *kg to* 10^{-11} *kg, with entities propagating away from microblackhole, monopole mass value reducing closer to* 10^{-47} *kg with evolution of time, continuous propagation of generators assisted by quantum field photon mediators will be expected to create quarks, antiquarks, as well as gluons out of vacuum quanta, and the universe size estimated by Iyer Markoulakis general problem solving theoretical analysis providing a value of observable universe, briefly shown within derivation essentially below. We estimate the size of Iyer Markoulakis Helmholtz Hamiltonian mechanics Pauli Dirac Planck monopole particle gaged matrix field circuitry assembly to be greater than Planck magnitude of* 10^{-34} *unit and less than quasi-particle size* 10^{-26} *metrics unit since this circuitry compressed having microblackhole acting.*

Using equations that relate $i\Psi$ *to* $E/(mc^2)$ *(where in general energy, E is different from relativistic particle matter energy,* mc^2*), and* $E_o/E_g \cong kr^2/k_e$*, where Eo is the vacuum energy and* E_g *is the zero-point gradient energy, we may write* $E_o/E_g = f(r)$*, where k and* k_e *are constants. We can show that* $\frac{\partial}{\partial t}[f(r)] = f'(r).v = \frac{\partial}{\partial t}(E_o/E_g) = 10^{18}\frac{\partial}{\partial t}(M_m r^2) = 10^{18}\frac{\partial}{\partial t}(M_m r^2) = 10^{18} M_m.2r.v$*, if* $M_m \neq f(t)$*, having* $v = \frac{\partial}{\partial t}(r)$*, r is the radial distance from zero-point. Simplifying, noting that* $E/(mc^2)$ *this equation then can be written as a function of r, we arrive at* $f(r) = E/(mc^2) \cong 10^{18} M_m.\int_t r.dt$*. Equating* $i\Psi$ *to* $E/(mc^2)$*, we can equate therefore:* $i\Psi \cong 10^{18} M_m.\int r.dt$*. For the PDPcg, if we have* $\Psi = \Psi_{NSZP}$*, where NSZP is a north south zero point dipole/monopole magnetic "quagmire" having imaginary value "i", then from above:* $i\Psi = i.i = -1 \cong 10^{18} M_m.\int_t r.dt$*. Thereby, we will obtain the value of* $\int_t r.dt \cong - 10^{-18} (M_m)^{-1}$*. We mentioned above that monopole mass can vary from* 10^{-47} *kg to* 10^{-11} *kg. In the region of a microblackhole,* $M_m = 10^{-11}$ *kg, and hence in* *magnitude* $\int_t r.dt \cong 10^{-8}$ *space-time unit metrics or a little higher value corresponding to size of a hydrogen atom. However in a zero-point far away from microblackhole,* $M_m = 10^{-47}$ *kg and hence* $\int_t r.dt \cong 10^{28}$ *space-time unit metrics or a little higher value in magnitude, corresponding to observable size of universe!! These calculations have already demonstrated the power of Iyer Markoulakis general formalism problem solving results that show real correlation to physical observables' measures. We will also investigate how relativistic astrophysical general metrics affect the observables; astrophysical equations, modifying on Einstein-Maxwell spacetime fields equations evaluating these metrics will be extensively considered as continuing articles of the present paper. Charge of a monopole is 1/2e, and the monopole core size is* 10^{-28} *cm or* 10^{-30} *m. Compared to Higgs boson having a lifetime of about* 10^{-22} *s, a magnetic monopole, if it exists may be absolute stable and can get destroyed only if it contacts with another monopole of having opposite charge. Hence, monopoles may be quasi-particles, coexisting with electron-positron particles, validating the PDP circuitry depicted per Figure 3 above.*

Table 1 below summarizes numerical achievements with operational mechanisms that are applicable for ongoing analytical modeling experimental parameters practically discussed above.

Zero-point gradient energy, Eg ≈ 10^{26} metric unit energy value order of magnitude

Monopole mass M_m (kg)	10^{-47}		10^{-11}
Entity sizes out of zero-point microblackhole (m)	10^{-8}		10^{-26}
Estimated space-time extent	10^{28}		10^{-8}
Monopole core size (m)		10^{-30}	
Charge of a monopole		***1/2e***	
Fermion size (m)		10^{-18} ***to*** 10^{-15}	
Estimated size of PDP monopole particle circuit assembly (m)		$<10^{-26}$	

Table 1: *Summary with data of numerical achievements with operational mechanism; monopole mass, zero-point microblackhole entity sizes, estimated space-time extent, monopole core size, monopole charge, size of a fermion typically, and estimated size of Pauli-Dirac-Planck circuit monopole particle assembly. We have tabulated the estimated size of Pauli Dirac Planck circuitry assembly to be greater than* 10^{-34} *Planck magnitude and less than quasi-particle size* 10^{-26} *metrics unit.*

Observable quantum physics discontinuity computing

The author has shown applying Equation (3) of "stringmetrics" algorithm having functional, $F^E_t\,(<\Psi_\mu(t)|\Psi^\mu(t)>) = \rho(t)\,V$*, discontinuum mathematical formulations. 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 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. By letting,* $F^{E}_{t} = \tau_{energy}$ *and* $(<\Psi_{\mu}(t)|\Psi^{\mu}(t)>) = \Psi_{fields}$*, it has also been shown* $\tau_{energy}\ \Psi_{fields} = V\ \rho(t)$ *to arrive in* <u>*Physics conjecture*</u>*: "*$\tau_{energy}\ \Psi_{fields}$*" ≡>: :<≡ observable with the* <u>*Proof*</u>*: Interpreting* $\rho(t)$ *= energy quantum density form of charge, i.e., i: current density, we easily obtain that* $V\ \rho(t) = V\ i$ *= 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, setting* $\{(\delta P)(geometry)\}$ *= output in the form of electrical energy transformable to mechanical motor action or photon light action; 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, "*$\tau_{energy}\ \Psi_{fields}$*" ≡>: :<≡ observable has thus proved there. Additionally,* <u>*Lemma*</u>*: Observable Physics "*$\tau_{energy}\ \Psi_{fields}$*" also representing "discontinuum line" physical mathematical "algebra", having* τ_{energy} *which is like continuum is multiplied by quantum non-continuum eigen* Ψ_{fields} *wavefunction, with the resultant discontinuum mathematically. Further,* ***Inferential Physics*** *has gotten advanced by considering that the classical mechanics equivalence of potential is velocity, v, and that of a wavefunction is trajectory, r(t). Parametrically then the author has been able to define* $\rho(t)$*.* $n(t) = o_{n\rho}$ *and* $o_{n\rho}.DL = 1$*, per unitary principle having quantum density matrix* $\rho(t)$ *to be inversely proportional to number n(t) of discontinuum lengths, DL. Then, having proportionality constant of* $\boldsymbol{o_{n\rho}}$ *a unitary proportionality with the* ***D,*** *analog equivalence replaces scalar potential* ***V*** *with velocity* ***v,*** *wavefunction* $\boldsymbol{\Psi}$ *with trajectory* ***r(t),*** *as well as the quantum density matrix* $\boldsymbol{\rho(t)}$ *with inverse of number* ***n(t)*** *of discontinuum lengths* ***DL,*** *that is a constant in gaging operations. This helped to derive* $\boldsymbol{F^{E}_{t}\ (<\Psi_{\mu}(t)|\Psi^{\mu}(t)>) = \rho(t)\ V}$ *to analogously equivalent* $\boldsymbol{F^{E}_{t}\ (<r_{\mu}(t)|r^{\mu}(t)>) = \{n(t)/o_{n\rho}\}^{-1}\ v}$*. Self-similarity with above equation of* $\boldsymbol{F^{E}_{t} = \tau_{energy}}$ *and* $\boldsymbol{(<\Psi_{\mu}(t)|\Psi^{\mu}(t)>) = \Psi_{fields}}$*, resulted to give relationship:* $\boldsymbol{F^{E}_{t} = \omega_{momentuam}}$ *and* $\boldsymbol{(<r_{\mu}(t)|r^{\mu}(t)>) = r_{discontinuum\_energy\text{-}fields}(t) = r_{DEF}}$*, and thus,* $\boldsymbol{\omega_{momentuam}\ r_{DEF}(t) = \{n(t)/o_{n\rho}\}^{-1}\ v}$*. By calculating* $\boldsymbol{r_{DEF}(t) = n(t).\ DL + r_{g}(t)}$*, with* $\boldsymbol{r_{g}(t)}$*: gap length of discontinuum length* ***DL,*** *and further gaging yielded equation of gage transform:*

$$\boldsymbol{g[r_{DEF}(t)] = g[n(t).\ DL] + g[r_{g}(t)] = g[n(t)].g[DL] + g[r_{g}(t)] = g[r_{g}(t)]} \qquad (7)$$

<u>Keynote</u>*: g the gage is a differential length and DL a constant will make g[DL] = 0. Similarly, velocity v will become gage velocity* v_g*; let that* $\omega_{momentuam} = \omega_P(t)$*. Above equations give additional relations:* $\omega_P(t)\ g[r_g(t)] = \{n(t)/o_{n\rho}\}^{-1}\ v_g$ *as well as* $v_g = \{n(t)/o_{n\rho}\}\ \omega_P(t)\ g[r_g(t)]$*, where* $g[r_g(t)]$ *is a "gage trajectory". Having proved that "*$\tau_{energy}\ \Psi_{fields}$*" is observable, we link observable "*$\tau_{energy}\ \Psi_{fields}$*" with "*$\tau_{H(t)}\ \Psi_{\mathcal{E}(t)}$*" since energy can be written in terms of kinetic energy,* $P^2/2m$ *and potential energy, V(r). Quantum Physics literature treats both H(t) and* $\mathcal{E}(t)$ *as observables!!* $\mathcal{E}(t)$ *is essential to have charge, whereas parity will be key to quantum 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* $r_g(t)$ *by binary matrix since these variables logically are discrete parameters.* $r_g(t)$ *has then countability with quantum density matrix* $\rho(t)$ *linked to 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!*

Signal/noise equation with unitarized energy generalizing of the Spectral Plenum Hod-PDP PHYSICS having a form modeling gage unitarizing energy matter fields

The author has advanced further theoretical physics with natural processes undergoing fundamental inherent prime factorizations, representing zero mode {dielectric, inductor, resistor}, Π/2 mode as: electric tensor, Π mode as magnetic tensor especially with <0, Π> =>: :<= >< {0, Π/2, Π}>< spin parity inner splitting of a turbulent Superluminal quagmire is proposed as progenitor mechanism. They are primordially based on switches states; the author has estimated to have these modes at 0 <" Ψ(off)" < 0.1, and 0 <" Ψ(on)" < 0.28 published theoretical earlier values. These are then linked to PDP circuitry scenario, Figure 4, 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. Group theory symmetry gage unified field groups presently advanced might provide classifications that correlate Standard Model Particle PHYSICS results with LHC and other experimental PHYSICS results.

Macroscopic simple examples of applied problem-solving physics normal observables

The author has already demonstrated earlier with the following situational PHYSICS. 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 Equations (4) and (5) 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. Also, having* 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;* $\mathcal{E}_{GR} = (\mathcal{E}_{GR})_{gv}$*: 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, observables can be thus algorithmically formulated equating with expansion matrix, like:* $<\Psi ducks(tg)| = (\Psi d1\ \Psi d2)$ *"ducks on a row";* $|\Psi swans(tg)> = \begin{pmatrix}\Psi s1\\ \Psi s2\end{pmatrix}$ *"swans on arrow". The gradient fields are up/down temperature. The vortex fields are anticlockwise-clockwise pressure. Configurations of above schema, substituting data of situations will give:* $[G_g]\,\Gamma_{ij}\ [(\mathcal{E}_{GR})_{gv}]^{-1}(<[\Psi_d(t_g)]|[\Psi^s(t_g)]>)[(\mathcal{E}_{GR})_{gv}] = [\rho_{ds}(t_g)]*[(\mathcal{E}_{GR})_{gv}]$.

Expansion value matrices, like Equation (5) would provide the following algorithm matrix set:

$$\begin{pmatrix}[Gg]\,\Gamma_{ij}^{l}\\ [Gg]\,\Gamma_{ij}^{\xi}\end{pmatrix}\begin{pmatrix}\hat{\varepsilon}_{GR,v} & \hat{\varepsilon}_{GR}^{g}\\ \hat{\varepsilon}_{GR,g} & \hat{\varepsilon}_{GR}^{v}\end{pmatrix}^{-1}(\Psi d1\ \Psi d2)\begin{pmatrix}\Psi s1\\ \Psi s2\end{pmatrix}\begin{pmatrix}\hat{\varepsilon}_{GR,v} & \hat{\varepsilon}_{GR}^{g}\\ \hat{\varepsilon}_{GR,g} & \hat{\varepsilon}_{GR}^{v}\end{pmatrix} = \begin{pmatrix}\Gamma_{ij}^{d1} & \Gamma_{ij}^{s2}\\ \Gamma_{ij}^{s1} & \Gamma_{ij}^{d2}\end{pmatrix}\begin{pmatrix}\hat{\varepsilon}_{GR,v} & \hat{\varepsilon}_{GR}^{g}\\ \hat{\varepsilon}_{GR,g} & \hat{\varepsilon}_{GR}^{v}\end{pmatrix} \quad (8)$$

Permutating process population pattern sequel will help to generate simulation algorithmic equation of the moving population greater than [2 × 2] matrix of the above-mentioned example.

Intensity matrix versus density matrix from Equation (5) formalism

Four vector matrix form physics

$\begin{pmatrix} \cdot \\ \varepsilon_{gr} \\ \cdot \end{pmatrix}(.\,\psi_{\omega}.)$ =>::<= (. $\Gamma_{\omega,gr}$.) or rewriting (. $\Gamma_{\omega,gr}$.) =>: :<= $\begin{pmatrix} \cdot \\ \varepsilon_{gr} \\ \cdot \end{pmatrix}(.\,\psi_{\omega}.)$, since astrophysically signal/noise measurable observations transformed to gage spatial fields gradient and the rotational wavefunction matrices. Typically, gradient gage spatial electromagnetic fields convertible toward having switching fields with mode {0, off, on}, so that $\begin{pmatrix} \cdot \\ \varepsilon_{gr} \\ \cdot \end{pmatrix}$ will appear as: [Ɛ] {0, off, on} or numerical matrix: $\begin{pmatrix} 0 \\ \emptyset \\ 1 \\ \phi \end{pmatrix}$. Standardization will evaluate $\begin{pmatrix} 0 \\ \emptyset \\ 1 \\ \phi \end{pmatrix}$ with proper physics referential calibration procedures, noting "0" would refer to zero fields; "Ø" would refer to neither off nor on fields; "1" would refer to on fields; "ϕ" thereby would refer to both off and on fields, such as with quantum entangled fields. Physical interpretation of "neither off nor on fields", would be that it is an intermittent nonzero field, switching, however not a fully on-field, but rather flickering observable signals. However, "both off and an on fields" would be like a quaternionic, turbulent, excessive, or entangled conditional form, for example, encounterable in explosive situations.

Rotational vortex matrix ($.\,\psi_{\omega}.$) will appear as rotational sense wavefunctions, appearing as: [Ψ] {clockwise, anticlockwise, positive, negative} or symbolically (ψc , ψɔ , $\psi_{+}\psi_{-}$). The author has already written with earlier paper article having ntensity matrix with gage unitary eigen field and the wavefunction to form signal/noise observable measurable matrix can be written having that:

(. $\Gamma_{\omega,gr}$.) =>: :<= $\begin{pmatrix} \mathbf{0} \\ \emptyset \\ \mathbf{1} \\ \boldsymbol{\phi} \end{pmatrix}$($\boldsymbol{\psi c}$, $\boldsymbol{\psi}$ɔ , $\boldsymbol{\psi_{+}\psi_{-}}$) specific case with $\phi \equiv i$. ***(9)***

We note that we can figure out the 4x4 four vector matrix form, quaternion algebra with $\phi \equiv i$.

Algorithm Equation (9) is a four-vector matrix form 4x4 quaternion matrix physical mathematics. This has power to quantify electromagnetic gravity applying Equation (5) like a gage time space fields probability signal matrix, transforming among observables, observations, measurements, experimental, natural, astrophysics, quantum, potential, wavefunction, mesoscopic, and normal physics!! 4x4 quaternion wavefunction gaging field physics would be having detailed elements with micro-macro mathematics space, charge, complex, astrophysical, quantum electromagnetic gravity fields entangled, decohered, neither or both wavefunction quaternion forms. These are key PHYSICS now used advancing group theory fields groups to Particle PHYSICS Standard Model classifications with operational algorithm quantum computing programmable simulations of physical processes. Standard definitions pure quantum state operator density matrix the author has already utilized like: $\rho = |\psi\rangle\langle\psi|$. Abstract *theoretical formalized algorithm PHYSICS logically converted to experimental design having a special hardware device development to capture spectral point to point astrophysical intensity signal/noise and spectra density matrices, with having microprocessor device like diamond chips, that are standardized to evaluate [∅] (x){off-mode} with physics references systems calibrations currently are configured as part of instrumentation designs. Equations (5) and (9) are telling that while electromagnetic force appears as signal profile fields matrix, gravitational force appears as density matrix time space manifesting flavor with mass factor, and both together in "Stringmetrics". Practically feasible observational measurements of the spectral density alongside intensities signal profiling will be then part of experimental physics. Once X=density matrix, Y=intensity matrix is obtained, then [Y] = g[X] can be graphed metrically!!*

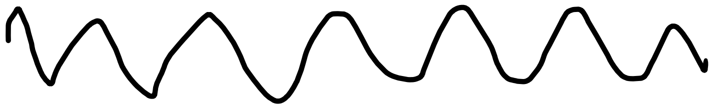
Hence, overall observable parameters that are observationally measurable physics:

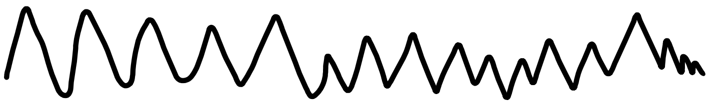
1. *"G" functional "Stringmetrics" field factor*
2. *"M" "Stringmetrics" mass factor*
3. *"Γ" hodPDP quantum astrophysical signal/noise factor*
4. *"ρ" density matrix factor, giving fields-masses.*

"G" & "M" are matrices affected by "ρ"; "Γ" is matrix affected by wavefunctions+gauges fields.

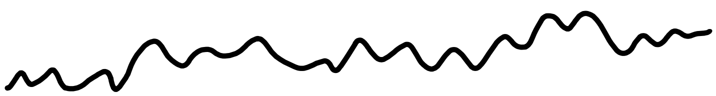
<u>Quantization of time</u> *has become quite feasible PHYSICS with Corrado Massa's minimal power determinations of 10^{59}ergs/sec that with the unitarized energy hv=1, proposes minimum time or quantum_time having hv/(minimal_power) ~ 1/(10^{59}.10^{-7}) ~ 10^{-52}secs. Also,* ***<u>["hod"]{quantum entangled magnetic monopole}</u>*** *<u>entity</u> is hypothesized to exist below 10^{-52} seconds; entities are hypothesized to exist in medium phase of superluminous plenum with dark decohered energy, like unlimited-disembodied-energy (UDE) per discontinuum PHYSICS that Emory Taylor and this author have advanced to have vacuum state with zero net total energy. It is then inferred further between 10^{-52} seconds and 10^{-34} seconds (Planck_time), entities exist as W.I.M.P. dark matter. Above 10^{-34} seconds entities exist as quasi-particles, partons, particles, atoms, molecules, elements, compounds, and material structures with environmental multiphases. They depend on mechanisms operating such as hod-PDP, Higgs-Boson, nuclear strong/weak, electromagnetic/gravity torsion energy force matter hydrogen helium astrophysical quantum fusion, fission with bonds. They are proposed to mainly consist of five fields per Aleksey Zakharenko's PHYSICS that will include two exotic fields with* ***magnetic, electric, elastic, gravitational, and torsional fields****, possessing five types of universal/local symmetries & waveforms.* ***(1) Perfect symmetry matrix (2) Time reversal symmetry (3) Magic square symmetry matrix (4) Prime factored symmetry (5) Π symmetry matrix, that are graphically sketched as earlier publications provide.***

(1)  ***"alpha Zakharenko" waves***

(2)  ***"electromagnetic" waves***

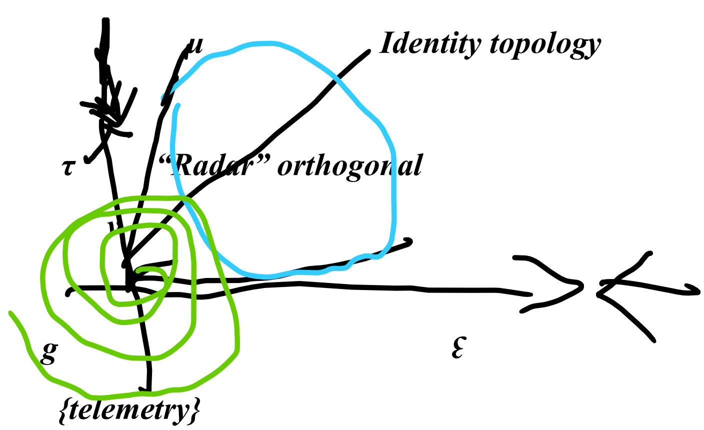
(3)  ***"gravitational" waves***

(4)  ***"vacuum zero-point fluctuations"***

(5)  ***h"zitterbewegung"***

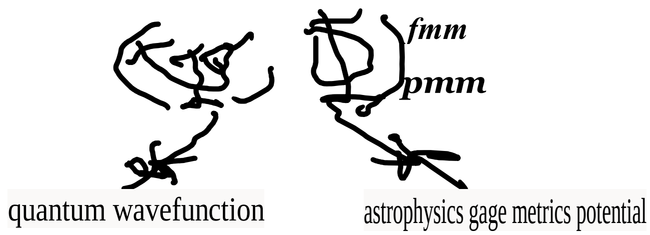
The author proposes Zeroth dimension ≡ absolute vacuum, and ***1 to 5*** *dimensions exhibiting zitterbewegung to alpha information waves!! The author has graphed schematically with algorithm gage PHYSICS****: x=μ(magnetic), y=ν(electric), X=Ɛ(elastic), Y=τ(torsional), g=*** g_{nr} ***=*** $g_{(}$ ***(gravitational)*** *to representing* ***gage algebra:*** $(x, y)_Y^X$ ***to give:*** $(\mu, \nu)_\tau^{\mathcal{E}}\big|_{\theta\Phi}$ ***g.***

Simplifications of the author shows ν(electric) = function of μ(magnetic) per Iyer Markoulakis model whereas Ɛ(elastic) and τ(torsional) are functors, linked by g_{nr} *=* $g_{(}$ *(gravitational) functional. n & r signify that within metrix graph [Y} versus [X], n will represent number of rotations or the frequency while the r represents the radius of oscillations, briefly schematically shown per publications.*



$(\boldsymbol{\Psi}, \boldsymbol{\Phi})_{Y}^{X}$ *with x =* $\boldsymbol{\Psi}\{\boldsymbol{o}, \boldsymbol{off}, \boldsymbol{on}\}$ *characterizing quantum wavefunction gauge switching.*

y *=* $\boldsymbol{\Phi}\{\boldsymbol{circuitry}\}$ *potential characterizing assembly gauge. In example per above equations.*



X≡fmm, Y≡pmm*, and then.* ***g[X]=[Y] =>: :<= g[fmm]=[pmm]****, where g quantifying crystal factor, applicable usefully with PDP.*

Retrofitting wavefunction, gage field phase-angle information onto reconstruction of algebra generalized mediating environment interacting entity per Feynman diagram quanta flowchart:

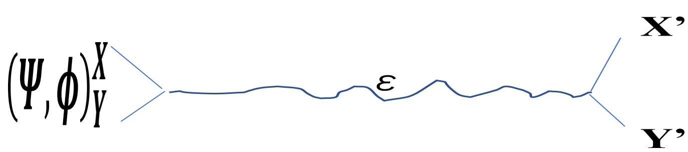


Figure 5: *states that if* ***X*** *=* $\boldsymbol{q_n}$*,* *the monopole* **N** *quantum charge,* ***Y*** *=* $\boldsymbol{q_s}$*, the monopole* **S** *quantum charge,* $\boldsymbol{\mathcal{E}}$ *=* $\boldsymbol{Q}_{\mathcal{E}}$*, the* **Q** *factor of dipole environment* $\boldsymbol{\mathcal{E}}$*, then* ***X'*** *=* $\boldsymbol{q_g}$*,* ***Y'*** *=* $\boldsymbol{q_l}$*. They are a function of wavefunction, gauge field, timeline versus worldline, temperature (heat), and point potential (all four field) aspects. Experimentally, profile density, potential, temperature, signal/noise, elapsing time, wavefunctions, and mode of switches could be sensed, measured, and analyzed having observations on the point-to-point basis.*

Quantum Gravity Modified Newtonian Dynamics PHYSICS Discontinuum Modeling

The author has derived formalism quantum gravity PHYSICS, starting with gravitational Galilean Newtonian equation. Force (Fqg) is Gm_1m_2/r^2*, gaged to quantum in the following way:*
$\boldsymbol{F_{qg} = (G_{qg})^{-1}\,(r_{qg}^{4})\,(g_{[r_{qg}]})^{-1}\,(H_n')^{2}\,(g[g_{[r_{qg}]}])\,(g[f^{*'}(H_n)]),}$ *where symbols Gqg: universal gravitational constant (G) gaged to quantum discontinuum; rqg: discontinuum energy fields (DEF) spatial length related to discontinuum length (DL) as a function of time (t); thereby, we have g[rqg] = gage of rqg, which is the gage discontinuum quantum velocity corresponding to DEF. (*rqg^4*) will represent topology, like toroidal or rotated*

mobius strip manifold spatial geometry. (g[g[rqg]]) will represent gage of gage of rqg, which is gage of discontinuum quantum velocity or gage acceleration like in gravity. H_n represents Hamiltonian, corresponds eventually to Iyer Markoulakis Model Formalism. H_n' corresponds to differential energy Hamiltonian. $g[f^{*'}(H_n)]$ corresponds to gage of Legendre transform of the (Lagrangian) Hamiltonian DEF. Thus, the above equation can express discontinuum physical mathematical gage Q2DDG that is defined per Taylor Iyer discontinuum PHYSICS. This equation already appears within peer published papers articles. ***Point Laplacian Gradient Microblackhole PHYSICS*** *has been treated to above equation having time evolution Hamiltonian defining microblackhole vortex action to get Laplacian gage solution with $H = \{i\hbar/(t_f - t_i)\}[\ln|\mathcal{L}p(t)|]$. Substituting this value of Hamiltonian in the above Equation with $H_n = H = \{i\hbar/(t_f - t_i)\}[\ln|\mathcal{L}p(t)|]$, and differential Hamiltonian $H_{n'} = \partial H/\partial t = (\partial/\partial t)(\{i\hbar/(t_f - t_i)\}[\ln|\mathcal{L}p(t)|]) = \{i\hbar/(t_f - t_i)\}\{\mathcal{L}'p(t)/\mathcal{L}p(t)\}$, with differential Laplacian $\mathcal{L}'p(t)$ has to get computed per physics. Hence, algorithmic equation microblackhole gage gravity force (Fqg) transforms to:*

$$F_{qg} = -i\hbar^3(G_{qg}(t_f - t_i)^3)^{-1}\,(r_{qg}^{\,4})\,(g[r_{qg}])^{-1}\,\{\mathcal{L}'p(t)/\mathcal{L}p(t)\}^2\,(g[g[r_{qg}]])\,(g[f^{*'}(\ln|\mathcal{L}p(t)|)]) \qquad (10)$$

PHYSICS formalisms predict time may be nonlinear operator

In the authors' papers articles reviews presentations as well as editorials, PHYSICS formalisms sampled has predicted parameter time not arithmetically numerical value, but a four-vector time matrix fields, like $\begin{pmatrix} \hat{t}_{pr,\mu\nu} & \hat{t}_g^{\mu\nu} \\ \hat{t}_{l,\mu\nu} & \hat{t}_r^{\mu\nu} \end{pmatrix}$ where $\hat{t}_{pr,\mu\nu}$: proper time, $\hat{t}_r^{\mu\nu}$: real-time, $\hat{t}_g^{\mu\nu}$: global time, and $\hat{t}_{l,\mu\nu}$: locally time. The author has published demonstrating gaging this time matrix to velocity matrix is possible by using a linear gaging metrics term of $(r/(gt^2))$ dot product multiplying with the time matrix above having $r \equiv gt^2$, with $(r/(gt^2))$ a unitary term. By keeping the 1/g term outside the matrix and r/t^2 term dot multiplying with each element of the time matrix, the four-vector velocity matrix fields transforms to $(\frac{1}{g})\begin{pmatrix} v_i & v_{vacuum} \\ v_j & v_M \end{pmatrix}$, with v_i: initial or proper velocity, v_j: local or general velocity, v_{vacuum}: non-inertial or global (vacuum) velocity, v_M: real matter or particle inertial velocity; r: space vector, g: gravitational constant (10 metric units) and t: gage time appropriately applied to the time matrix as well to perform the following calculations.

Order of magnitude (O) computing *has been shown to give* ***r = O (500) m*** *or* ***O (1/2) km.*** *Interpreting this, order of magnitude (O) computing would predict so that time may be linear spatially only within O (1/2) km = O (1/4) mile, noting time is a four-vector time matrix {proper, real, global, local}. For example, the O (1/4) mile observable may have to be scalar fields of the sound and light, vibrationally sensibly visible mesoscopic, for example, having event timeline within a big game, like baseball, football, or other arena gaming sports, typically. Everything within those systems will work like clockwork, even within seconds – functionally. However, outside that system, for example, more than a mile away, we won't know what is going on there unless a functional communicator operator like a television informs us. Hence this game system (r < O (1/4) mile) and outside (r > O (1) mile) are functors to each other, forming typical* *discontinuum entities!! More examples with observables appear in the authors' many peer-reviewers' publications as well as presentations.*

Invoking Operator Algebras, functions, functors, transforms and detailed mathematical physics treatment with more than 20 pages of derivational process, the author has expressed the Equation (10) with only time, space-field, and rotational parameters quantifying essence of the quantum gravity PHYSICS!! With inverse Fourier transform from the time domain to the rotational (frequency, v) domain, noting the time, $t \equiv \mathcal{F}^{-1}(\omega)$*, and hence,* $t_g \equiv \mathcal{F}_{\mathscr{g}}^{-1}(\omega)$*, the inverse Fourier transform of angular velocity or speed,* $\omega = 2\pi v$*, taking into account Hod-PDP mechanism to have trixial rotational orthogonal contributions like* $[(\omega)]_{effective}$ *=>::<=* $\{\theta_{spin}, \eta_{rotation}, \kappa_{revolution}\}$*, which are the angle of spin, angle of rotation, and angle of revolution of Hod-PDP quantum assembly explained per published algorithm model ICMHZT magneto-electric Schematic within the Figure 4 explaining Hod-PDP assembly of the rotational fields.* *To perform a complete gage transform of the quantum gravity gage force,* F_{qg} *in Equation (10) underwent gaging of space,* r_{qg}*, and topology* r_{qg}^4 *terms by noting that the quantum gage velocity,* $v_{qg} = \omega_{qg}.r_{qg}$*. In general, the* $[(\omega)]_{effective}$ *is a rotation matrix with elements of quaternions, a.k.a. versors as well as spatial rotations. These parameters synchronize functions of time in physics transforms originally derived earlier by this author. Mathematical transforms operational manipulations performed completely with simplifying computing is given in the resulting algorithm equation having graphical metrics,* $[Y] = g_g[X]$*, where output matrix [Y] is a metrically adjusted function of input metrical matrix [X] such that* g_g *is a gage fibrational string parameter. Typically,* $g_g = 1$ *to get a resultant Algorithm Graphical Equation with scalar quantum gauge field* $||[\varepsilon_{GR}]||$ *in terms of general transforms with Laplacian, Fourier, and the Legendre gaging the spin, rotation, revolution, and* ω_{qg} *as a function of time. Hence, these are theoretical to experimental observable measurable parameters purely in terms of algebra transforms. Universal constants, which may not be constants over a long time of observations have been essentially eliminated by this thorough mathematical transformation process of the operator algebra. With this operator approach, Equation graphic algorithms have been thoroughly derived by this author, mathematically solving within linear operator region of space quantum gravity that gives algorithm graphical metrics,* $[Y] = g_g[X]$*, giving the following results:*

<u>***Algorithm numeration matrix simulation programmable***</u>

- ✓ *Equation (10) with above explained methods, the author transformed quite in general to time tensor gauge field rotation, spin, and revolutions only as a function of space-fields-time.*

- ✓ $$[X] = \{(\mathcal{L}'p(F^{-1}(g[\{cos\theta_{spin}(t), sin\theta_{spin}(t)\}, \eta_{rotation}(t), \kappa_{revolution}(t)])))^{2}$$
$$(\mathcal{L}p(F^{-1}(g[\{cos\theta_{spin}(t), sin\theta_{spin}(t)\}, \eta_{rotation}(t), \kappa_{revolution}(t)])))^{-2}$$
$$(g\ [f^{*'}(ln\ |\mathcal{L}p(F^{-1}(g[\{cos\theta_{spin}(t), sin\theta_{spin}(t)\}, \eta_{rotation}(t), \kappa_{revolution}(t)]))])\}^{-1}.\omega_{qg}(t)$$

$$[Y] = ||[\varepsilon_{GR}]|| \qquad (11)$$

where $\mathcal{L}p$: Laplacian; $g[f^{*\prime}(f'(p^2))] \equiv$ gage of Legendre transforms of Lagrangian energy term p^2/m having p: momentum, and m: mass has been taken care of with transform manipulations.

$\mathcal{L}p(\mathcal{F}^{-1}(g[\{\cos\theta_{spin}(t), \sin\theta_{spin}(t)\}, \eta_{rotation}(t), \kappa_{revolution}(t)]))$: Legendre transforms of inverse Fourier gage angular {spin, rotation, revolution} which are functions of time.

$\mathcal{L}'p(\mathcal{F}^{-1}(g[\{\cos\theta_{spin}(t), \sin\theta_{spin}(t)\}, \eta_{rotation}(t), \kappa_{revolution}(t)]))$: Jacobian, 1st derivative of Legendre transforms of inverse Fourier gage angular {spin, rotation, revolution} that are functions of time.

$\omega_{qg}(t)$: quantum gravity angular velocity as a function of time.

$||[\mathcal{E}_{GR}]||$: scalar space quantum gauge field matrix protocol, measurable normalized parameter.

<u>Prototype set-ups, figures, variable measuring instrumentation systems Experimental Designs</u>

The flowchart in Figure 6 gives graphics of how theory translates to determining parameters of observables by applying matrix algorithms developed here above. Starting from the original Iyer Markoulakis point gradient vortex formalism, the IMMOHZT model quantitatively characterized the Hod-PDP mechanism hypothesized to operate within a superluminous plenum. Physics with the north and south monopoles that form like "dark matter energy" within the churning Superluminous_Plenum, by Hod-PDP mechanism transforms to dipolar magnetic electric fields to create "real matter-energy". Peer-reviewed papers listed at the end of this Chapter detail complete physical mathematics formalisms theory from which observables have been analytically pulled out by the above-explained methodology. These thorough process derivations make all these measurement flowcharts feasibly viable. Algorithmic flowcharts with proper physics will help in launching theoretical computer programming simulations as well as prototype testing experimental investigations. The flowchart given in Figure 6 tells us about wavefunction-potential within Superluminous_Plenum having north, and south monopoles[44] or normally dipoles like Hod-PDP will give signal/noise matrix output that is quantum parametrically forked to switching gauge fields and then separately as wavefunctions characteristics of the spin, rotation, and the revolution matrix of particles that are hypothesized to generate out of universal Superluminous-Plenum quagmire.

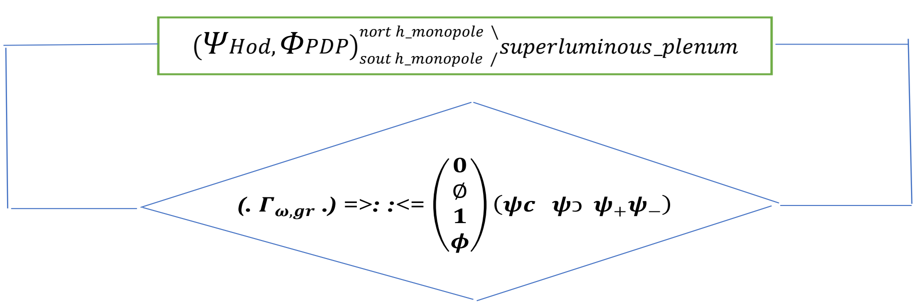
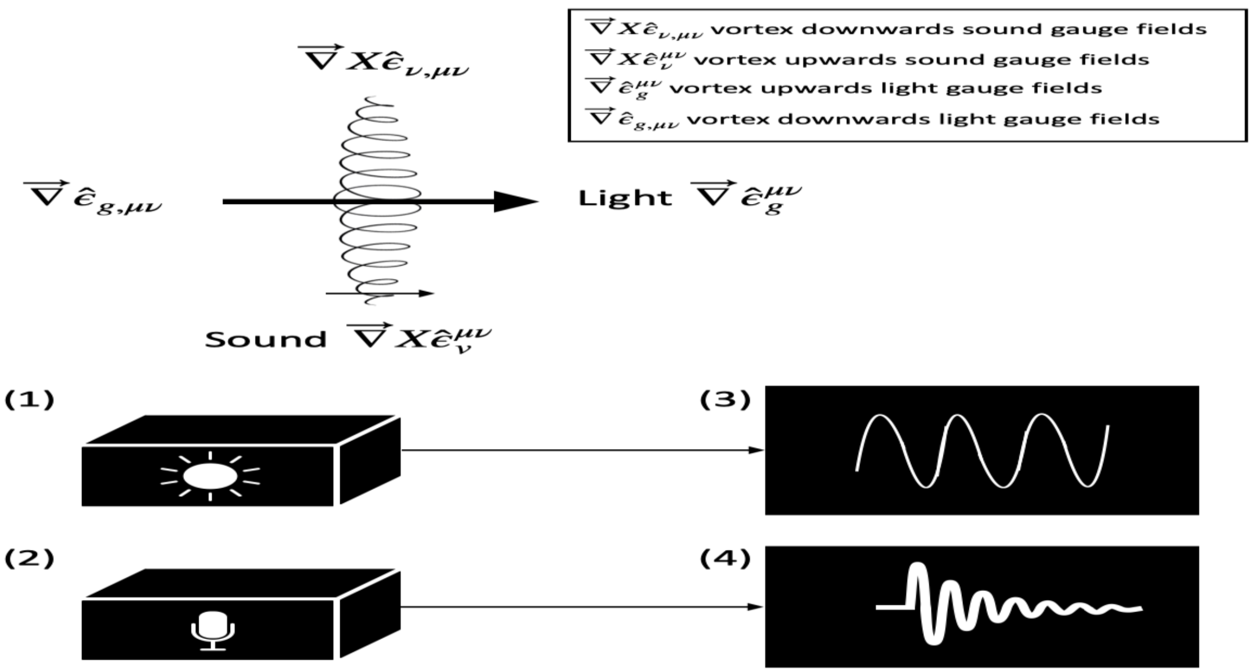


***Figure 6:** Overall measurement procedure theoretical to experimental with Algorithm Equations (5) and (9) with connected explanations giving parametric measurement grid flowchart schematically.*



(1) *Point-to-point astrophysical light intensity signal/noise and spectra density matrices measurement sensor microprocessor like diamond chips embedded operational device.* ***(2)*** *Sound acoustic-electric transducer profile switches signal pattern density matrices measurement sensor microprocessor like piezoelectric operational device embedment.* ***(3)*** *Photometer sensor point-to-point profiling switches [mode] {0, off, on} oscilloscope density matrices signal/noise pattern measurement calibration enhanced systems.* ***(4)*** *Sound-meter spectroscopic signal/noise pattern measurement oscilloscope attachment density matrices signal/noise pattern measurement calibration enhanced systems. Per the above explanation, Poynting vector can be used to measure the electric and magnetic fields of the light at a given point and apply formula S = (E x B) / μ0 to calculate the Poynting vector at any point in space.*

Figure 7: *Schematics of an intensity profile signal/noise matrix measurement instrumentation system with point-to-point precision accurate integrated circuit diamond chips microprocessors. Observable measurable astrophysical signal/noise matrix of sound and light detected by sensors decoded by component elements linked to oscilloscope spectroscope and sound meter to gauge fields and the quantum wavefunctions quantified Algorithm Equations (5) and (9).*

Figure *7 provides a viable means of capturing observable measurable astrophysical signal/noise matrix of sound and light. These parametric scalar gauge fields are then sent appropriately to sensors linked to oscilloscope spectroscope sound meter instrumented measurement systems. Sensors are essentially fabricated devices having point-to-point precision accurate integrated circuit diamond chips microprocessors. They are thus equipped to detect point-to-point astrophysical light intensity signal/noise and spectra density matrices of light signals. Photometer sensor point-to-point profiling switches [mode] {0, off, on} measure signal/noise pattern density matrices with calibration enhanced systems. Sound signals are separately captured, sent to detectors, and analyzed by using acoustic-electric transducer profile switches to measure signal pattern density matrices.*

Presently we are working on the design and development of transducing sensors to have piezoelectric operational device embedment. We have our goal to have computer systems linking with integrated sound and light input sensors to sound-meter spectroscopic signal/noise patterns sent to proper measurement oscilloscopic calibration enhanced systems output devices. Extracting signals out from noisy signals by logical amplification and noise cancellation enabling techniques to enhance signal/noise with modulation and Fourier transform techniques, and feedback circuit mechanism to computationally adjust the input/output device performance with real-time monitoring error signals will advance observational measurements with real-time parametric data collections. Eventually, data processing will help us to identify particle presence and their quantum density matrix profile by employing innovative state-of-the-art physics testing set ups.

Fibrational Bundle Gage Transforms PHYSICS Systems

*Algorithmic Graph Equation (11) in fibrational graphic form of **[Y] = g_{fts} [X]** can be substituted to gage specific parameters as **||[$\mathcal{E}_{GR}$]|| = g_{fts} f(grouping_transforms(time)).** Mathematically inverse operation of this equation gives algorithm: **grouping_transforms (time) = f^{-1}(||[$\mathcal{E}_{GR}$]||/g_{fts}).** Time is extractable from this algorithm equation by having mathematically inverse transforms, giving four-vector time matrix:*

$$\left\| \begin{pmatrix} \hat{t}_{pr,\mu\nu} & \hat{t}_{g}^{\mu\nu} \\ \hat{t}_{l,\mu\nu} & \hat{t}_{r}^{\mu\nu} \end{pmatrix} \right\| = g^{-1}[f^{-1}(\|[\mathcal{E}_{GR}]\|/g_{fts})] = g_{ifts}\,[transforms] \qquad (12)$$

where with $\hat{t}_{pr,\mu\nu}$:proper time, $\hat{t}_{r}^{\mu\nu}$: real time, $\hat{t}_{g}^{\mu\nu}$: global time, and $\hat{t}_{l,\mu\nu}$: locally time; ||[$\mathcal{E}_{GR}$]|| : scalar space gauge matrix fields gaging to normalized four-vector time matrix.

***Keynote**: (1) **[transforms]** represent **{||[$\mathcal{E}_{GR}$]||, g_{fts}}** fibrational bundle gage transforms physics systems. (2) Hod may have the ability to break strong energy condition of PDP circuit functor that involves electrons, positrons, north and south monopoles assemblage within a Superluminous Plenum quagmire "Superfluids". Weak gravity may act on the superluminous plenum superfluids. Strong gravity then comes because of Hod-PDP mechanism with strong energy condition of PDP activated by Hods to create vacuum wave dynamic particle real energy matter universe. Coupling aspects with the modons as the Dirac strings of the monopoles electrodynamics with quantum density matrix may act to produce strong gravity via Hod-PDP mechanism generating dipoles-particles. Knowledge of the weak and the strong gravity are brought out in subsequent sections of this Chapter.*

Quantifications, Measurements, and Discontinuum gravity_bundle_transform PHYSICS

Peer published articles Discontinuum PHYSICS that Taylor and Iyer have brought out advancements quantitatively entire universal quantum astrophysics to be a part of existence in the general embodied-energy-discontinuum (EED) field and a disembodied-energy-discontinuum (DED) field are part of each other. Therefore, they don't exist separately, meaning if an EED-field exists so does a DED-field such that these two fields are part-of each other. Additionally, if the one

EED-field disappears, then the one DED-field also disappears and therefore, vice versa. Inseparability is a property of "The one EED-field and one DED-field that are part-of each other", and hence, inseparability is a property of the discontinuum energy field (DEF) as well. We deduce that the DEF satisfies gage-field of algorithmic transforms equations above, forming like topological fields, analogically gravitational topology. ***Gist of what it will apply to quantify discontinuum PHYSICS*** *with a simpler way, the formalisms, referring to results of Equations (11) and (12) with linking equations lead to the following algorithmic equation expressing:*

(gage_field) = (fiber_transforms) *(gage_time_matrix)*. This relationship when applied to discontinuum physics will lead to algorithmic equation expressing:*

(gage_(DEF)) = (fiber_transforms) *(gage_velocity*). In this equation, fiber_transforms typically will have open_strings as well as closed_strings (loops) that connect functor (discontinuum) cells. Typically, fiber_transforms will have gage_time with gage_fields of light and sound that can be connected to Taylor and Iyer TOR predictions with the discontinuum physics so that gage_velocity will correlate with discontiunnum object equation of motion. In general, we can put together equating* ***(DEF) = Σ{(fiber_transforms)*(gage_velocity)}****, noting* ***DEF = spatial differential of gravitational force*** = $\partial/\partial r(GmM/r^2)$ *and rearranging by substituting* $M/r^2 = \rho r^3/r^2$ *such that* **ρ** *the gravity density matrix is equivalent to concentrated huge gravitational mass,* ***M*** *which is having its gravitational influence spreading over* ***r,*** *the spatial distance between* ***m*** *and* ***M.*** *Thereby,*

DEF = spatial *differential of gravitational force* = $\partial/\partial r(Gm\rho r) = Gm\rho = Gmg\rho/g = (G\rho/g).mg$. ***(Gρ/g)*** *constitutes bundle gravity transform, with* ***G, the universal gravitational constant.*** *Then,* ***mg*** *will be like normal measurable weight due to gravity like action of earthern gravity,* ***g*** *on an object mass,* ***m.*** *Hence, one may write this equation with computational substitutions to be:*

(DEF) = (gravity_bundle_transform) (weight). *We note weight is measurable quantity, experimentally viable to be tested as physically observable parameter. Also, that*

(DEF) = Σ{(fiber_transforms) *(gage_velocity)}*as noted above, allowing us to write the DCP algorithm equationally in the form:*

(DEF) = (gravity_bundle_transform) (weight) = Σ{(fiber_transforms)*(gage_velocity)} ***(13)***

Equation (13) summarizes with a gist of DisContinuum PHYSICS (DCP), allowing evaluation of the (DEF) by having computation of algorithm using typically algebraically general mathematics: $[Y] = f_T[X]$; $f_T \equiv$ *fiber_transform, Experimental observations with measurements of gage_velocity and the weight relationships to get Equation (13) that has theoretical capability to facilitate an experimental design by having circuit analog. [Y] and [X] have parametric adjustments to estimate (DEF), Algorithm Equation (13) tells us that determination of the (gravity_bundle_transform) is possible by having programmatic computation of general equation of the algorithm [Σ{(fiber_transforms) *(gage_velocity)}]/(weight).*

With above instrumentation design protocol capable of feasibly measuring ***ρ*** *occurring per Figures 6 and 7,* ***(Gρ/g)*** *may be evaluated by obtaining estimation of bundle gravity transforms. Application of trial-and-error techniques on experimental observations complemented by verifiable measurements with computer programming simulations will make us to graphically determine the* ***(DEF) versus (gage_velocity)*** *for varying matter_weights. Thus, discontinuum physics can be quantified towards gage unifying paradigm shifting PHYSICS.*

IT of algorithm Quantum Computing PHYSICS coding matrix

Making that amenable to computer programming simulation operator algorithm, the author has advanced further with IT four-vector matrix "qnbit", keeping intact quantum computational probability properties. The resulting algorithm equation, like 2x2 S2 "coefficient" matrix with eigenspinor "ketvector" value to give resultant quantum "ketvector" parametric values. These appear in peer published articles. The compact algorithm IT coded to represent states of time switching quaternion patterns with states of switch off = 0, on =1, not_off = ~~0~~, not_on = ~~1~~ ***(note: not_off ≠ on and not_off ≠ off*** *in general****) operated by "ketvector" [on off]*** *to generate global and local quantum parameters,* $\boldsymbol{q_g}$ *and* $\boldsymbol{q_l}$ *is given by the algorithm IT quaternions PHYSICS matrix:* $\begin{pmatrix} 0 & 1 \\ \not{1} & \not{0} \end{pmatrix}\begin{pmatrix} on \\ off \end{pmatrix} = \begin{pmatrix} q_g \\ q_l \end{pmatrix}$ *evaluating with Pauli matrices equivalently with quaternion spinor to get:*

$$\begin{pmatrix} \mathbf{0} & \mathbf{1} \\ \not{\mathbf{1}} & \not{\mathbf{0}} \end{pmatrix}\begin{pmatrix} \boldsymbol{on} \\ \boldsymbol{off} \end{pmatrix} = \begin{pmatrix} \mathbf{0} & -\mathbf{i} \\ \boldsymbol{i} & \not{\mathbf{0}} \end{pmatrix}\begin{pmatrix} \boldsymbol{on} \\ \boldsymbol{off} \end{pmatrix} \qquad \textbf{(14)}$$

The author then carried out further analytical mathematics to find the relationship of switching states and off and on modes. Evaluating Equation (14):
0*on + 1*off + ~~1~~*on + ~~0~~*off = -i*off + i*on. *Hence****, -i*off + i*on = ~~1~~*on + ~~0~~*off.*** *Inputting values* ***~~0~~≡off-on & ~~1~~≡on-off,*** *we get****: -i*off + i*on = on-off * on + off-on * off.*** *On simplifying the author gets resultant****: (i – on-off) * on = (i + off-on + 1) * off.*** *It helps to evaluate off in terms of on mode.*

$$\textbf{i.e., } \boldsymbol{Off} = \frac{(\boldsymbol{i} - \boldsymbol{on} - \boldsymbol{off})}{(\boldsymbol{i} + \boldsymbol{off} - \boldsymbol{on} + \mathbf{1})} \boldsymbol{* on} \qquad \textbf{(15)}$$

which has s nonzero denominator; an inference will be if off is nonzero, noisy it is like nebulae!!

*We can have condition****: off = 0 if i = on-off,*** *or* ***(on-off)***^{2} ***= -1,*** *translating to quaternions equation* ***(on-off)***^{4}***= 1.*** *It will then be analogous to switches mode multiplier, that appears like* ***"ΠQuaternion switches modulating equivalent synthesis waveforms"****. This can be graphically shown having a square wave that is on-off multiplying over to generate photomultiplier like effect. There are pattern binary coding sequences that are eventually computer simulation programming to show switching signal/noise effects. We can apply Equation (15) to transform Equation (14) into numerical values with binary coding 0 and 1 matrix forms. However, it is to be noted Algorithm IT Quaternions PHYSICS Matrix:* $\begin{pmatrix} \mathbf{0} & \mathbf{1} \\ \not{\mathbf{1}} & \not{\mathbf{0}} \end{pmatrix}\begin{pmatrix} \boldsymbol{on} \\ \boldsymbol{off} \end{pmatrix} = \begin{pmatrix} \boldsymbol{q_g} \\ \boldsymbol{q_l} \end{pmatrix}$ *has non-integer values with ~~0~~ and ~~1~~. In the following, the author has derived equivalent numerical matrix by recognizing the natural processes of the prime number factorizations. Hence,* ***~~0~~ = pf0*** *and* ***~~1~~ = pf1*** *in notation symbols to programming.*

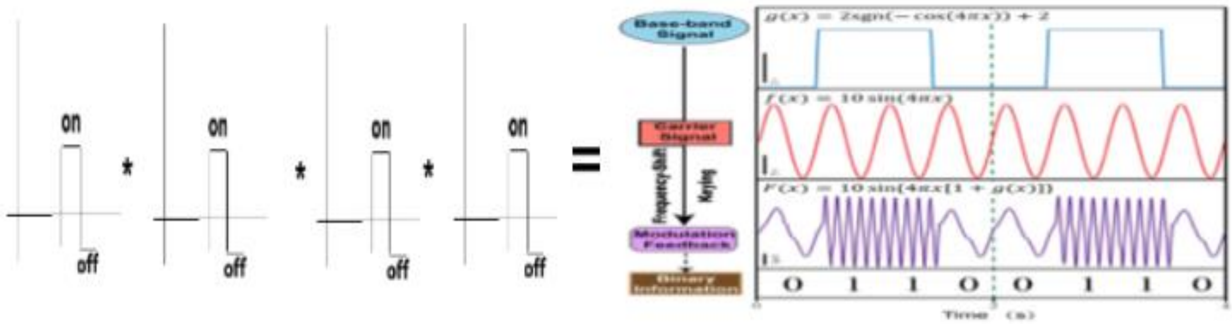


Figure 8: *Quaternion on-off switches modulating square waves effect like photomultipliers lasering!! Mesoscopic observable twinkling stars sky!! [Reference: image Wikipedia output].*

PHYSICS results matrix value coding

$\begin{pmatrix} \mathbf{0} & \mathbf{1} \\ \mathbf{1} & \mathbf{0} \end{pmatrix} \begin{pmatrix} \boldsymbol{on} \\ \boldsymbol{off} \end{pmatrix} = \begin{pmatrix} \boldsymbol{q_g} \\ \boldsymbol{q_l} \end{pmatrix}$ *the logic Algorithm IT Quaternions PHYSICS Matrix will become:*

$$\begin{pmatrix} \mathbf{0} & \mathbf{1} \\ \boldsymbol{pf}\mathbf{1} & \boldsymbol{pf}\mathbf{0} \end{pmatrix} \begin{pmatrix} \mathbf{1} \\ \mathbf{0} \end{pmatrix} = \begin{pmatrix} \boldsymbol{q_g} \\ \boldsymbol{q_l} \end{pmatrix} \qquad \textbf{(16)}$$

*Equation (16) has parameters **pf1** (permutating) as taking up values of (1/prime_number); thereby, **pf0** (permutating) taking up conjugatively values (-1/prime_number); we know already, [prime_number] set takes values of {1, 2, 3, 5, 7, ……} input to syntactically machine coding computer program. Graphically then plotting **[X] axis =** $\boldsymbol{q_g}$**:** the quantum global as well as then the **[Y] axis =** $\boldsymbol{q_l}$: the quantum local parametric values will output PHYSICS characterizing properties!! Typical examples with arithmetic numeration matrix calculations are given in many of the author's peer publications thus exemplifying without prime number factoring process to make it simple. However, computer programming simulation graphing has generated results that are also demonstrated at a later section of this Chapter.*

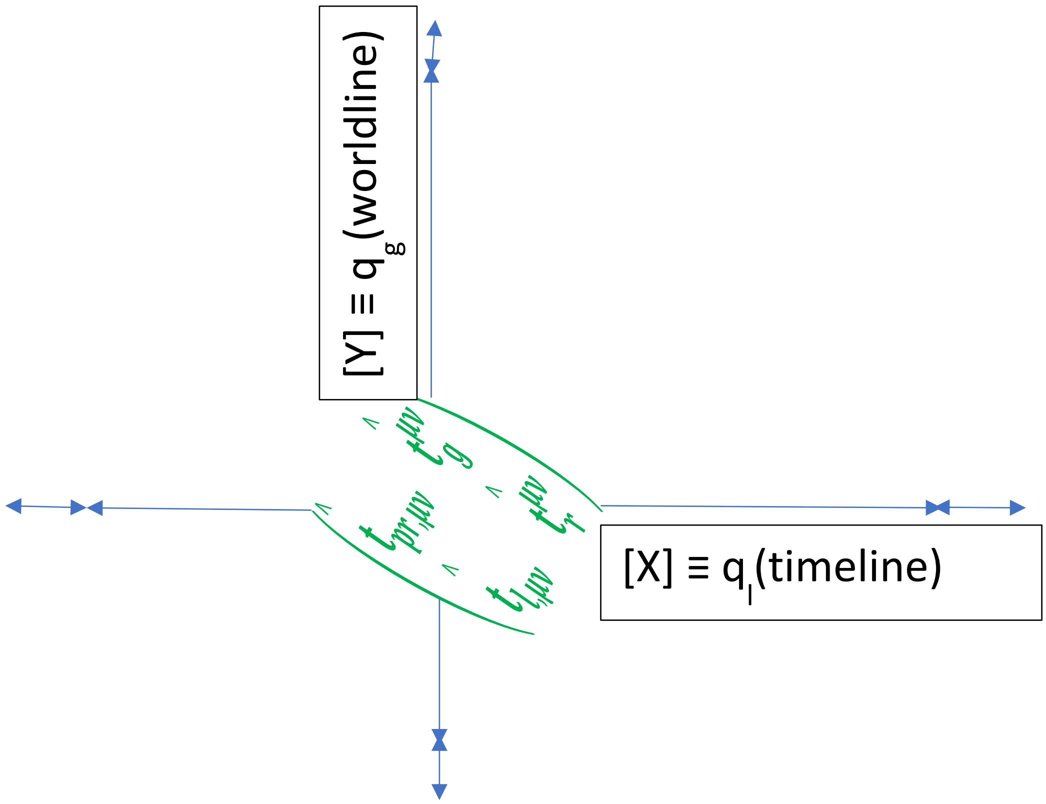


***Figure 9**: tensor time four-vector matrix rotated to correspond to graphing quantum parameters variables with [X] ≡ q_l(timeline) and [Y] ≡ q_g(worldline) axes Equations (11) through (16).*

*Graphing the global quantum, $\boldsymbol{q_g}$, versus the local quantum, q_l, by rotation matrix to suit **[X]-[Y]**, which are interchangeable, plotting corresponding to tensor time four-vector matrix format is shown per **Figure 9**. Thereby, q_l & q_g were computed per algorithm quaternion PHYSICS digital switching circuit gauge matrix fields algorithm Equations (15) and (16). Fluctuating, on, off deconvolute, convolute, gradient, vortex heat and energy field matrix gauge operator metrics protocol were carried out. q_l versus q_g plot schematically showing possible outliers and perhaps, discerning precise band of inliers stochastically analyzable like having Bayesian statistics evaluating distorted field anomalies within quagmire magnetic gauge monopole energy interpretive "superfluid" local action cells PHYSICS developing overall unifiable to having a grand field theory!! We can prove: q_l(timeline): the quantum local timeline event and q_g(worldline): the quantum global worldline operator linking temporal macro micro variables. Since, [X] and [Y] are interchangeable, we will alternatively make **[X]**= $\boldsymbol{q_g}$ &**[Y]**= $\boldsymbol{q_l}$. Mapping [X] = q_g(worldline) versus [Y] = q_l(timeline). where [X] and [Y] are adjusted to PHYSICS operator metrix protocol might provide anomaly_band like zone at inlier within a linear regression plot, like in anomaly earthquakes and nebular-blackhole astrophysics. We may associate vibrational vortex and cosmic microwave background radiative gauge matrix fields to worldline-timeline. Hence, timeline=>: :<=vibrational vortex=>: :<=gravitational wave, while having the worldline=>: :<=cosmic microwave background radiative, where =>: :<= shows associativity.*

Figure 10 *mapping* ***[X] = q_g(worldline)*** *versus* ***[Y] = q_l(timeline)*** *shows quantum probability values within Superluminous Magnetic Plenum. IT computer algorithm* ***Equation (16)*** *was eventually program coded to run on computer per the author's global collaborative coauthor Christopher O'Neill, IT Physicist of Cataphysics Group, Ireland that appear in peers-reviewers' publications. Here, briefly these preliminary theoretical results are enumerated executing program to compute* q_g *and* q_l *for* ***pf0*** *and* ***pf1*** *prime numbers up to 10,000 in one case and 100,00 in the other. *Mathematics constraint with** pf1 *(permutating) = 1/prime_number;* ***pf0*** *(permutating) = -1/prime_number;* ***[X] axis =*** q_g*, quantum global parameter and* ***[Y] axis =*** q_l*, the quantum local parameter computed Algorithm:* $\begin{pmatrix} \mathbf{0} & \mathbf{1} \\ \boldsymbol{pf1} & \boldsymbol{pf0} \end{pmatrix}\begin{pmatrix} \mathbf{1} \\ \mathbf{0} \end{pmatrix} = \begin{pmatrix} q_l \\ q_g \end{pmatrix}$ *in computer graphing* ***Figure 11****.*

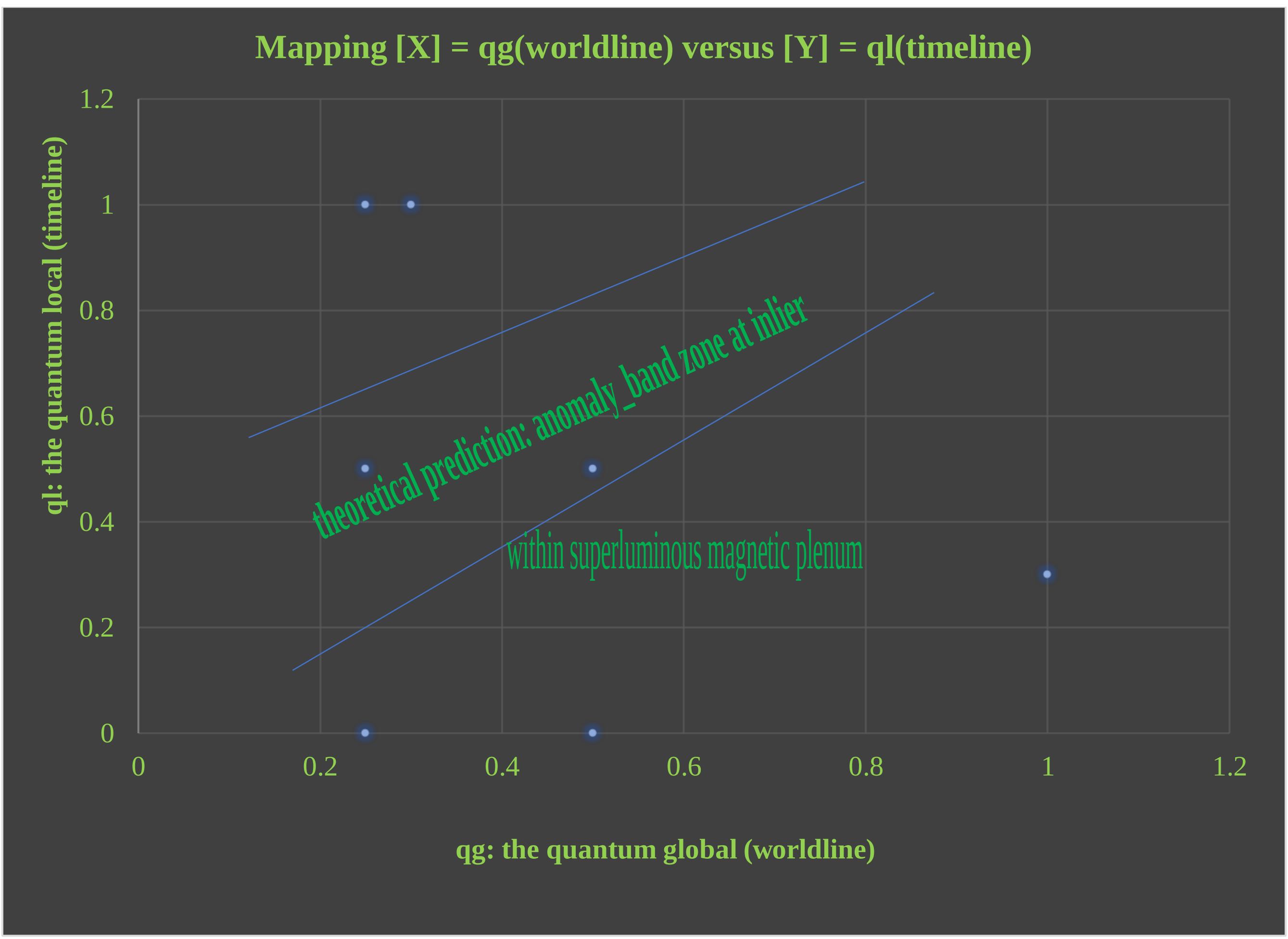
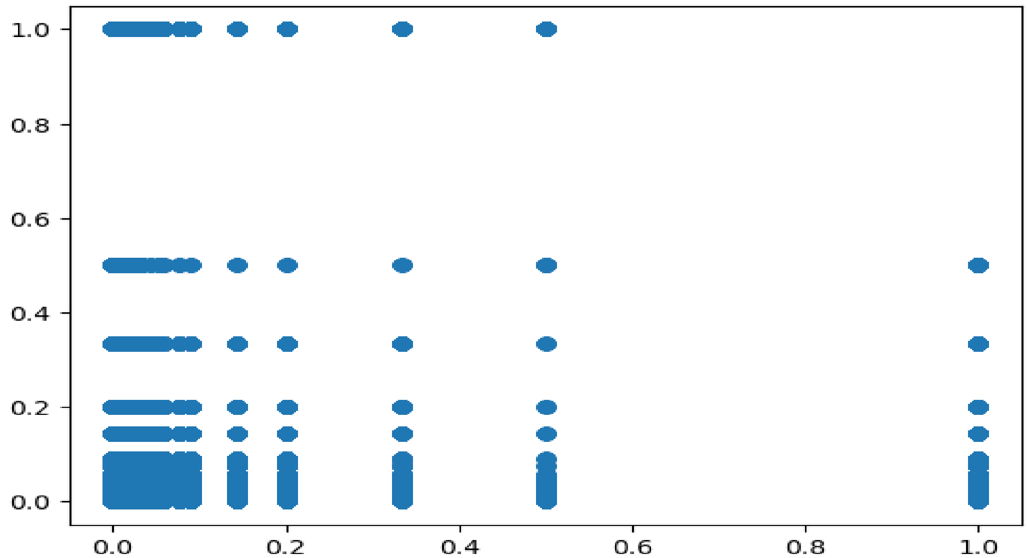
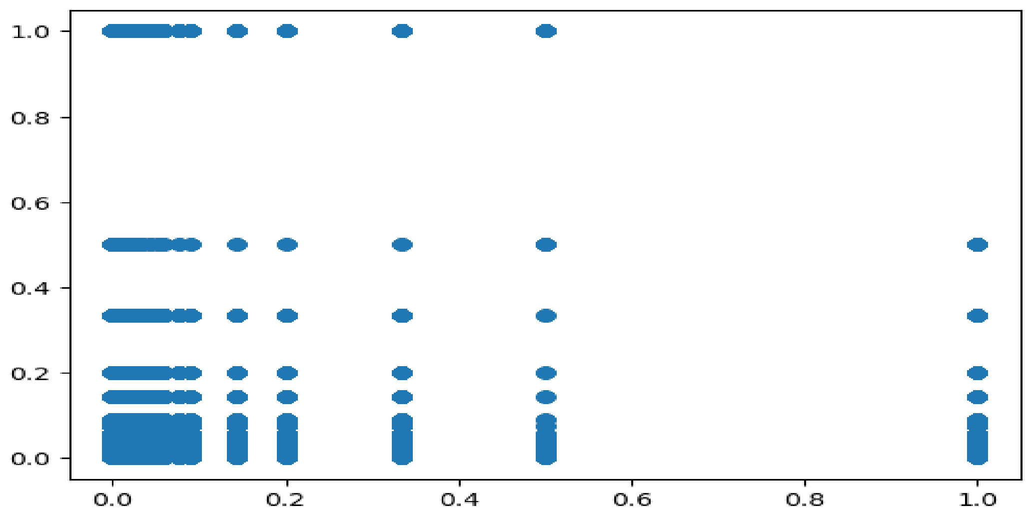


Figure 10: schematically shows mapping [X] = q_g(worldline) versus [Y] = q_l(timeline). where [X] and [Y] are adjusted to PHYSICS operator metrix protocol, plotting quantum probability values manifesting Equations (15) and (16), within Superluminous Magnetic Plenum.

Results for 10,000 prime number factorisations* (M1)

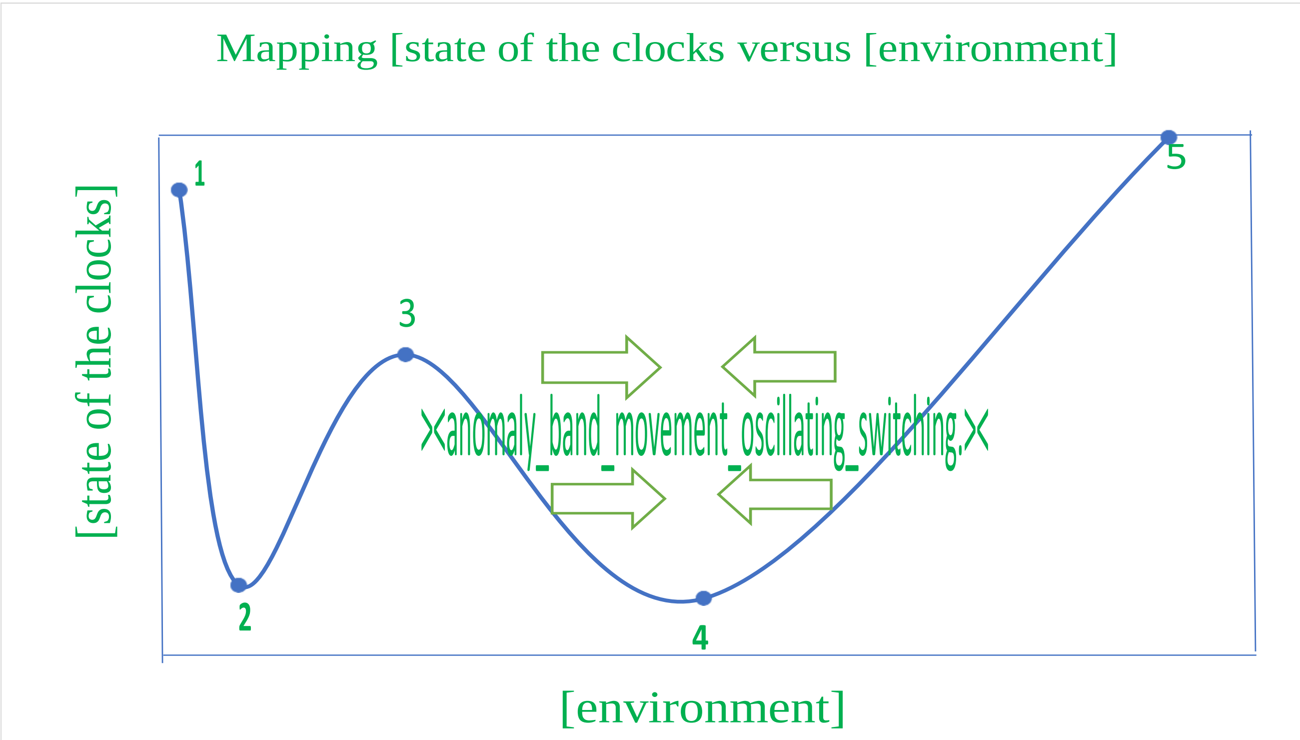


Results for 100,000 prime number factorisations* (M2)



^Origin (0, 0) zero time point ^(vacuum?!) intersection nodes of timeline weaving worldline!!

Figure 11: *outputs graphing to plot computer programmed algorithm Equation (8) to map* q_l *and* q_g*for pf0 and pf1 prime numbers up to 10,000 in one case (m1) and 100,00 in the other (M2). *Mathematics constraint with* pf1 (permutating) = 1/prime_number; pf0 (permutating) = -1/prime_number; [X] axis =* q_l*: the quantum local; [Y] axis =* q_g*: the quantum global parametrizing variables. Courtesy: Christopher O'Neill, IT Physicist of Cataphysics Group, Ireland coding* executed computer simulation programming***.**



Legends ***[environment]*: 1. wormhole inertia; 2. event horizon maximizing inertia; 3. subluminal; 4. vacuum; 5. Superluminar.**

***[state of the clocks]*: absolute quantum relativistic speeds within light (vacuum) slowing due to inertia (1->2), then minimum at event horizon (2), running faster with subluminal (3), frozen at vacuum light speed (4), time clocks going higher than speed of light getting negative time runs (5), similar events happening (2->1).**

***Figure 12**: The state of the clocks versus environment interactivity (schematical outlines). Legends explain how the environment affects the state of the clocks, especially in quantum relativistic way.*

Superimposition of analog clock on mapping [state of the clocks] versus [environment] we get time core information-time comparing quantum global mapping quantum local. One may surmise that environmental point ><1>< <-> ><5>< may represent conscious mind, then point ><1,2><3>< <-> ><4,5><3>< may represent subconscious mind, point ><2>< <-> ><4>< may represent unconscious mind states existing within environment!!

Analysis of Switches States Equations (14)&(15) Quaternion Matrix

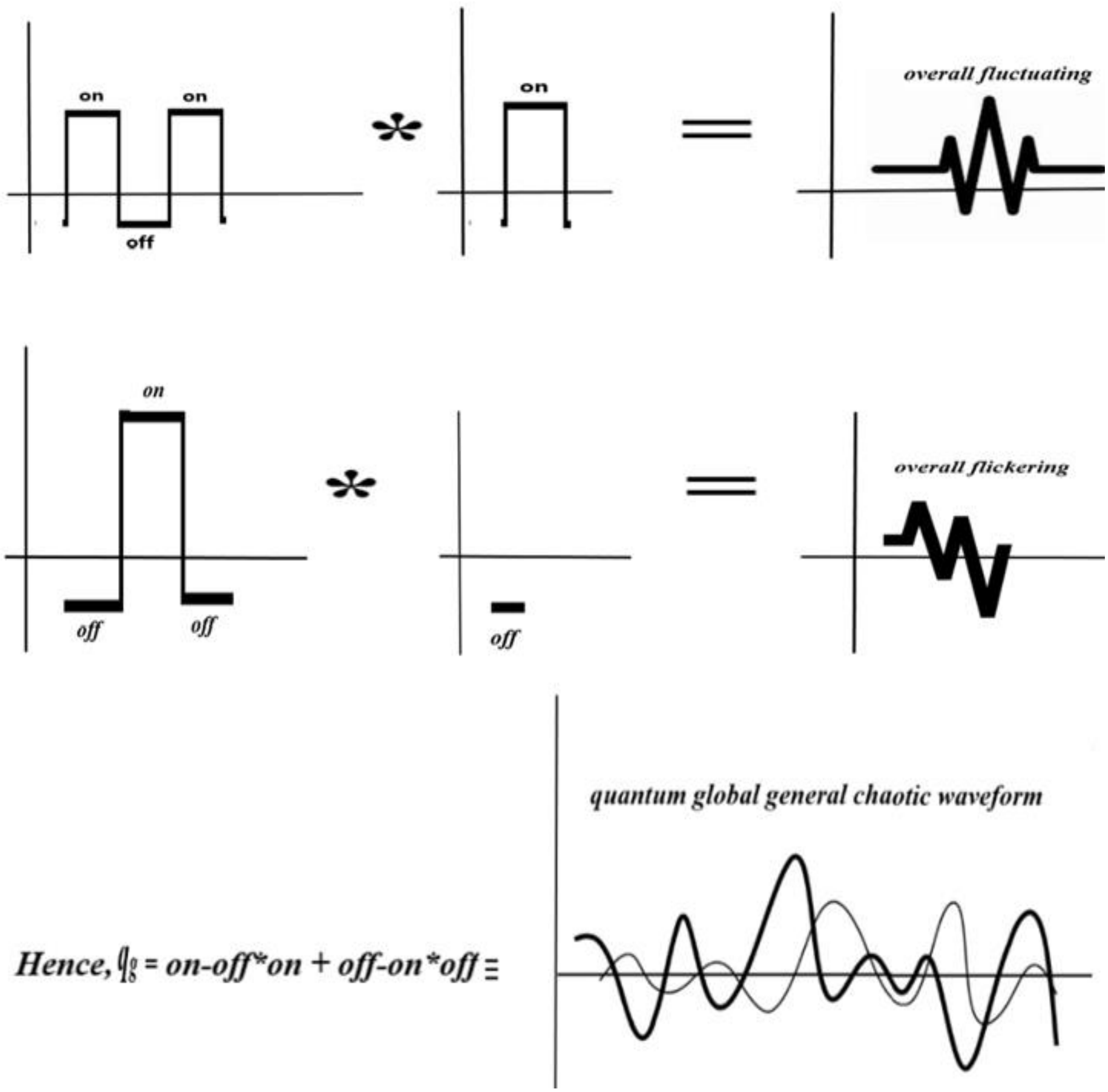


***Figure 13**: The graphical solutions to Equations (14) and (15) having q_g = on-off*on + off-on*off to give prime number values: pf1 = ~~1~~ = on-off, pf0 = ~~0~~ = off-on, refer to the main text as well. Keynote: scalar space gauge field can also be written in square bracket notation like: [0 off-on 1 on-off] switching analog form to indicate mode of switches, with 0 indicating no switches or vacuum; off-on indicating mostly off-mode but coming on or flickering; 1 indicating mode on condition switches; on-off indicating mostly on but mode coming off or fluctuating. Thereby, quaternion condition that will include quantum entanglement, superposition, quantum computing, analog switching signal processes, quantum waveform with particle interactivity, mathematically imaginary to real fields operator protocol, and Hod-PDP circuit mechanism activated by having distorted discontinuum energy fields vortex within superluminal Plenum turbulent quagmire extent phase may be characterized by the four-vector "ket" matrix.*

Geometry of space: *dimensionless {point, Superluminous, Plenum, magnetic, quagmire} to dimensional {Hod, dipole, magnetic, planar field} to {PDP, clockwork, assembly, discontinuum, mechanism} to {particle, photon, quark, gluonical, matter} Graphically, flowchart like Feynman diagram (Figure 14) providing the process of north and south monopoles within get mediated by Superluminous Magnetic Quagmire Plenum to create Hod-dipolar planar magnetic rigid entity having high energies to breaking symmetry to create quasi-particles generating electron-positron pair to assemble with north-south monopoles to create PDP circuit clockwork mechanism. Through photon wave (produced by Hod) mediation, the Hod-PDP assembly induces quark-gluonical particle to matter forming. This process has been graphically sketched below. Hod_Plenum mechanism is the key to the author's collaborative coauthor John Hodge's Scalar Theory of Everything PHYSICS.*

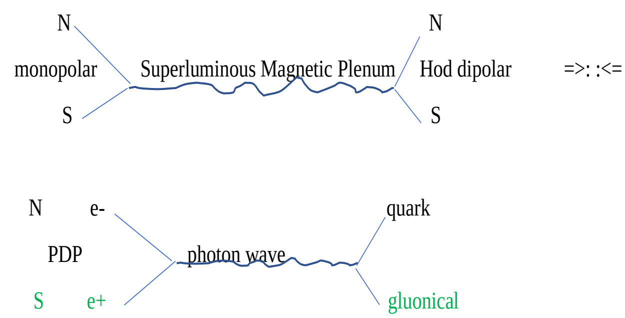


Figure 14: *Two Feynman-like diagrams.*

One of effects will be component of timeline global time versus locally time get affected by worldline component of the real time with the proper time. Events at locally time get changed faster. This will have many timeline-event ongoing change. Worldline expanded millions of billions of years, likely "Back to ongoing future" exactly. However, because time transforms gauge shows universe a "black box", if feedback loop condition satisfies self-consistent physics becomes a real possibility. Inferentially, this will point to a four-vector time matrix, as shown in Equation (12). {charge, parity, time reversal symmetry} =>: :<= {change, picture, time four vector matrix}. Worldline and timeline compatible units coming comparable magnitude topology will start altering disc to geometry spatial toroidal transforming transitioning to time bubble. [charge] topological transforms [parity] Superluminous Plenum to Hod-PDP quantum mechanism with [time reversal] {nuclear, plasma, quark, particle, gluon, matter} [X Y] =>: :<= [X' Y'] phases mediated by environmental energetic gage force field operator global having charge like a topological defect, parity like a transform's operator, and time reversal like fibrational strings. General dependence properties characterize analogical [charge] on {structure like topological defect}, [parity] on {shape like transforms geometrical disc toroidal bubble}, and [time reversal] on {mechanism like Hod-PDP quantum level distorting Superluminous Plenum}.

Keynote: *Earth perhaps spinning faster probably due to worldline compressing timeline longitude of Earth now?! Applying classical mechanics with moment of inertia, squeezing effect especially on magnetics will enhance spinning faster. This may have an effect with changing picture timeline event locally making time closer global real outcome?! If we write in terms of a four-vector gauge information matrix (time, bubble, having, toroidal) [rotations_operator_metrix_protocol], having also worldline and timeline compatible scalar units, transforming to topology of space will be seen altering geometric shape of disc to toroidal corresponding to time bubble.*

Dimensional conjectural physics shifting paradigm

In a gist manner, we can extend physics conjectures to make sense by justifying dimensions of various entities that make up the universe, listed briefly here in ***Table 2.***

Table 2: *The entity and expected property for several dimensional ranges. Note that adsorption signals may occur with Hod, as well as with Hod-PDP clocking mechanisms.*

Dimensional range	***Entity and expected property***
0 to 1	***Superluminous Plenum that may be noisy, however not observable***
1 to 2	***Open strings, typically 1D; Closed strings or loops, typically 1D to 2D***
2	***Hod that will not have thickness, hence transparent not observable***
2 to 3	***Quasi-particles, particles like fermions and bosons - potentially observable***
3	***Matter universe general Euclidean observable***
3 to 4	***Space-time manifold, for instance, blackholes observable effects***
4 to 5	***Hod-PDP assembly dynamics, effects quantum physically interpretable***

We can sketch time-event connecting sense rotations with geometry of space per ***Figure 15.***

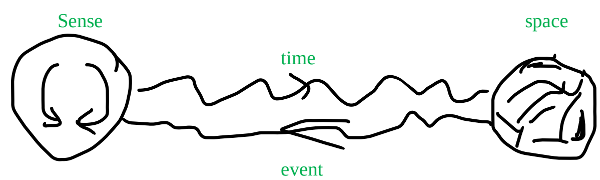


Figure 15: *The diagram for time-event connecting sense to space.*

"What is it?" …. Time is mixed operator …… "Why?"

- *Time has linear as well as nonlinear aspects.*
- *Time is a functional linking directionally conjugatively typically with open strings event information like functors sense to space connectivity, per sketch above.*
- *Time is marking global to local ongoing directionally matrix operator strings with information local linking global, interpreting sketch above in terms of information-timeline.*
- *Time is a four-vector matrix.*
- *Worldline towards a proper timeline pattern pathway, per Preliminary Results above.*

"How?".... *defining time in terms of moment and history.... Time is microscopically reversible macroscopically with quantum tunneling process switching subatomic sense to spatial nonlinear operator mesoscopic irreversible timeline event.*

Theoretical Algorithm Graphing wave particle real link value

Let's treat the diagram shown above in Figure 5. In the figure, Ψ is the wavefunction of electron positron pair and φ is the gage field function with phase angle can be evaluated from designs experimental measurements shown per Figures 6 and 7. Hence, values of (ψ, φ) can be evaluated to complete quantification of the following process diagram:

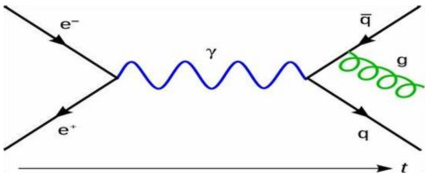
(ψ, φ) 

***Figure 16**: The Feynman-like diagram of electron-positron mediated by light photon to generate quark, antiquark, as well as gluon in the time scale. The retrofitting of this diagram upfront with the wavefunction and phase angle per Figure 5 scheme will help to establish particle quantum conditions.*

*This algorithm graphing with ITSTEM physics will have several usages, especially quantum computing applications. Will provide via working calibrator in experimentally measuring Γ and ρ with instrumentation systems shown below in prototype designs, having calibrated ƐPDP = (0 Ø 1 ɸ) to yield Ψ values by iterative processes computer programs. Such practical results are possibly obtained by theoretical computer programming in conjunction with experimental techniques. Once these quantum results have been achieved, that will then lead to evaluating |Ψ>. Then, real <Ψ| values can be evaluated by solving algorithm with theoretical and experimental procedures that have been already described above to get values of wavefunction matrix (**ψc ψɔ ψS ψN**) via trial-and-error basis. This extensively elaborate methodology will then supply all values to compute ρ = |Ψ>. Wavefunction-phase angle electron positron photon mediator quark antiquark gluon. In this Feynman diagram (Figure 16), referring to list of literature references at the end of this Chapter. The whole assembly with software algorithm with hardware particle will help to stabilize quantum computer equipment self-correcting operationally calibrating accessories that maybe supplied alongside eventual quantum computer internet technological systems.*

Emergent processes timeline event worldline operator vector matrix

In quantum emergence, time within transforms evolves processes to come out of the space fields. Time coexists with space fields, via sense giving field effect to space and time having mesoscopic emergence event timeline. With astrophysical emergence, time within transforms evolves processes to come out of the space fields, which generate worldline. Worldline interacting timeline weaving nodes create matter energy. Observable physical analogy with the quantum as well as astrophysics with the illustration of Bob-Alice personified processes movement event horizon time reference evolution story telling aspects, we can think of spider generating, mediating web that will eventually lead to entrapment of prey. Analogically, that web is fields emergence like time out from quantum forming timeline intersecting time out from astrophysics forming worldline. While spider timeline will meet prey worldline at the node.

Essentially, that topological field of the web is more than 2D, like fractal having 2<dimension<3 topology; spider emerges web having topology essentially worldline timeline meeting at the node where the prey entrapment happens. Spider resides within the timeline whereas prey comes from the worldline. Timeline perspective appears mesoscopic, while worldline imaginary weaving operator generating environment. State of the clock emergent event spider capturing. Physics extending processes like the Higgs fields or the general fibrational like web where two entities of the spider and the prey coexist in the time-loop advancing emergent circuiting timeline event worldline pooling!! A conscious observer sees events emerging state of clock worldline timeline event environment proceeding processes altogether!!

In the time-loop, spider locally moving globally, while at the horizon of node of timeline worldline process the prey moving proper time really within environment of the web topology!! A conscious observer's four vector time matrix sees state of the clock advancing emergent event together in timeline event unfolding environment worldline processes!! "Quantum hair" may be time sticking out quantum mesoscopic astrophysics!! Quantum towards timeline will appear like the Higgs field; however, astrophysics worldline towards mesoscopic will appear like the aether!! Are aether universal and Higgs field essentially similar PHYSICS?!

Strong gravity versus weak gravity thesis PHYSICS

Quantifying gravitational physics dense fibers transforms propositions.

- Strong gravity will act like a rope which is a braided (closed) bundle of strings system able to pull large weight, whereas weak gravity will act like a stranded (open) or string pulling.

- Weak gravity may be observed as a horizontal force on tangential plane of a stratified geodesic like the Earth having spherical concentric equidensity-matrix stratified towards the mass center like a sphere approximately, increasing pressure (hence density matrix) towards gravity center. Weak gravity models as fiber transform (open) strings pulling object.

- Strong gravity will all be like rope that is closed braided bundle strings' system pulling large weight by acting together with rope as one unit, hence having the stress tensor to pull object towards center of gravitational mass.

- Weak gravity is like normal acceleration, whereas strong gravity is like acceleration due to gravity. Gage_velocity links weak gravity to strong gravity. Equivalence principle thus will apply linking weak gravity to strong gravity.

- While there is a gravitational acceleration linking strong gravity, there is normally conjugate acceleration associated then the weak gravity.

- Quantum density matter-energy field spreads away object influence onto environment to almost infinity.

- *Causality of the weak gravity particle-particle collision interaction of density fields of object influence on other environmentally separated objects produces chaining of concomitantly sequential action reaction processes naturally happening.*

- *Strong gravity high-density fields lead to warping to eventual causality curving the geometry of space-time to form, for example, black holes.*

- *weak gravity timeline interweaves strong gravity worldline carrier waves.*

- *earth is affected by curving of interweaving worldline with timeline events.*

-

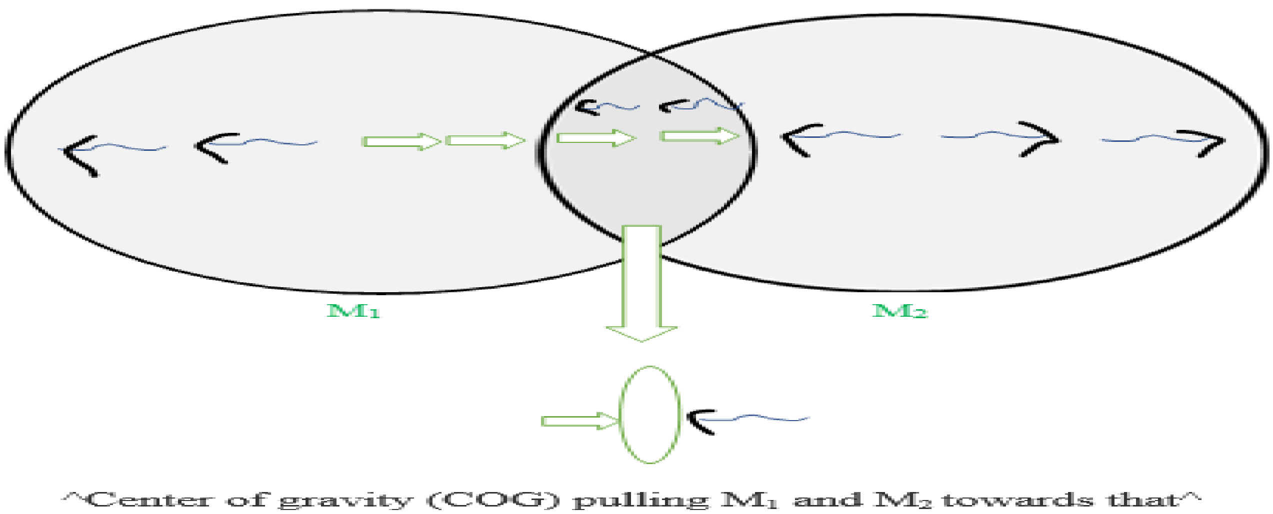


Figure 17: *The spreading of the density matrix from M_1 and M_2 massive objects pulling them towards center of gravity (COG).*

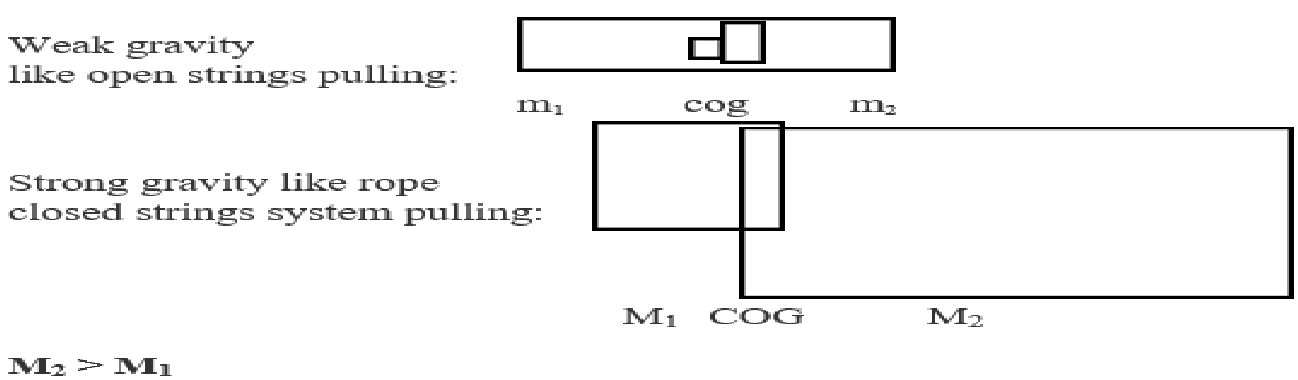


Figure 18: *The matter masses m_1 and m_2 are like open strings pulling on each other, representing weak gravity. Matter masses M_1 and M_2, with $M_2 > M_1$ are like rope constituting braided bundle of the strings together, pulling on each other acting like closed strings system to represent strong gravity.*

Explaining interpretations physics discussing propositions

Figure 17 *shows how matter spreads mass forming distributed density matrix over space. Then each object will have its own sphere of influence interacting through density matrix, having attractive versus repulsive forces to occupy space. We know that non-bosonic (nonlight) matter will not overlap occupation of space, meaning one particle, such as fermions occupying one point in space displace another particle trying to occupy its space. This will generate the action-reaction sequence of collisions, like thermodynamics of ideal gas particles, creating center of gravity (COG). while equilibrium of motion vectors culminates resultants at intersecting regions balancing opposing vectors, shown as lenticular region at interaction intersection of the two objects' spheres of influence. With this scheme, we can deduce that massive objects having larger density matrix will typically have relatively stronger spheres of influence over lighter objects having a smaller density matrix. The pulling towards COG will be a resultant of opposite vectors cancelling one another. Note that actual vector alignment is not drawn explicitly. However, translational property of vectors will imply equilibrium with balance of density matrix vector forces.* ***Figure 18*** *shows how types of force pulling on one another towards COG can create strong gravity versus weak gravity. To demonstrate simply weak gravity, one can test with a single strand string to pull certain object; it can only pull weakly. Whereas strong gravity will act like a rope braided multiple strands of strings that can pull heavily. Here, strong gravity works analogous to closed strings that are joined at the ends and hard to break or stretch out. Weak gravity works analogous to open strings that are loose at the ends and easier to break or stretch out.*

The effect of gravity is measurable as weight of an object. Also, measurable are those observables revealing typical event causality in terms of parity and sense, for example, observable measurable magnetic polarity with compass sensing needle varying with (latitude, longitude) coordinates specifically exposed to earthen global/local environment. It will give point information to complement gravitational waves and cosmic microwave background radiation measurement values translatable with analysis of interactive worldline-timeline-event. Strong energy gravity condition arises from fields originating per schemes outlined above, Hamiltonian-Helmholtz-Coulomb gaging (2 × 2) matrix of the original IM Iyer-Markoulakis formalism of theory of a universal physics superluminal vacuum quanta (to having the diagonal elements corresponding to strong gravity and the cross-diagonal elements corresponding to the weak gravity. Astrophysical explanations have already been advanced by various stellar mathematical mechanics verifiable with telescopic radiometric techniques, the author working with Manuel Malaver in Quantum ASTROPHYSICS general theory analysis projects, publications, and books that are referenced at the end of this Chapter. Based on these, we can surmise that strong gravity energy conditions on the diagonal microblackhole elements of IM (2 × 2) tensor will cause the diagonal shrinking. Weak gravity energy conditions on the cross-diagonal zero-point tensor will cause cross-diagonal expansion. Thus the "stringmetrics" bundle of the electron-positron graviton mass tensor metrics pointing quantum astrophysical galactical stellar objects' discs accretion that are observed at the blackhole, wormhole, supernova, and emissions might be used to provably verify observables. Presently, ongoing grand unifying physics efforts are underway to put all first principles' formalisms altogether!! We have many projects publications with collaborative international scientists' forum platform to enable it within a few years. The weak gravity cross-diagonal term will stretch like bow as per "Stringmetrics", while the strong gravity diagonal term will be like arrow of time.

Action of Strong Gravity versus Weak Gravity Transforms

- *Quantum levels strong weak gravity operator.*
- *Strong gravity predominates at astrophysical level.*
- *Weak gravity predominates at mesoscopic level.*
- *Gravity-time-event mesoscopic interactive energy matter environment.*
- *Possible wormholes through astrophysical to quantum.*

Planck Quantum Point PHYSICS Vortex Gradient Fields Structures

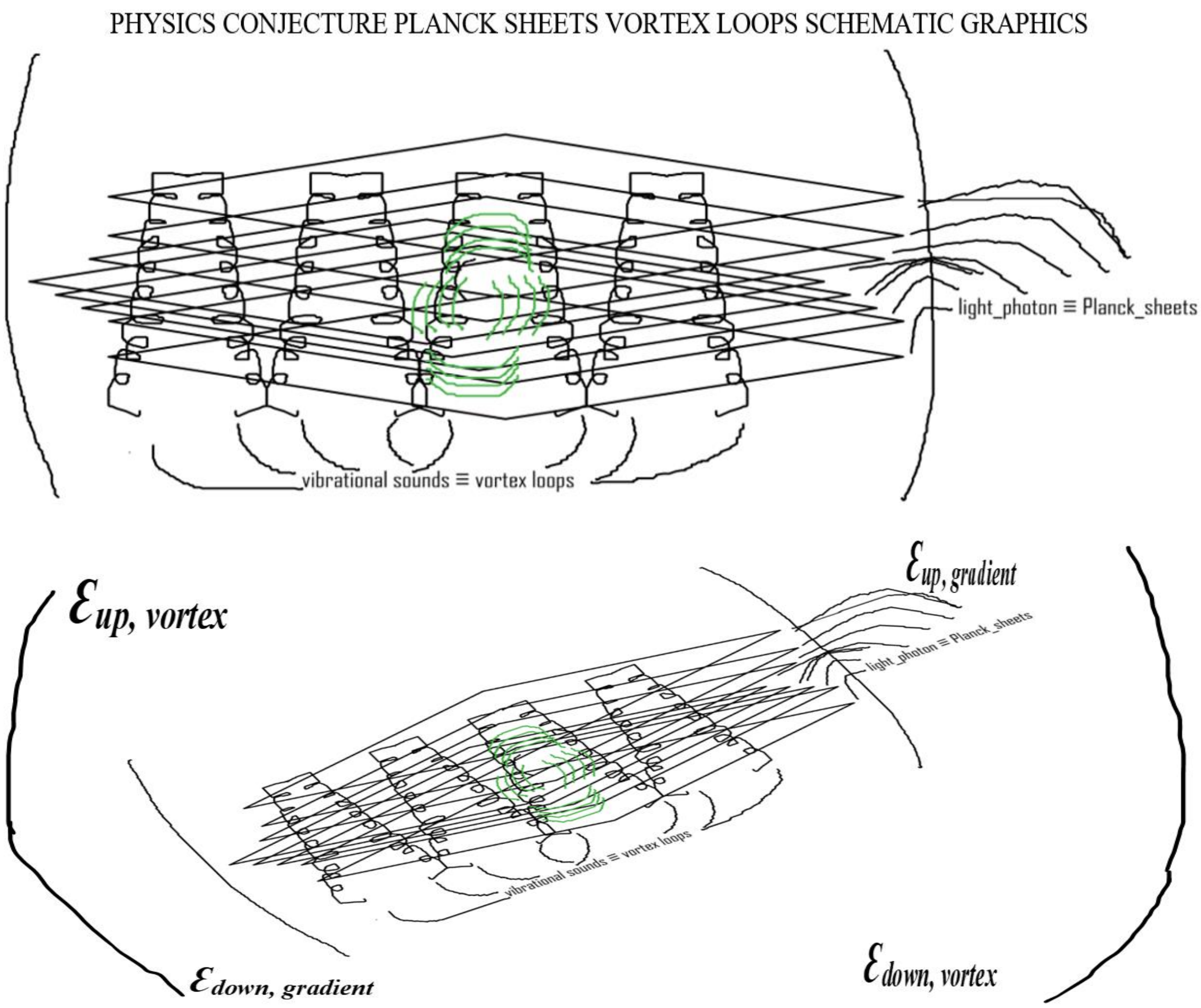


Figure 19: *The sound and light tensor fields that create radar structures' graphics space out of firewall with intersecting photonic_Planck_sheets/vibrational_vortex_loops. Greenish wavelines generate matrix signals' radar emanating via firewall of intersections. Quantifiability with computable matrix Helmholtz decomposed fields are given as well. Label modifications: Light_photon = Planck_sheets to be read as light_photon like Planck sheets, as also vibrational_sounds = vortex_loops will have to be modified to vibrational_sounds like vortex_loops.*

Keynote: Modifying above Figure label modifications

Light_photon = Planck_sheets will have to be modified to light_photon like Planck sheets, relativistically equivalent to wave front space $dR^2 = c^2dt^2$ because space time interval $ds = 0$ by having the event separation with a light signal; the general relativity equation then reduces to that from original formula that is written: $ds^2 = c^2dt^2 – dR^2$ having $dR^2 = dx^2 + dy^2 + dz^2$. Similarly, vibrational_sounds = vortex_loops will have to be modified to vibrational_sounds like vortex_loops because at the quantum level light and sounds vibrational_sounds like vortex_loops may exist unlike gauge fields at mesoscopic levels.

Some simple experiments that can verify theoretical model

- *A laser light = gauge fields gradient may be mesoscopic observables of light_photon like Planck_sheets.*
- *Smoke rings = gauge fields vortex may be mesoscopic observables of vibrational_sound like vortex_loops.*

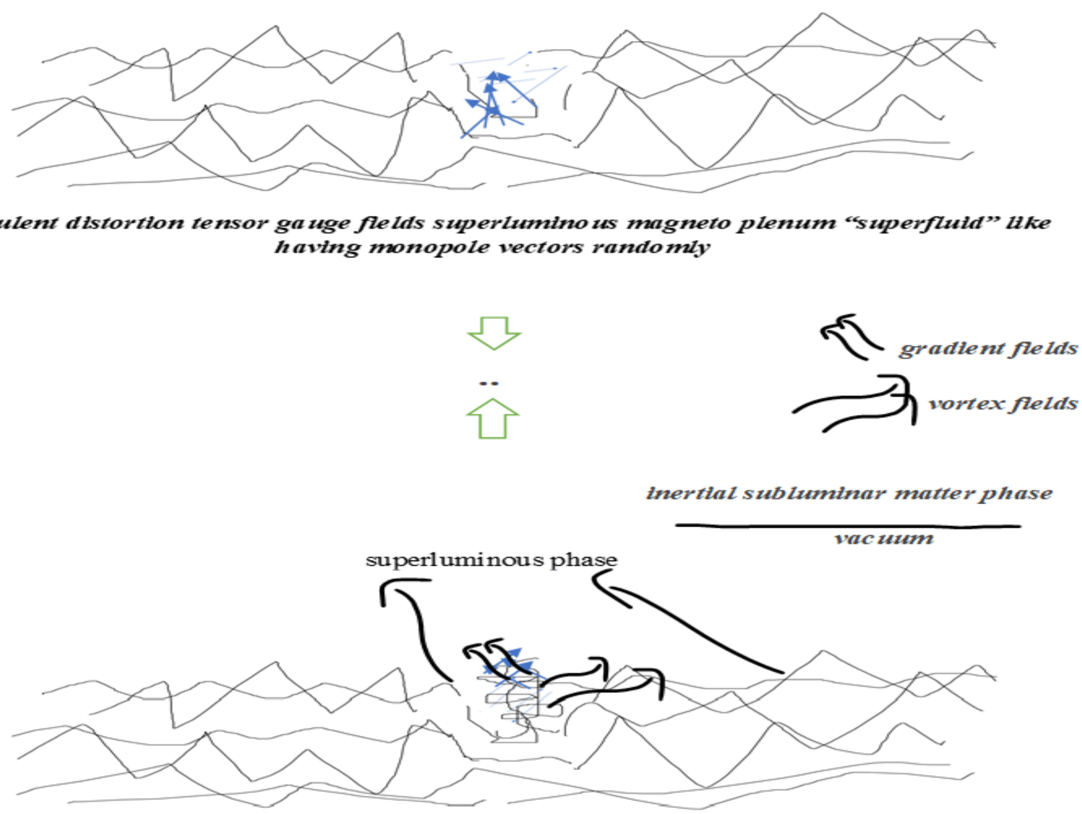


Figure 20: *The local vortex gradient tensor fields' Superluminal Magneto Plenum Mechanism forming Hod-PDP locally clocking circuit assembly. Pinch-off effect after inversion process with gauge fields may have sufficient energy to make Standard Model particles, with gauge fields mesoscopic_objects_like {hdeconvolute convolute gradient vortex} [$\mathcal{E}_{on}$ $\mathcal{E}_{off}$], with $\mathcal{E}$: gauge fields.*

Sense fields, Switches_states, and the vacuum energy fields

With quaternion values linking switches with the off to the on states per Figure 8 as well as Equation (15) quaternion off-mode switch states may collapse to zero in catch 22 manner!! We may also interpret interlinking connections between sense and the switch states. There is asymmetry -1< off_switch_state_value ≤ 1, where at 1, it can be shown based on my PHYSICS derivations that off_switch_state_value (= on) is real!! This may then project to vacuum state energy with the off_state_value = 0 corresponding to true vacuum on plotting switch state graphically, and off_state_value ≠ 0 may correspond to false vacuum!! This may then determine Higgs field to be at true vacuum or false vacuum states. The quaternion imaginary sense gauge fields, then act as decision making operator to give fields to time and space within energy processes!! Oscillations such as zero point, zitterbewegung, as well as Casimar effect, tunneling reversing sequential event timeline quantum, capillary action, configuration of minimum energy with noisy entropy, wavefunction collapse high energy generators, that can alter harmonicity of oscillations because of high nonlinear interactions complex wavefunction quarternionity!! Example Mars-like-earth global warming sequences shifting existentialisms!!

Question of true false vacuum, weak, and the strong energy

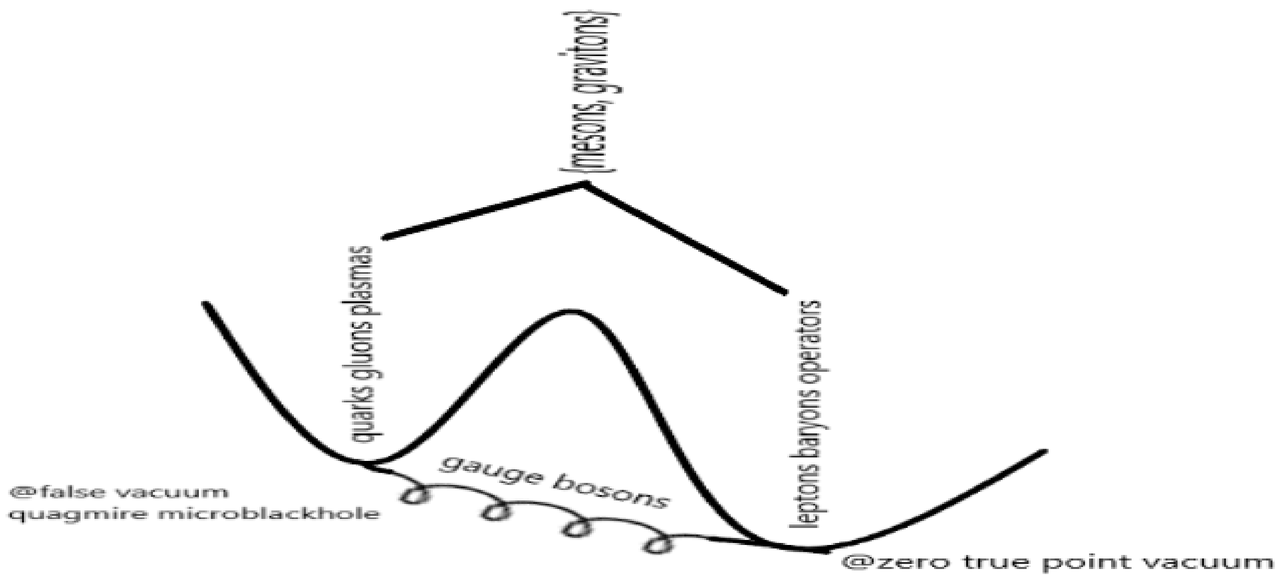
Per Figure 12, quaternion switch state on/off will give about state of the clock indicating energy minima or maxima. Quantum field theory posits two energy minima false and true vacuum. It is possible to conjecture false vacuum to be minimum energy with higher absolute temperature, versus true vacuum minimum entropy with lower absolute temperature. Hadrons mesons (2 quarks) gluonic bosons constitute maybe higher temperature phases hence the false vacuum. Hadrons baryons (3 quarks) such as gravitonic fermions constitute maybe lower temperature phases with true vacuum. vacuum oscillations possibly extending to true false vacuum, barrier between them might have time space oscillatory characteristics, generating super crystal defects. Possibilities arise having Casimir effect {alter the vacuum expectation value of the energy of the second-quantized electromagnetic fields}in submicron range micron to nanometer [https://physicsworld.com/a/the-casimir-effect-a-force-from-nothing/]. Whereas capillary action can occur at mesoscopic level 200 microns to meters [https://en.wikipedia.org/wiki/Capillary_action]. Quantum tunneling occur @nanometer level [https://phys.libretexts.org/Bookshelves/University_Physics/Book%3A_University_ Physics_ (OpenStax)/University_Physics_III__Optics_and_Modern_Physics_(OpenStax)/07%3A_Quantum_Mechanics/7.07%3A_Quantum_Tunneling_of_Particles_through_Potential_Barriers]. At quantum subquantum levels, like with Hod-PDP mechanism and Planck processes, vortex and the gradient gauge fields of Helmholtz decomposed point matrix fields PHYSICS FORMALISMS originated per Iyer Markoulakis approach may play key role in the vacuum energy phases. With these mesoscopic to quantum mechanisms, we conjecture that minimum energy higher temperature phase may have vortex fields that can generate vacuum loops, having speed of light propagation consistent with quantum field theory predictions of vacuum bubbles expanding onto the universal level. Additionally, at the minimum entropy lower temperature phase it may have gauge gradient fields that constitute fermionic or baryonic oscillations, like brought out above.

Microblackholes or blackholes may correspond to the former with vortex gauge fields, while zero-point may correspond to the latter gradient gauge fields!! Nucleus within atom at false vacuum states, while electrons at true vacuum states possibly coexist operationally!!

Presently the author is pursuing high level project to unify theoretical PHYSICS formalisms developing symmetry gage theory unified field group. Principles borne out of the quantum field theory (QFT) and quantum chromo dynamics (QCD) are utilized concomittantly with Particle PHYSICS to understand more about the false and true vacuum aspects. They seem to be most fundamental outcome of theoretical physics, that may link to how strong and the weak energetic forces maybe coming together in certain platforms. From the above foregoing reviews, the common particles' classification of electrons and positrons that form in the group of the fermionic leptons group under baryons which are light hadrons. While, quark gluon plasma that form the key to strong force classified as mesonic group of strong hadrons. At the point level, these connect with microblackhole and zero-point fields. Gage bosons and the gravitons play important role transitionally and directionally as well.

The true vacuum may act as receptacle to constitute leptons, baryons operating fields within zero point decomposed Helmholtz quagmire, while the false vacuum may act like crucible synthesising the strong interactions of quarks, gluons, plasmas activating in the presence of the gauge bosons. These are systemically feasible if there are microwormholes linking false vacuum microblackholes with true zero pathway point vacuum. They resultantly generate gravitons, mesons radiating emanating from such configurations within sense-time-space manifolds!! All these are brought out in the following schematics of how they come together and how the Feynmann diagrm may be sketched to show the synthesis proceses to foster future PHYSICS project!!

How baryons, gravitons, and gluon quark mesons synthesize



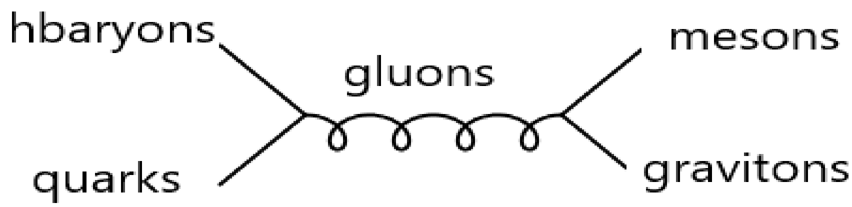


Figure 21: *Schematics showing synthesis {weak, strong} system generating particle spectra producing {mesons, gravitons} out of {quarks, gluons} plasmas at the false vacuum quagmire microblackhole (fvqm). Mediating environment gauge bosons combine {leptons, baryons} operators at zero true point vacuum (ztpv). Gage unifying original Iyer Markoulakis point PHYSICS with Standard Model's mathematical quantum field theory unifies weak and strong fields of nuclear with gravitational gravitons to electromagnetic leptonic fermionic fields. The author's viewpoint graphics bring out the probable possible gage unified symmetry gauge fields.*

LITERATURE REFERENCES

Sources:

[1] S. Drake: Galileo: pioneer scientist, 1990 - books.google.com.

[2] M. H. Shamos: Great experiments in physics: firsthand accounts from Galileo to Einstein, 1987, books.google.com.

[3] V. I. Arnol'd: Mathematical methods of classical mechanics, 2013, books.google.com.

[4] T. L. Chow: Classical mechanics, 2013, books.google.com.

[5] L. F. Wei, Gauge, canonical and Galilean transformations and the non-uniqueness of Lagrange functions, European Journal of Physics, 2020, iopscience.iop.org.

[6] J.R. Mohallem, Galilean invariance in Lagrangian mechanics, American Journal of Physics, 2015, pubs.aip.org

[7] E. Verlinde, On the origin of gravity and the laws of Newton, Journal of High Energy Physics, 2011, Springer.

[8] J. Earman and M. Friedman, The meaning and status of Newton's law of inertia and the nature of gravitational forces, Philosophy of science, 1973, cambridge.org.

[9] S. Hossenfelder, Covariant version of Verlinde's emergent gravity, Physical Review D, 2017, APS

[10] L. Randall and R. Sundrum, An alternative to compactification, Physical Review Letters, 1999, APS.

[11] S. Hossenfelder and T. Palmer, Rethinking superdeterminism, Frontiers in Physics, 2020, frontiersin.org.

[12] E. Noether and N. Jacobson, Gesammelte Abhandlungen-Collected Papers, AMC, 1983, maa.org.

[13] V. A. Etkin, Generalized Law of Gravitation, World Scientific News, 2017, bibliotekanauki.pl.

[14] E. L. Hill, Hamilton's principle and the conservation theorems of mathematical physics, Reviews of Modern Physics, 1951, APS.

[15] M. A. Tavel: Milestones in mathematical physics Noether's theorem, Transport Theory and Statistical Physics, 1971, Taylor & Francis.

[16] K. T. Valsaraj and E. M. Melvin: Principles of environmental thermodynamics and kinetics, 2018, books.google.com.

[17] W. Pauli and C. P. Enz: Thermodynamics and the kinetic theory of gases, 2000, books.google.com.

[18] H. C. Van Ness: Understanding thermodynamics, 1983, books.google.com.

[19] A. J. Schwab and P. Fischer, Maxwell, Hertz, and German radio-wave history, Proceedings of the IEEE, 1998, ieeexplore.ieee.org.

[20] U. Langer, D. Pauly, and S. Repin: Maxwell's Equations: Analysis and Numerics, 2019, books.google.com.

[21] V. V. Borisov, A. B. Utkin Some solutions of the wave and Maxwell's equations, Journal of Mathematical Physics, 1994, aip.scitation.org.

[22] A. Plotnitsky, A. Plotnitsky: Bohr, Heisenberg, Schrödinger, and the principles of quantum mechanics, Principles of Quantum Theory, From Planck's …, 2016, Springer.

[23] Physics: Maxwell's Equations, Light and the Electromagnetic Spectrum. https://www.encyclopedia.com/science/science-magazines/physics-maxwells-equations-light-and-electromagnetic-spectrum.

[24] A. Bohr, B. R. Mottelson, and O. Ulfbeck: The principle underlying quantum mechanics Foundations of Physics, 2004, Springer.

[25] R. Fitzpatrick: Quantum Mechanics, Google Books, https://books.google.com/books/about/Quantum_Mechanics.html?id=v947DQAAQBAJ.

[26] Atom - Bohr's Shell Model | Britannica. https://www.britannica.com/science/atom/Bohrs-shell-model.

[27] S. Hossenfelder: Existential Physics: A Scientist's Guide to Life's Biggest Questions, 2022, Atlantic Books.

[28] W. Pauli: Exclusion principle and quantum mechanics- Writings on physics and philosophy, 1994, Springer.

[29] S. Hossenfelder: Experimental search for quantum gravity, 2017, books.google.com.

[30] L. Randall and M. D. Schwartz, Quantum field theory and unification in AdS5, Journal of High Energy Physics, 2001, iopscience.iop.org.

[31] J. Oppenheim and S. Wehner, The uncertainty principle determines the nonlocality of quantum mechanics, Science, 2010, science.org.

[32] General Relativity, University of Pittsburgh, https://sites.pitt.edu/~jdnorton/teaching/HPS_0410/chapters/general_relativity.

[33] H. A. Lorentz, A. Einstein, H. Minkowski, H. Weyl et al.: The principle of relativity: a collection of original memoirs on the special and general theory of relativity, 1952, books.google.com.

[34] L. I. Schiff, On experimental tests of the general theory of relativity, American Journal of Physics, 1960, aapt.scitation.org.

[35] R. Carballo-Rubio, F. Di Filippo, S. Liberati, and M. Visser, Phenomenological aspects of black holes beyond general relativity, Physical Review D, 2018, APS.

[36] O. Dreyer, B. Kelly, B. Krishnan, and L. S. Finn et al., Black-hole spectroscopy: testing general relativity through gravitational-wave observations, Classical and Quantum Gravity, 21, 4, 787-803, 2004, iopscience.iop.org.

[37] L. Iorio, An analytical treatment of the clock paradox in the framework of the special and general theories of relativity, Foundations of Physics Letters, 2005, Springer.

[38] First Image of a Black Hole | NASA Solar System Exploration, https://solarsystem.nasa.gov/resources/2319/first-image-of-a-black-hole.

[39] S. Hossenfelder, A possibility to solve the problems with quantizing gravity, Physics Letters B, 2013, Elsevier.

[40] I. Sakalli and A. Ovgun, Hawking radiation and deflection of light from Rindler modified Schwarzschild black hole, Europhysics Letters, 2017, iopscience.iop.org.

[41] V. Berezin, Quantum black hole model and Hawking's radiation, Physical Review D, 1997, APS.

[42] K. K. Y. Ng, K. W. K. Wong, T. Broadhurst, and T. G. F. Li, Precise LIGO lensing rate predictions for binary black holes, Physical Review D, 2018, APS,

[43] M. Novello, M. Visser, and G. E. Volovik, Artificial black holes, 2002, books.google.com.

[44] K. Akiyama, A. Alberdi, W. Alef, J. C. Algaba et al., First Sagittarius A event horizon telescope results. III. Imaging of the galactic center supermassive black hole, First Sagittarius A* Event Horizon Telescope Results. I. The Shadow of the Supermassive, Black Hole in the Center of the Milky Way, The Event Horizon Telescope Collaboration, The Astrophysical Journal Letters, 930: L12 (21pp), 2022, iopscience.iop.org.*

[45] K. Akiyama et al., First Sagittarius A Event Horizon Telescope Results. II. EHT and Multiwavelength Observations, Data Processing, and Calibration, Event Horizon Telescope Collaboration, The Astrophysical Journal Letters, Volume 930, Issue 2, id. L13, 31 pp., 2022, iopscience.iop.org.*

[46] K. Akiyama et al., First Sagittarius A Event Horizon Telescope Results. III. Imaging of the Galactic Center Supermassive Black Hole, Event Horizon Telescope Collaboration, The Astrophysical Journal Letters, Volume 930, Issue 2, id. L14, 64 pp., 2022, iopscience.iop.org.*

[47] K. Akiyama et al., First Sagittarius A Event Horizon Telescope Results. IV. Variability, Morphology, and Black Hole Mass, Event Horizon Telescope Collaboration, The Astrophysical Journal Letters, Volume 930, Issue 2, id. L15E, 52 pp., 2022, iopscience.iop.org.*

[48] K. Akiyama et al., First Sagittarius A Event Horizon Telescope Results. V. Testing Astrophysical Models of the Galactic Center Black Hole, Event Horizon Telescope*

Collaboration, The Astrophysical Journal Letters, Volume 930, Issue 2, id. L16E, 49 pp., 2022, iopscience.iop.org.

[49] K. Akiyama et al., First Sagittarius A Event Horizon Telescope Results. VI. Testing the Black Hole Metric, Event Horizon Telescope Collaboration, The Astrophysical Journal Letters, Volume 930, Issue 2, id. L17E, 44 pp., 2022, iopscience.iop.org.*

[50] A. Rueda and B. Haisch, Gravity and the quantum vacuum inertia hypothesis, Annalen der Physik, 2005, Wiley Online Library.

[51] H. E. Puthoff and S. R. Little, Engineering the zero-point field and polarizable vacuum for interstellar flight, arXiv preprint arXiv:1012.5264, 2010, arxiv.org.

[52] J. F. Woodward, Gravity, inertia, and quantum vacuum zero point fields, Foundations of Physics, 2001, Springer.

[53] R. L. Jaffe, Casimir effect and the quantum vacuum, Physical review D, 2005, APS.

[54] L. M. Caligiuri and T. Musha, Quantum vacuum energy, gravity manipulation and the force generated by the interaction between high-potential electric fields and zero-point-field, International Journal of Astrophysics and Space Science, 2(6-1): 1-9, 2014.

[55] D. A. Abbott, B. R. Davis, N. J. Phillips, L. Le Su, and K. Eshraghian, Quantum vacuum fluctuations, zero point energy and the question of observable noise, in Unsolved Problems of Noise, eds • Published 1997.

[56] V. L. Ginzburg: Theoretical physics and astrophysics, 2013, books.google.com.

[57] Lisa Randall, Higgs Discovery: The Power of Empty Space, 2013, Harper Collins Publishers, New York, NY, ISBN 978-0-06-230047-8.

[58] A. Rouet, Theoretical Physics in Real Life, International Journal of Geometric Methods in Modern Physics, vol. 05, issue 08, p. 1337, 2008.

[59] C. M. Will: Theory and experiment in gravitational physics, 2018, books.google.com.

[60] R. C. Fernow: Introduction to experimental particle physics, 1986, library.oapen.org.

[61] Physics Science Experiments Science Buddies, https://www.sciencebuddies.org/science-experiments/physics.

[62] W. E. Burcham, M. Jobes, and E. M. Henley: Nuclear and particle physics, 1995, scipp.ucsc.edu.

[63] S. Tavernier: Experimental techniques in nuclear and particle physics, 2010, library.oapen.org.

[64] N. K. Glendenning: Compact stars: Nuclear physics, particle physics and general relativity, 2012, books.google.com.

[65] Manuel Malaver, Hamed Kasmaei, and Rajan Iyer. Magnetars and Stellar Objects: Applications in Astrophysics, Eliva Press Global Ltd., Moldova, Europe, 2022, pp. 274, ISBN:978-99949-8-246-2.

[66] B. D. Keister, W. N. Polyzou: Relativistic Hamiltonian dynamics in nuclear and particle physics, 1990, homepage.physics.uiowa.edu.

[67] A. Afriat: The Einstein, Podolsky, and Rosen paradox in atomic, nuclear, and particle physics, 1998, books.google.com.

[68] Y. Lim: Problems and solutions on atomic, nuclear and particle physics, 2000, books.google.com.

[69] R. M. Turnbull: Structure of matter. An introduction to atomic, nuclear and particle physics, 1979, osti.gov.

[70] H. M. Nussenzveig: Diffraction effects in semiclassical scattering, 1992, ui.adsabs.harvard.edu.

[71] H. Fritzsch, G. Mandelbaum, Weak interactions as manifestations of the substructure of leptons and quarks, Physics Letters B, 1981, Elsevier.

[72] P. Fayet, Relations between the masses of the superpartners of leptons and quarks, the goldstino coupling and the neutral currents, Physics Letters B, 1979, Elsevier.

[73] R. Raitio, A model of lepton and quark structure, Physica Scripta, 1980, iopscience.iop.org.

[74] I de Medeiros Varzielas, G. Hiller, Clues for flavor from rare lepton and quark decays, Journal of High Energy Physics, 2015, Springer.

[75] U. V. S. Seshavatharam and S. Lakshminarayana, Strong nuclear gravitational constant and the origin of nuclear Planck scale, Progress in Physics, vol. 3, 2010 - books.google.com.

[76] A. Salam, J. C. Ward, Electromagnetic and weak interactions, Physics Letters, 1964, apps.dtic.mil.

[77] M. K. Gaillard, P. D. Grannis, F. J. Sciulli, The standard model of particle physics, Reviews of Modern Physics, 1999, APS.

[78] E. Goldfain, Complexity in quantum field theory and physics beyond the standard model, Chaos, Solitons & Fractals, 2006, Elsevier.

[79] L. F. Abbott and E. Farhi, Are the weak interactions strong?, Physics Letters B, 1981, Elsevier.

[80] W. A. Bardeen, On naturalness in the standard model, 1995, cds.cern.ch.

[81] A. Joyce, B. Jain, J. Khoury, and M. Trodden, Beyond the cosmological standard model, Physics Reports, 2015, Elsevier.

[82] T.P. Cheng and L.F. Li: Gauge theory of elementary particle physics, Oxford University Press, 1982, ISBN 0-19-851961-3.

[83] Y. Aoki, G. Endrődi, Z. Fodor, S. D. Katz, K. K. Szabó, The order of the quantum chromodynamics transition predicted by the standard model of particle physics, Nature, 2006, nature.com.

[84] G. E. Volovik, and M. A. Zubkov, Higgs bosons in particle physics and in condensed matter, Journal of Low Temperature Physics, 2014, Springer.

[85] Higgs boson: The 'god particle' explained|Space, https://www.space.com/higgs-boson-god-particle-explained.

[86] R. Penrose, On the gravitization of quantum mechanics 2: Conformal cyclic cosmology, Foundations of Physics, 2014, Springer.

[87] P. H. Frampton and S. L. Glashow, Chiral color: an alternative to the standard model, Physics Letters B, 1987, Elsevier.

[88] S. Hawking and R. Penrose, The nature of space and time, 2010, books.google.com.

[89] S. Hossenfelder, Theory and phenomenology of space-time defects, Advances in High Energy Physics, 2014, hindawi.com.

[90] S. Hossenfelder, S. Hofmann, M. Bleicher, and H. Stöcker, Quasistable black holes at the Large Hadron Collider, Physical Review D, 2002, APS.

[91] S. Hossenfelder, D. J. Schwarz, and W. Greiner, Particle production in time-dependent gravitational fields: the expanding mass shell, Classical and Quantum Gravity, Volume 20, Number 11, 2003, iopscience.iop.org.

[92] S. Hossenfelder, Observables of Quantum Gravity at the LHC, 2007, pos.sissa.it.

[93] S. Hossenfelder, Physics beyond the Standard Model, [https://citeseerx.ist.psu.edu.](https://citeseerx.ist.psu.edu)

[94] T. S. Grigera, V. Martín-Mayor, G. Parisi, and P. Verrocchio, Phonon interpretation of the 'boson peak'in supercooled liquids, Nature, 2003, nature.com.

[95] G. Parisi, The order parameter for spin glasses: a function on the interval 0-1, Journal of Physics A: Mathematical and General, 1980, iopscience.iop.org.

[96] G. Parisi, Recent progresses in gauge theories, AIP Conference Proceedings, 1980, aip.scitation.org.

[97] K. T. McDonald, The Helmholtz Decomposition and the Coulomb Gauge, Joseph Henry Laboratories, Princeton University, 2020, kirkmcd.princeton.edu.

[98] A. Chubykalo, A. Espinoza, R. A. Flores, and A. G. Rodriguez, Helmholtz theorem and the v-gauge in the problem of superluminal and instantaneous signals in classical electrodynamics, Foundations of Physics …, 2006 – Springer.

[99] R. Iyer and E. Markoulakis, Theory of a superluminous vacuum quanta as the fabric of Space, Physics & Astronomy International Journal, 2021, 5(2):43–53.

[100] R. Iyer, Physics Formalism Helmholtz Matrix to Coulomb Gage, Oral PRESENTATION at the 6th International Conference on Combinatorics, Cryptography, Computer Science, and Computation, 2021, November 17-18th, and published proceedings pp.578-588. http://i4c.iust.ac.ir/UPL/Paper2021/accpapers/i4c2021- 1001.pdf.

[101] J. Bender and E. Zohar, Gauge redundancy-free formulation of compact QED with dynamical matter for quantum and classical computations, Physical Review D, 2020, APS.

[102] R. Iyer, Problem solving vacuum quanta fields, International Journal of Research and Reviews in Applied Sciences, 2021, 47(1):15–25.

[103] R. Iyer, C. O'Neill, M. Malaver, Helmholtz Hamiltonian mechanics electromagnetic physics gaging charge fields having novel quantum circuitry model, Oriental Journal of Physical Sciences, 2020, 5(1–2):30– 48.

[104] R. Iyer, C. O'Neill, M. Malaver, J. Hodge, W. Zhang, and E. Taylor, Modeling of Gage Discontinuity Dissipative Physics, Canadian Journal of Pure and Applied Sciences, 2022, 16(1), 5367-5377, Online @ www.cjpas.net. This paper introduces the concept of Hod Plenum PDP assemblages and their role in generating ordered energy signals from noisy vacuum quanta.*

[105] E. Markoulakis, A. Konstantaras, J. Chatzakis, R. Iyer, E. Antonidakis, Real time observation of a stationary magneton, Results in Physics. 2019, 15:102793.

[106] R. Iyer: Absolute Genesis Fire Fifth Dimension Mathematical Physics, Engineeringinc.com International Corporation, 2000, pp.63, Amazon.com.

[107] R. Iyer, and M. Malaver, Proof Formalism General Quantum Density Commutator Matrix Physics, Physical Sciences & Biophysics Journal, 2021, 5(2): 000185.

[108] S. Hossenfelder, Anti-gravitation, Physics Letters B, 2006, Elsevier.

[109] S. Hossenfelder et al., Signatures in the Planck regime, Physics Letters B, 2003, Elsevier.

[110] S. Hossenfelder, Phenomenological quantum gravity, AIP Conference Proceedings, 2007, aip.scitation.org.

[111] M. Malaver, H. Kasmaei, and R. Iyer: Magnetars and Stellar Objects: Applications in Astrophysics, Eliva Press Global Ltd., Moldova, Europe, 2022, pp. 274, ISBN:978-99949-8-246-2.

[112] R. Iyer, Observables physics general formalism, Physics & Astronomy International Journal, 2022.

[113] R. Iyer, Configuring Observables Solving Physical Algorithm Quantum Matrix Gravity: Mini Review, Journal of Modern and Applied Physics, 2022, 5(2), 1-5.

[114] L. Randall, A. Shelest, and Z. Z. Xianyu, An Efficient Signal-to-noise Approximation for Eccentric Inspiraling Binaries, The Astrophysical Journal, 2022 - iopscience.iop.org.

[115] R. Iyer, Algebra Fields Time Transformations Geometry of Space Gaging, Oral INVITED SPEAKER PRESENTATION at the ICFAS2023 10th International Congress on Fundamental and Applied Sciences, 2023, June 8-10 in SPECIAL SESSION: ALGEBRA WITH APPLICATIONS.

[116] R. Iyer, Review force general conjectural modeling transforms formalism physics, Review Article, Physics & Astronomy International Journal, 2022, 6(3):119-124.

[117] L. Randall: Warped passages: Unravelling the universe's hidden dimensions, *2006, Penguin, UK.*

[118] R. Iyer, M. Malaver, and E. Taylor, Theoretical to Experimental Design Observables General Conjectural Modeling Transforms Measurement Instrumented PHYSICS Compendium, Research Article, Research Journal of Modern Physics, 2023, 2(1):1-14.

[119] L. Randall and G. Servant, Gravitational waves from warped spacetime, Journal of High Energy Physics, 2007, iopscience.iop.org.

[120] E. Taylor and R. Iyer, Rethinking Special Relativity, Spacetime, and proposing a Discontinuum, PHYSICS ESSAYS 35, 1, 2022.

[121] M. Malaver and R. Iyer, Some new models of anisotropic relativistic stars in linear and quadratic regime, International Astronomy and Astrophysics Research Journal Volume 5, Issue 1, Page 1-19, 2023; Article no.IAARJ.98115, arXiv:2303.12161 [gr-qc], https://doi.org/10.48550/arXiv.2303.12161.

[122] M. Malaver and R. Iyer, Charged Dark Energy Stars in a Finch-Skea Spacetime, arXiv:2206.13943 [gr-qc], https://doi.org/10.48550/arXiv.2206.13943.

[123] M. Malaver, R. Iyer, A. Kar, S. Sadhukhan, S. Upadhyay, E. Gudekli, Buchdahl Spacetime with Compact Body Solution of Charged Fluid and Scalar Field Theory, https://arxiv.org/pdf/2204.00981, 2022, ui.adsabs.harvard.edu.

[124] M. Malaver, H. D. Kasmaei, R. Iyer, S. Sadhukhan, A. Kar, A theoretical model of Dark Energy Stars in Einstein-Gauss Bonnet Gravity, Applied Physics, Volume 4, Issue 3, page 1-21, 2021 ISSN: 2664-0821DOI: https://doi.org/10.31058/j.ap.2021.43001, arXiv:2106.09520.

[125] M. Malaver, R. Iyer, Analytical model of compact star with a new version of modified chaplygin equation of state, Applied Physics, Volume 5, Issue 1, page 18-36, 2022, https://doi.org/10.31058/j.ap.2022.51002, arXiv preprint arXiv:2204.13108, 2022 - arxiv.org.

[126] L. Randall, Extra dimensions and warped geometries, Science, 2002, science.org.

[127] K. Jones-Smith, Identifying quasi-particles using non-Hermitian quantum mechanics

using PT quantum mechanics, Philosophical Transactions - Mathematical, Physical and

Engineering Sciences, 371(1989), 1-14, (2013).

[128] E. Taylor and R. Iyer, Discontinuum physics leads to a table of realities for making predictions, PHYSICS ESSAYS 35, 4, 395-397, 2022.

[129] R. Iyer, Quantum Physical Observables with Conjectural Modeling: Paradigm shifting Formalisms II: A Review, Oriental Journal of Physical Sciences, 2022, 7(2).

[130] R. Iyer, ALGORITHM OF TIME PRELIMINARY THEORETICAL RESULTS POINTING TO SPACE GEOMETRY PHYSICS TRANSFORMS, Canadian Journal of Pure and Applied Sciences, 2023, 17(2): 5673-5685, Publishing Online ISSN: 1920-3853, Print ISSN: 1715-9997, Online @ www.cjpas.net. This paper applies the Hod PDP mechanism to the analysis of time and space geometry and proposes a four-vector time matrix tensor algorithm to describe quantum gravity.

[131] R. Iyer, STRONG GRAVITY VERSUS WEAK GRAVITY: FIBER TRANSFORMS GRAVITY- BUNDLE - STRINGS: PRELIMINARY RESULTS, Canadian Journal of Pure and Applied Sciences, 2023, 17(2): 5697-5703, Publishing Online ISSN: 1920-3853, Print ISSN: 1715-9997, Online @ www.cjpas.net. This paper compares the effects of strong and weak gravity in terms of fiber transforms bundle strings, and relates them to the Hod PDP mechanism and the micro-blackhole force.

[132] E. Taylor and R. Iyer, Einstein's questioning and speculations lead to theoretical photon momentum, PHYSICS ESSAYS 35, 4, 2022.

[133] E. Taylor and R. Iyer, How Einstein Prevents Bohr's Quantum Mechanics From Being A Fundamental Theory, PHYSICS ESSAYS 36, 3, 2023.

[134] E. Taylor and R. Iyer, How an electron can transit between energy levels without the atom emitting electromagnetic radiation, https://discontinuumphysics.com/sp/published-paper-7.

[135] M. Malaver, R. Iyer, and I. Khan, Study of Compact Stars with Buchdahl Potential in 5-D Einstein-Gauss-Bonnet Gravity, Physical Science International Journal, Volume 26, Issue 9-10, Page 1-18, 2022; Article no. PSIJ.96077ISSN: 2348-0130, arXiv preprint arXiv:2301.08860, 2023, arxiv.org.