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Matter-Management: Coordinated Resonance-Driven Universal Matter Synthesis with Quantum-Classical Ramifications

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Review Article

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ABSTRACT

Constructive resonance, a fundamental phenomenon observed across various scales, plays a pivotal role in both quantum and astrophysical realms. This study delves into the dynamic intricacies of constructive resonance, exploring its implications for matter creation and the origin of force-fields like gravity. It posits that constructive wave couplings between fundamental particles induce a resonant attractive force akin to gravity at the subatomic level, conserving energy within the system. We conceptualize space-time as an interconnected fabric encoding linear and non-linear patterns within an Information Field, revealing interactions between fundamental particles as 'Constructive Resonance Waves,' giving rise to the material universe. Cosmic Information (CI) is introduced as a fundamental basis vector, tied to the dimensions of space and time, culminating in a 5-D universe.

This paper introduces a theoretical framework encompassing Constructive Resonance and the Resonance Induced Information Force Field (RIIFF) to offer a dynamic perspective on fundamental forces. By integrating these concepts into existing theories, we unveil a fresh understanding of gravity, electromagnetism, and other forces. The RIIFF framework, expressed as $\partial F/\partial t=\nabla$. RIIFF, elucidates how forces vary over time and space due to resonant interactions, providing a foundation for future research into the dynamic nature of the cosmos.

Keywords: Constructive resonance; Matter creation; Gravitational forces; Cosmic information vector; Dynamic framework

INTRODUCTION

Constructive resonance is a ubiquitous phenomenon observed across a spectrum of conventional and unconventional micro and macroscopic contexts. While electrons and photons represent extensively studied elementary particles, their interactions in the unconfined domain of free space remain incompletely investigated. Recent scientific investigation has revealed that, when subjected to precise resonant circumstances, the electron energy spectrum experiences a form of modulation, giving rise to distinct energy sidebands.

The phenomenon of constructive resonance in the context of electron energy spectrum modulation can be expressed as follows:

Let E(ω) represent the electron energy spectrum as a function of angular frequency ω. The modulation of this spectrum under resonant circumstances can be described using the following equation:

$$E(\omega, t) = E\_0(\omega) + \Sigma\, [A\_n \cos(\Delta\omega\_n\, t + \varphi\_n)]$$

Where:

- E(ω, t) is the modulated electron energy spectrum as a function of angular frequency ω and time t.
- E_0(ω) is the unperturbed electron energy spectrum.
- Σ denotes the summation over all relevant resonant modes, where n represents the mode index.
- A_n is the amplitude of the nth resonance mode.
- Δω_n is the angular frequency difference between the resonance mode and the unperturbed frequency.
- φ_n is the phase angle associated with the nth resonance mode.

The interference maxima in the modulated spectrum occur when the conditions for constructive resonance are met, i.e., when Δω_n t+φ_n equals a multiple of 2π for each resonance mode n. This leads to the enhancement of specific energy sidebands, as observed and documented by Tsarev et al., in their research [1].

Comprehending the dynamic intricacies of constructive resonance and its ramifications for matter creation and the genesis of universal field-forces like gravity constitutes a pivotal concern in both quantum and astrophysical domains.

The potentiality of generating all fundamental particles stipulated by the standard model through photon interactions, including direct pair production and indirect processes, can be formulated as follows:

Direct pair production ($\gamma+\gamma \rightarrow e^+ + e^-$)

If E_γ1 and E_γ2 represent the energies of two photons involved in the process, then, direct pair production can occur when the combined energy of the two photons ($E\_\gamma 1 + E\_\gamma 2$) exceeds defined minimum threshold energy (E_threshold) for this process.

Indirect generation *via* boson decay ($\gamma+W^- \rightarrow e+\nu e$)

This process involves the interaction of a photon (γ) with a W^- boson, leading to the generation of an electron (e) and an electron-antineutrino (ve) [2]. The probability and rate of this process can be described using quantum field

theory and the relevant resonance coupling constants. The electromagnetic term (L_EM) describes the interaction of photons (γ) with charged particles, such as electrons (e):

$$L\_EM=-1/4\ F\_\{\mu\nu\}F\^\{\mu\nu\}$$

Here, F_{μν} represents the electromagnetic field tensor, and the Lagrangian term describes the interaction between the electromagnetic field and charged fermions.

SUBJECTIVE HEADING

Mass generation by photon-boson interactions

The Higgs interaction term (L_Higgs) describes the interaction between the Higgs field (H) and Fermions (F). This term is essential for the Higgs mechanism and is responsible for providing mass to fermions:

$$L\_Higgs=-y\_F\bar{\psi}\_FHF+h.c.$$

In this equation: H represents the Higgs field and y_F is the Yukawa coupling constant for fermion F.

Momentum conservation and matter generation

Momentum conservation laws dictate that the spontaneous creation of a fermion pair (matter particles) from a single photon is precluded. Matter generation becomes possible when another particle, whether a boson or a fermion, shares the primary photon's momentum, thereby satisfying momentum conservation laws. The Breit-Wheeler process involves the collision of two photons (γ) to produce an electron (e^-) and a positron (e^+). This process is governed by the principles of Einstein's equation, $E=mc^2$, where the energy (E) of the photons is transformed into the mass (m) of the generated particles.

Photon-fermion inter-conversion in the early universe

In the early universe, where massless photons and massive fermions coexisted, mutual inter-conversion occurred without constraint. This inter-conversion can be described using quantum field theory and the energy-momentum relationships of the particles involved.

Persistence of residual fermions

As the photon medium expanded and cooled, low-energy photons became unable to disintegrate certain fermions. The survival of these residual fermions in limited quantities ($\sim 10^{-10}$) can be described in terms of their interaction cross-sections and energy thresholds [3].

As a well-known phenomenon, the collision of two photons has the potential to yield matter- particles, specifically electrons, and their antiparticles, positrons, which bear positive charges akin to electrons [4].

Collision of two photons

When two photons (γ_1 and γ_2) collide, they have the potential to yield matter-particles, specifically electrons (e^-) and positrons (e^+), which carry positive charges (q) [4].This can be expressed as:

$$\gamma_1+\gamma_2 \text{ -> } e^- + e^+$$

Constructive resonance through the mechanism of wave interaction

The constructive wave interaction embedded in the resonant condition leads to particle pairing or the formation of complex entities occurs when one incident particle approaches the resonant frequency (f_res) of another particle. This can be represented as:

$$f_1 \approx f_2$$

In the post-interaction phase, the combined frequency (f_combined) becomes the sum of the interacting wave frequencies (f_1+f_2), resulting in a higher energy state (E_high).

$$f\_combined=f_1+f_2$$

$$E\_high=h * f\_combined$$

The higher energy state (E_high) leads to the creation of 'regions' characterized by pronounced 'space-time curvature.' This curvature can be mathematically described in terms of Einstein's field equations or other relevant equations from general relativity theory.

Probability density of particle location

The elevated energy state of resonant Constructive Resonance Waves ($Y^2\Psi^2$) enhances the probability density (ρ) of locating particles (e^- and e^+) in a collapsed state with mass attributes (m) at specific space-time coordinates (x, y, z, t).

This can be represented as:

$$\rho(x, y, z, t) \text{ a } |Y^2\Psi^2|\text{^}2$$

Conversely, the reversal of this mechanism, termed 'out-form' interference, may result in domains exhibiting destructive wave resonances spanning a range of frequencies. Such regions could consequently exhibit negative permittivity (ε) and permeability (μ), representing an intriguing concept akin to anti-gravity.

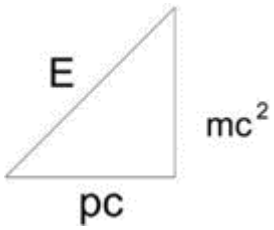
During the aforementioned interactive event, the system's total energy remains constant both before and after. Initially, the mass is zero, transforming into twice the mass of an electron afterward. Specifically, before the interaction, considering λ as the wavelength of photons, the energy is given by $E=hc/\lambda$. The combined energy of the two photons sums the energies of their respective wavelengths. Importantly, photons are inherently devoid of mass. However, post-interaction, the electron-positron pair possesses a total energy equivalent to that of the two photons, thereby conserving energy. This electron-positron pair acquires a combined mass equal to twice the mass (m) of an individual electron or positron, approximately $9.1 \text{ x } 10\text{^}-31$ kilograms. This mass did not exist prior to the interaction. Consequently, the Kinetic Energy (KE) following the interaction is determined as KE=total energy (consistent before and after) minus $2mc\text{^}2$ i.e. $KE=E - 2mc\text{^}2$.

The relationship between energy (E), momentum (p), and mass (m) in special relativity can be represented using the energy-momentum-mass right triangle and the equation for energy momentum-mass equivalence. Additionally, the description of matter creation in terms of frequency (f) and wavelength (λ) can be incorporated:

In special relativity, the energy (E), momentum (p), and mass (m) of a particle are related by the energy-momentum-mass equivalence equation:

$$E^2=(pc)^2+(mc^2)^2$$

This equation can be visualized as a right triangle with the following sides: The horizontal side represents energy (E), the vertical side represents momentum (p), the hypotenuse represents mass-energy (mc^2).



Matter creation condition

The intricate process of matter creation is contingent upon the precise frequency (f) and corresponding wavelength (λ) that photons (γ) and fermions (e.g., electrons, e^-) exhibit. The relationship between energy (E), frequency (f), and wavelength (λ) is given by the photon energy equation:

$$E=hf$$

where:

- E is the energy of a photon or fermion.
- h is the Planck constant.
- f is the frequency of the photon or fermion.
- λ is the wavelength of the photon or fermion.

Matter creation occurs when the energy (E) of the photons or fermions meets or exceeds the minimum energy required (E_min) for the matter creation process to manifest:

$$E \geq E\_min$$

Where E is the energy of the photons or fermions, and E_min represents the minimum energy required for the matter creation process to occur under specific frequency and wavelength conditions.

This phenomenon establishes a 'center of mass frame' for all newly formed matter entities. In this frame, the total momentum is zero. The concept of mass-driven gravity, as originally postulated by Newton, can be related to the presence of mass (m) and its associated energy (mc^2) in the vicinity, leading to gravitational effects.

The blueprint of universal creation, gravity and cosmic order

Constructive resonance waves are characterized by specific frequencies (f) and momenta (p) that lead to resonant interfaces between colliding fundamental particles, particularly photons (γ) and combinations of photons and fermions (e.g., electrons, e^-).

Matter creation through pair-production (entanglement) occurs when two photons or particles approach specific 'in-phase' ordered frequencies and momenta.

$$f_1=f_2$$

$$p_1=p_2$$

The energy (E) and momentum (p) of the interacting particles are governed by the fundamental laws of energy and momentum conservation, which can be expressed as:

$$E_1+E_2\ E\_total$$

$$p_1+p_2=p\_total$$

The matter creation process leads to the creation of an initial repository of information (Ψ), reflecting the evolving state of the system and the flow of time. This foundational process establishes the five-fold orientationally ordered universe, defining the precise patterning in the distribution and positioning of celestial entities from the inception of the cosmos.

Origin of gravity

Gravity, as described by both Newtonian and Einsteinian theories, emerges from the dynamics of constructive resonance wave interference among interacting waves.

Primordial perturbations, arising from quantum fluctuations at scales of Planck length, evolve to galactic scales, and are related to the emergence of gravitational forces [5]. The warping of time and space, akin to gravity, arises from the wave interface mechanism pervading the universe. This mechanism creates dense probability regions where gravity manifests as a clustering of mass particles. The interplay between photon bosons and electron fermions catalyzes the emergence of 'Time and Space' intertwined with matter. Photons acquire temporal attributes upon interaction with bosons, leading to the realization of space. The presence of a scalar field violates the symmetry of the system, leading to the appearance of mass in initially massless particles, as observed in the Higgs field.

Within the four-dimensional event encompassing one-dimensional time and three-dimensional space, the total mass and energy inherent to interacting particles exert resonant gravitational influences on each other, akin to celestial bodies within the universal fabric of spacetime on the macro scale.

Exchange interactions

Exchange interactions, which manifest differently for bosons and fermions due to the Pauli Exclusion Principle, have profound implications for particle behavior. For fermions, this interaction is governed by the Pauli Exclusion Principle, while for bosons, it results in an effective attraction, exemplified by Bose–Einstein condensation [6].This interaction significantly alters the expected inter-particle distances when the wave functions of indistinguishable particles overlap, either increasing (fermions) or decreasing (bosons) the expectation value compared to distinguishable particles [7,8].

In the context of wave-particle interaction, it is reasonable to anticipate non-trivial connections between free electrons/fermions and the inherent thermal fluctuations within their surrounding resonance force field environment. The investigation of these connections has hitherto been extensively conducted, primarily within the context of solid-state environments. For instance, studies have demonstrated non-adiabatic effects in the interaction between electrons and phonons in graphene, and the coupling of plasmons with phonons in graphene interacting with a polar substrate has also been observed [9].

Given that photons directly couple to all fundamental fields carrying electromagnetic current, including leptons, quarks, W0s, and super-symmetric particles, we posit that electron-electron, electron-photon, or photon-photon constructive wave couplings result in a resonant attractive force, akin to gravity at the subatomic scale [10]. This process conserves energy within the system, either re-distributing or absorbing destructive wave coupling energies by constructive waves or returning them to their source-reservoir. Thus, Constructive interference plays a pivotal role in orchestrating the genesis of dimensions and establishing a vector space order within the fabric of space-time. This intricate process serves as a template for shaping the complex symmetries and structures that define the cosmos. Notably, during the early stages of the universe, the primordial phase of interference, occurring at 2π or $360°$, between colliding fundamental particles, primarily photons or combinations of photons and fermions, is postulated to have given rise to the foundational properties of gravity, time, and space.

The mathematical formulation for the above process, where the primordial phase of interference between colliding fundamental particles gives rise to the foundational properties of gravity, time, and space, can be represented as follows:

Let Ψ_collide(x, y, z, t) represent the wave function describing the collision of fundamental particles, primarily photons (γ) or combinations of photons (γ) and fermions (f), in three-dimensional space (x, y, z) at time t.

The interference process occurring at 2π or 360° phase difference between colliding particles can be mathematically expressed as:

$\Psi\_Interference(x, y, z, t)=\Psi\_collide(x, y, z, t)+e^{(i2\pi)}*\Psi\_collide(x, y, z, t)$

Where:

- Ψ_interference(x, y, z, t) represents the interference wave resulting from the collision of fundamental particles.
- Ψ_collide(x, y, z, t) is the wave function describing the collision itself.
- $e^{(i2\pi)}$ represents the complex phase factor corresponding to a 360° phase shift.

Constructive wave dynamics of super-positions

Constructive wave dynamics manifest through the superposition of two independent waves, reciprocally influencing each other's displacements to give rise to a completely novel resultant wave within a continuous, resonant interference environment characterized by three spatial dimensions and one temporal dimension. The resultant wave exhibits a composite amplitude, total energy (E), polarization (e^), amplitude (A), frequency (f), momentum (k), and initial phase (φ), all contingent upon the constructive interference taking place at that specific moment in time. This phenomenon is formally expressed as:

$$\nabla^2\psi - \left(1/c^2\right)\partial^2\psi/\partial t^2 = 0$$

In this equation, ψ denotes the wave function, ∇^2 signifies the Laplacian operator, which signifies the spatial second derivative concerning the position (x, y, z), $\partial^2/\partial t^2$ symbolizes the second derivative concerning time, and c represents the speed of wave propagation.

Expanding upon the aforementioned principles to elucidate the interference between matter waves and photons, we ascertain:

$$\psi\_total(x, y, z, t)=\psi\_matter(x, y, z, t)+\psi\_photon(x, y, z, t)$$

This represents the superposition of matter and photon wave functions, where their amplitudes add constructively. Now, to describe the proposed resonant attractive force at the subatomic scale resulting from electron-electron, electron-photon, or photon-photon constructive wave couplings, we introduce an energy potential U(x, y, z, t):

$$U(x, y, z, t)=-\nabla^2\psi\_total(x, y, z, t)$$

Where:

- U(x, y, z, t) is the energy potential associated with the constructive wave interference.
- ∇^2 is the Laplacian operator representing the spatial second derivative with respect to position (x, y, z).
- ψ_total(x, y, z, t) is the superposition of matter and photon wave functions.

The negative sign indicates an attractive force, akin to gravity, at the subatomic scale. This potential describes how matter and photons interact and couple through constructive wave interference.

The conservation of energy within the system can be described by the time-dependent Schrödinger equation or a similar equation that takes into account the evolution of the wave functions and the energy exchange between matter waves and photons. This equation would capture how energy is redistributed and absorbed by constructive waves or returned to their source-reservoir, ensuring energy conservation in the system.

Entanglement entropy in curved space-time

In a curved space-time scenario, observed that entanglement entropy (S) undergoes progressive increments due to Hawking radiation [11].The mathematical expression for entanglement entropy in this context can be written as:

$$S\_curved = S\_initial + \sum \Delta S\_i$$

Where:

- S_curved represents the entanglement entropy in curved space-time.
- S_initial is the initial entanglement entropy at the beginning of the simulation.
- ΔS_i represents the incremental change in entanglement entropy at each time step or due to the influence of Hawking radiation.

Quantum interference and reflection in flat space-time

In flat space-time, Yen et al [29] observed two distinct wavefronts arising from quantum interference and reflection processes. The mathematical constructs for these wavefronts can be expressed as:

Quantum interference wavefront (Ψ_interference):

$$\Psi\_interference(x, y, z, t) = A(x, y, z) * \cos(\omega t + \varphi)$$ Reflected Wavefront (Ψ_reflection):

$$\Psi\_reflection(x, y, z, t) = B(x, y, z) * \cos(\omega t + \delta)$$

Where:

- Ψ_interference(x, y, z, t) represents the wavefront resulting from quantum interference in flat space-time, with amplitude A(x, y, z), angular frequency ω, and initial phase φ.
- Ψ_reflection(x, y, z, t) represents the reflected wavefront in flat space-time, with amplitude B(x, y, z), angular frequency ω, and initial phase δ.

These mathematical constructs capture the dynamic behavior of entanglement entropy in curved space-time and the wavefronts resulting from quantum interference and reflection in flat space-time, as observed in the quantum simulation [11].

Our conceptualization envisions space-time as a fabric interlinking all mutually interacting events and entities, encapsulating both linear and non-linear patterns encoded within an information field characterized by a specific quantum of energy and momentum. According to this scientific conjecture, all events, whether occurring at the micro or macro level, entail inherent patterns of non-physical interactions between fundamental particles, colloquially regarded as the 'building blocks' of the universe. These interactions manifest as 'Constructive Resonance Waves,' carrying quanta of energy [12]. Particles at varying vibrational frequencies, ultimately manifesting either in quantum or classical forms and giving rise to the material universe.

Notably, these space-time distortions fundamentally manifest as metrics, potentially yielding regions of varying volume or 'concentric pockets' described mathematically as curvature i.e. $G\mu\nu = 8\pi G T\mu\nu$, which relates the curvature of spacetime (described by Gμν) to the presence of matter and energy (described by Tμν) [6].

Resonance energies, lifetimes, and their corresponding eigenfunctions can be derived by studying the evolution of physical properties exclusively based on initially populated resonance states, eliminating the need for wave packet propagation [13]. Resonance absorption of high-frequency waves occurs *via* induced 'transitions' between energy levels, with energy dependent on the magnetic field, described by $2\mu_0 H = h\nu$, where μ_0 is the Bohr magneton and H is the magnetic field [14].

At the subatomic level, quantum tunneling, facilitated by post-barrier resonance states of interacting systems, induces transitions leading to the generation of specific collision energy [3]. Further delving into quark dynamics, the recent observation of a novel vector resonance (2900) by LHCb has provided insights into the internal structure of this state and enabled the calculation of its physical parameters. This resonance (2900) is theorized as an exotic vector state, comprised of a light diquark and a heavy antidiquark [15].

Phonon effect for sustained resonance

Addressing the challenge of preserving resonant states in interacting waves, it is conjectured that phonons play a pivotal role. Phonons ensure the continuous supply of a precise energy quantum ħω required to sustain harmonic oscillations within the lattice of interacting waves across three-dimensional spatial vectors. In the study, it was empirically established that, under specific conditions, acousto-optic diffraction can give rise to a phenomenon characterized by inter-system photon–phonon entanglement [16]. The described phonon effect for sustained resonance and related phenomena can be summarized and represented mathematically as follows:

Phonons play a pivotal role in providing a continuous supply of energy quantum (ħω) required to sustain harmonic oscillations within the lattice of interacting waves across three-dimensional spatial vectors. Under specific conditions, acousto-optic diffraction leads to the emergence of a vector beam from a photon during Stokes acousto-optic interaction. The resulting vector beam exhibits intra-system entanglement, characterized by differing circular polarization signs and orbital angular momentum.

During acousto-optic interaction, a diffracted photon and an acoustic phonon emitted concurrently exhibit inter-system entanglement between their respective circularly polarized vortex states.

The observed entanglement between photons and phonons holds the potential to facilitate the creation of entangled states involving particles from both acoustic and optical subsystems. This entanglement opens up prospects for applications such as quantum teleportation between acoustic and optical subsystems and mutual support between these subsystems. Employ time-dependent wave-packet calculations to evaluate resonance energies and lifetimes in the interaction region [13].

The approach suggests that, *via* suitable initial conditions, one can ascertain the parameters of specific desired resonance states within the conventional framework of quantum mechanics. Wave packet dynamics in the interaction region are described as a superposition of Non-Hermitian exponential divergent Eigen functions of the physical Hamiltonian.

While these mathematical descriptions provide an overview of the phenomena and concepts discussed, the detailed equations and models used to represent these phenomena would depend on the specific physical systems and interactions being studied.

Dynamic regulation of resonance constant

The phenomenon of resonant particle production during inflation has garnered significant attention. If inflation is coupled to a massive particle, the resonant production of particles [17]. During inflation can modify inflation's evolution and leave distinct features in the primordial power spectrum of the early universe.

Resonant particle production during inflation is characterized by the modification of inflation's evolution due to the coupling of inflation to a massive particle. This can be described as a modification to the inflationary potential $V(\phi)$, where ϕ represents the inflation field.

The resonance constant Λ may exhibit periodic variations over the course of universal creation, denoted as Λ(t), where t represents cosmic time. These variations in Λ influence the expansion and contraction of the universe, contributing to the overall dynamics.

The variations in the resonance constant Λ can be correlated with the timing of cosmic inflation (t_inflation) and contraction (t_contraction). One full cycle, or 'eon,' of cosmic evolution occurs when these variations complete a periodic pattern, reflecting the regulatory role of Λ.

The early maps of the universe during its embryonic stages provide a representation of its future growth and development. These maps are characterized by precise placements and alignments of celestial objects relative to principal axes of constant mobility and rotation.

Dynamic values of the resonance constant

The dynamic values of the resonance constant Λ(t) may evolve over cosmic timescales. These variations generate organized arrangements of universal constituents, reflecting a deterministic organizational template spanning the entire cosmic expanse. The dynamic values of Λ(t) contribute to the organized development of stars, planets, and galaxies, influencing their placements and alignments. This dynamic regulation paints a vivid picture of a well-coordinated and harmonious system governing the entire universe's creation and evolution. While this description outlines the mathematical components of the concept, the specific equations and functional forms representing the dynamic regulation of the resonance constant Λ(t) would depend on the proposed model and the physical mechanisms involved.

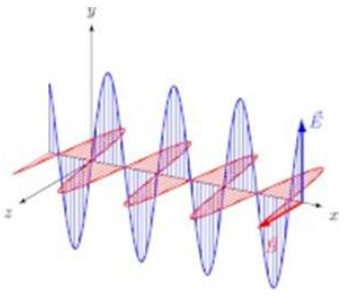
These equations would likely require detailed cosmological and field theory considerations to fully capture the dynamics of universal creation and evolution as described.

Potential quantum-classical ramifications

Drawing upon the previously elucidated mechanism of universal matter creation, we can systematically propose, predict, and effectively explain certain phenomena observed at both quantum and classical scales:

The micro-scale dynamics of universal order: from sub-atomic polarization to quantum information science: The structured orientation and arrangement of our ordered universe across its various developmental stages find their origin in the micro-scale dynamics of plane polarization-a phenomenon that spans the direction of information vector propagation alongside the electromagnetic vectors (Figure 1) of fundamental building-block particles during the early phases of universal evolution. At the subatomic level, this planar polarization mechanism emerges as a pivotal factor in facilitating the future orderly arrangement of macro-scale entities composed of these foundational building-block particles [18,19].

Figure 1. Linearly-polarized (plane-polarized) sinusoidal electromagnetic wave in an isotropic medium, propagating in the x direction, with the electric field vectors E and D in the y direction and the magnetic field vectors B and H in the z-direction.



Notably, Electro Magnetic (EM) waves originally emitted from sources inherently possess the property of plane polarization. Interactions with ions during processes such as refraction can alter the direction of propagation, giving rise to multi-directional propagation and interactions that ultimately shape the three-dimensional character of our universal space [20].

This perspective helps elucidate how seemingly random observational measurements, a paradox within quantum mechanics, can contribute to the 'required definitive order' of our macroscopic universe, a regulation driven by the dynamics of the resonance constant, as previously explained. Within the confines of this structured boundary condition, sentient observers retain a significant degree of freedom. They possess the capability to dynamically, simultaneously, independently, and precisely manipulate the constitutive properties of resonant EM waves [21]. This manipulation, in turn, facilitates spatial and time-varying wave properties, leading to the generation of intricate waveforms and enabling direct information manipulation. Consequently, this manipulation results in time-dependent evolutionary changes within the micro-scale realm of reality, leaving an indelible mark within the cosmic repository of Information [22]. This elucidates the omnipresent and all-encompassing nature of the Resonance-induced information force field of the creational universe as well as multiverses postulate proponded by Max Tegmark [23]. It promises revolutionary advancements in fields such as Quantum Information Science, Quantum Consciousness, Cognitive Science, Next Generation Wireless Technologies, among others.

Moreover, spin-wave devices, which hold immense promise in future information processing by manipulating spin-wave propagation within sub micrometer waveguides, exemplify the practical applications of these profound concepts [24].

Resonance induced cosmic information vector at the cosmic scale of universal organization: Resonance induced Cosmic Information (CI) can be comprehended as a fundamental basis vector, constituted by a unique combination of information vectors spanning a vector space. The movement and transition of this information vector from one spatial point to another give rise to the dimension of time, thereby completing the 5-D depiction of the universe, encompassing time, space, and consciousness. Although space is conventionally perceived as comprising three distinct physical dimensions, in a broader context, it can be viewed as a unified entity within the single dimension of the physical reality of 'Space.' This continuous movement of the Cosmic information vector, a collective representation of the dynamic behavior of all matter and antimatter particles throughout the universe, underlies the incremental accumulation of knowledge within the cosmos as it progresses from one point in 'time and space' to another.

This continuous accrual of information or knowledge fundamentally shapes the evolutionary characteristics of the universe at the physical level. Consequently, the trajectory of this sub-microscopic information consciousness vector's movement, symbolizing the mutual act of observation occurring among interacting particles, can be modeled through deterministic classical mechanisms represented by mathematical equations. This mechanism may have played a pivotal role in shaping the future state of the universe, including the formation of spatial volumes housing gravitating bodies and endowing the universe with the property of 'space-time curvature.'

The operational and organizational framework inherent in constructive resonance furnishes a distinct platform for postulating a novel dimension in the cosmic context—The Resonance Induced Information Force Field (RIIFF). In the context of the paradigm that combines three-dimensional space, one-dimensional time, and the quantum-mechanical perspective, where Newtonian and Coulombian forces of attraction are reinterpreted as Quantum-Mechanical forces, these forces can be mathematically represented as follows:

$$F\_quantum=-\nabla U\_quantum$$

Where:

- F_quantum represents the quantum-mechanical force.
- U_quantum denotes the quantum potential energy.

These quantum forces manifest within the dynamic framework of Constructive Resonance Wave interactions occurring at the microscopic level.

This amalgamation of quantum forces and wave interactions bridges the realms of quantum gravity and classical gravity within the trilogy of time, space, and the observational dimension, serving as an information vector. However, the myriad functional dependencies inherent in interfering waves across diverse contexts challenge our quest for a unifying general theory. Consequently, we find it compelling to speculate about a linear and distinct force field—a force field of cosmic information induced by resonance. The mathematical construct for the described force field that extends the understanding to a 5-D universe, where spatial dimensions are linked by time and information consciousness, can be represented as follows:

$$F\_5D(x, y, z, t, I) = -\nabla U\_5D$$

Where:

- F_5D represents the 5-dimensional force field.
- (x, y, z) are the spatial coordinates in the 3-D universe.
- t is the time coordinate.
- I represents the information consciousness dimension.
- ∇ signifies the gradient operator.

U_5D denotes the 5-dimensional potential energy, which serves as the custodian and repository of the entire spectrum of the Space-Time fabric of the universe. This mathematical construct describes a force field that encompasses both the traditional 3-D spatial dimensions, the time dimension, and an additional dimension representing information consciousness, thereby extending the universe's understanding to a 5-D framework.

Furthermore, the Information vector operates as the 'Cosmic Memory and Clock' of the creational universe. It selectively preserves the constructive and creational facets of wave interactions, while diminishing or redistributing destructive interfaces. In some instances, this redistribution occurs in the form of dark matter and energy. Recent studies, as illustrated, suggest that Vector bosons with masses exceeding $10-22$ eV could potentially serve as dark matter candidates, distinguished by unique experimental signatures [25]. Additionally, it has been demonstrated that the production mechanism for vectors, whose mass is derived from a dark Higgs, naturally transpires through parametric resonance. If the dark Higgs maintains a substantial field value post-inflation, energy within the Higgs field can efficiently transfer to vectors. This revelation broadens the spectrum of vector dark matter as a cosmologically viable entity, further invigorating experimental pursuits in this realm.

Moreover, we postulate the resonant production of Dark photons, potentially catalyzed by the oscillating axion field during the early stages of the universe. This resonant production mechanism has been employed in various contexts, encompassing phenomena like dark photons, dark matter, and the generation of primordial magnetic fields [26,27].

It is paramount to emphasize that throughout our discourse, the term "information consciousness vector" invariably refers to the cumulative behavioral information pertaining to mass, energy, vibrational frequency, and position. This information is collectively encapsulated within a 'quanta of energy,' which is possessed and distributed uniformly across wavelengths by all fundamental particles within the comprehensive vector space 'v'. This unifying perspective harmonizes both particle and wave models, providing a holistic understanding of the properties and behaviors of fundamental particles.

This conceptual framework underpins a comprehensive and integrated comprehension of the universe. It bridges the divide between quantum and classical physics, yielding novel insights into the nature of reality and consciousness on a cosmic scale.

More recently, Shi, et al., reported that due to recent advancements in the design of tunable couplers for superconducting circuits [28,29]. It has become possible to perform precise quantum simulations of resonance coupling involving fermions in curved spacetime. This is akin to constructing an analog of a black hole using a configuration of 10 superconducting transmon qubits, which can be regarded as elements of an information vector, as suggested earlier.

In fact, their achievement involves the development of a superconducting processor integrated with a one-Dimensional (1D) array of 10 qubits. These qubits are equipped with interaction couplings that can be controlled by 9 tunable couplers, allowing them to emulate both flat and curved space-time backgrounds. This accomplishment further bolsters our hypothesis that the information force field itself can be regarded as an additional dimension (1-D) alongside the well-established four-dimensional framework of space-time in modern physics.

It is crucial to acknowledge the existence of anomalous resonance between low-energy particles and electromagnetic plasma waves-both in the early stages and the present state of universal expansion. This further underscores the role of the robust wave field, referred to here as the Resonance Induced Information Force Field (RIIFF), in nonlinearly altering the resonant landscape of the universe. Furthermore, a novel mechanism is proposed for generating coherent photons through the interaction between relativistic electrons (moving at velocities greater than the electromagnetic phase velocity in the medium) and coherent electromagnetic waves incident from the opposite direction [30].

Quantum entanglement

Paired electron particles exhibit simultaneous responses to changes in the behavior of their distant counterparts. Within the framework of constructive resonance proposed here, matter wave coherences are posited to facilitate the investigation and generation of quantum correlations and entanglement between massive and massless elementary particles, both with and without the need for classical coupling constructs [1]. This phenomenon is believed to occur through spontaneous information exchange facilitated by the all- encompassing medium of the Resonance Information Force Field (RIIFF) within the universe.

Furthermore, treating Quantum Entanglement as a manifestation of Shared Information Memory Vector across the entirety of space, every interaction occurring at any fractional moment in time between newly forming information vector entities of mutually interacting or combining particles leads to an overall augmentation of the total information reservoir spanning the universe. This instantaneous sharing among all constituent vectors exemplifies the framework of entanglement as understood in the realm of quantum mechanics.

It is plausible to hypothesize that particles, even if separated shortly after the Big Bang and following divergent evolutionary paths, remain entangled in their primordial waveform through the 'cosmic memory' property of the

information consciousness vector space. This conception highlights the intricate and enduring connections woven into the fabric of the universe itself, transcending time and space.

Quantum entanglement at the beginning of the universe

All the forces, particles, and constituents of the universe share a common origin from a singular source. Consequently, it's plausible that even throughout the complex evolution and vastness of the universe, their mutual entanglement remains unbroken. Whenever a change occurs in the form, position, momentum, or angle of fundamental particles during the process of interactive creation, a corresponding 'mutually reinforcing' change can be observed or measured in all other entangled particles, regardless of their spatial separation within the universe. This mechanism of mutual reinforcement ensures that the exchange of entangled information happens at a speed far exceeding that of light. The entangled information vectors, distributed across the entire universe, mutually reinforce, synchronize, and share knowledge about this change, resulting in instantaneous universal information dissemination. This process contributes to an incremental increase in the total information consciousness memory space. The rate of increase can be described by:

$$dM/dt = k * N * \Delta\Psi(i)$$

Where:

- dM/dt represents the rate of increase in the total information consciousness memory space.
- k is a constant factor.
- N is the total number of fundamental particles.
- $\Delta\Psi(i)$ represents the change in the state of the i-th particle.

This mathematical construct describes the proposed mechanism of interconnectedness and instantaneous information dissemination among all fundamental particles in the universe, resulting in the expansion of the total information consciousness memory space.

Formation of black holes

It's worth noting that Stephen Hawking predicted that entanglement entropy increases when a black hole forms and subsequently evaporates due to Hawking radiation [31]. Each Hawking particle is entangled with a partner particle inside the black hole. This quantum feature plays a crucial role in our understanding of black holes, wormholes, and the dynamics of quantum information [32].

The formation of black holes can also be elucidated through the phenomenon of resonance. Constructive resonance is responsible for inducing changes in the intra- and extra-universal environment. Consequently, oscillatory wave resonances occurring in different space-time environments and originating from various topographical backgrounds can be compared. The total intensity, in terms of frequency and magnitude of wave resonances at different time- space points, brings about changes in the progressing universal cycles.

The total intensity of resonances at different time-space points, I(x, y, z, t), is a function of both the frequency and magnitude distributions:

$$I(x, y, z, t) = \int [f(x, y, z, t) * A(x, y, z, t)]\, dt$$

Where,

- I(x, y, z, t) represent the total intensity of resonances at a specific time-space point, characterized by its position (x, y, z) and time (t).

- f(x, y, z, t) represent the frequency distribution of wave resonances at that point.
- A(x, y, z, t) represent the magnitude distribution of wave resonances at that point.

In this context, the cumulative resultant energy density becomes proportional to the resonance intensity (oscillatory wave amplitude) within a specific time-space domain. The frequency exhibiting the greatest energy density indicates the dominant resonance oscillation frequency, leading to the emergence of a very high gravitational state within the system. This situation may occur at multiple time-space points under diverse evolutionary conditions within the universe. To understand this, we can perturb the Einstein field equations around black hole solutions and observe the eigen frequencies for free oscillations of the black hole surface, including the event horizon. Both rotating (Kerr) and non-rotating (Schwarzschild) black hole solutions reveal not just one resonant frequency, but an entire series of resonant frequencies known as quasi-normal modes. These complex frequencies correspond to gravitational radiation emitted by black holes [33].

We can envision these entities within our universe as 'clustered pockets of highly intense resonant locations' dispersed across the fabric of time and space. In these locations, all the substances that constitute space exhibit an extremely high degree of resonance gravity, eventually leading to the formation of black holes. It is proposed that at the event horizon point of black holes, the value of the Resonance constant is astronomically different from the rest of space, explaining why no known physical laws apply at that locational point and within black holes.

Photons, big bang, big crunch and continuity of information

Photons, serving as the primordial building blocks behind the creation of the universe, reappear in abundance during the time of the Big Crunch [34]. As all physical entities, along with their entangled information vectors, undergo degeneration through assimilation by colossal colliding black holes, a 'Photon-Dominant' universe re-emerges. In this universe, devoid of mass-based information vectors that interact or interfere with one another, there is virtually no gain in the incremental information within the total vector space.

Expanding upon the concept that information accrual occurs continuously at every juncture of universal creation to this new universe state, it can still be regarded as a new information vector. However, as it gradually degenerates in total mass, the overall information gradient of the universal vector space stabilizes at zero. This represents a loss of all memory of time and space, ultimately leading to the singularity. Only the addition of information from an extra-universal source beyond this information vector space can initiate the process of physical creation anew, similar to a new Big Bang.

Nonetheless, when considering the cyclical cosmology perspective, it can be argued that even as black holes absorb the masses of physical entities and the entire energy of inhaled masses nears extinction beyond the event horizon, the information vector space of the eonic cycle remains intact. This is because the 'new information' about the 'complete loss of mass' still constitutes an incremental gain within the grand total reservoir of information vector space memory across series of eons. The mathematical formulation for this concept can be expressed as:

Total information vector space: $I(t)=\int \Delta I(t)\, dt$

- Total Mass Absorbed by Black Holes: $M\_loss(t) =\int [M(t)-M(t-\Delta t)]\, dt$
- Total Energy Inhaled by Black Holes: $E(t)=\int [E(t)-E(t-\Delta t)]\, dt$
- Incremental Gain in Information Vector Space: $\Delta I(t)=k * [M\_loss(t)+E(t)]$

Where:

- Δt is a small time interval.

- k is a constant factor that relates the absorbed mass and energy to the incremental gain in information vector space.

This mathematical construct describes the idea that even as black holes absorb masses and energy, the Cosmic Information vector space remains intact and continues to grow as "new information" is added, including information about the complete loss of mass and energy. It emphasizes the role of information in the context of cyclical cosmology and the persistence of information even in situations analogous to singularities. However, the specific functional forms and values of k would require further theoretical development and empirical evidence for precise characterization [35-37].

CONCLUSION

This paper introduces a theoretical framework that extends our understanding of fundamental forces in the universe. We propose that the behavior of these forces can be elucidated by considering them in a dynamic context over cosmic timescales. Key concepts include the Constructive Resonance and Resonance-Induced Information Force Field (RIIFF). By integrating these elements into existing physical theories, we offer a fresh perspective on the dynamic nature of the cosmos, which may have profound implications for our understanding of gravity, electromagnetism, and other fundamental forces.

The foundation of modern physics, notably Newton's theory of gravity, has historically been characterized by static descriptions of natural phenomena. While these theories have been successful in explaining much of the observed behavior of the universe, they are limited in their ability to account for the dynamic evolution of cosmic systems over extended periods.

To create an overarching framework for the Resonance-Induced Information Force Field (RIIFF) varying over time, we can start with a general framework that describes how forces vary over time and space due to resonant interactions. This framework can be adapted to specific force interactions as needed. Let's denote the force as F, then,

$$\partial \mathrm{F}/\partial \mathrm{t} = \nabla . \mathrm{RIIFF}$$

Where:

- $\partial F/\partial t$ represents the rate of change of the force
- ∇ is the gradient operator, representing spatial derivatives.
- RIIFF represents the Resonance-Induced Information Force Field.

This equation states that the rate of change of the force F with respect to time is related to the spatial variation of the RIIFF. The specific form of RIIFF and the details of how it influences forces like gravity and electromagnetism would require additional equations and considerations tailored to those specific interactions. In practice, the actual mathematical construct describing the RIIFF's influence on forces would depend on the detailed physics and mechanisms underlying the resonant interactions between particles and entities in the universe. These equations would need to be developed based on the specific physical theories and observations relevant to the RIIFF framework.

The Resonance-Induced Information Force Field (RIIFF) framework introduces a dynamic viewpoint regarding fundamental forces, presenting a comprehensive approach to comprehending phenomena like gravity and electromagnetism. By accounting for the temporal fluctuations in the Resonance Constant, this framework has the

potential to pave the way for innovative explorations and could potentially lead to a paradigm shift in our understanding of the dynamic universe.

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REFERENCES

1. Tsarev M, et al. Nonlinear-optical quantum control of free-electron matter waves. Nature Physics. 2023.
2. The standard model of particle physics. Nature. 2007;448:270.
3. Yang T, et al. Enhanced reactivity of fluorine with para-hydrogen in cold interstellar clouds by resonance-induced quantum tunneling. Nature Chemistry. 2019;11:744-749.
4. Adam J, et al. Measurement of e+e− momentum and angular distributions from linearly polarized photon collisions. Phys Rev Lett. 2021;127:052302.
5. Mukhanov V, et al. Theory of cosmological perturbations. Physics Reports. 1992;215:203-333.
6. Einstein A. Quantentheorie des einatomigen idealen Gases. Königliche Preußische Akademie der Wissenschaften. Sitzungsberichte.1924;261-267.
7. Heisenberg W. Mehrkörperproblem und resonanz in der quantenmechanik. Zeitschrift für Physik. 1926;38:411-426.
8. Dirac PAM. On the theory of quantum mechanics. Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences. 1926;112:661-677.
9. Yu X, et al. Electron cooling in graphene enhanced by plasmon–hydron resonance. Nature Nanotechnology. 2023;18:898–904.
10. Brodsky SJ, et al. Nucl Instrum. Meth A. 1995:355:19.
11. Yan Z. Strongly correlated quantum walks with a 12-qubit superconducting processor. Science. 2019;364:753.
12. de Broglie L. Waves and quanta. Nature. 1923;112:540.
13. Goldzak T, et al. Resonance energies, lifetimes and complex energy potential curves from standard wave-packet calculations. Molecular Physics. 2012;110:537-546.
14. Bagguley D, et al. Paramagnetic resonance and magnetic energy levels in chrome alum. Nature. 1947;160:532-533.
15. Agaev SS, et al. Vector resonance X1(2900) and its structure. Nuclear Physics A. 2021; 1011:122202.
16. Kostyrko M, et al. Photon–phonon entanglement in the acousto-optic interaction of vector beams. Results in Optics. 2023;10:00350.
17. Chung DJH, et al. Probing planckian physics: resonant production of particles during inflation and features in the primordial power spectrum. 1999.
18. Griffiths, DJ. Introduction to Electrodynamics (3rd ed.). Prentice Hall. 1998ISBN 0-13-805326-X.

19. Minami Y, et al. New extraction of the cosmic birefringence from the planck 2018 polarization data. Physical Review Letters. 2020;125:221301.
20. Appleton EV. Polarisation of downcoming wireless waves in the southern hemisphere. Nature. 1931;128:1037.
21. Li JH, et al. The anomalous resonance between low- energy particles and electromagnetic plasma waves. Communications Physics. 2022;5:300.
22. Wu GB, et al. A universal metasurface antenna to manipulate all fundamental characteristics of electromagnetic waves. Nature Communications. 2023;14:5155.
23. Tegmark M. Our mathematical universe: my quest for the ultimate nature of reality. ISBN. 2014;978-0307599803.
24. Xing X, et al. How do spin waves pass through a bend? Scientific Reports. 2013;3:2958.
25. Dror JA, et al. Parametric resonance production of ultralight vector dark matter. Physical Review D. 2019;99:035036.
26. Kitajima N, et al. Resonant production of dark photons from axion without a large coupling. 2023.
27. Agrawal P, et al. Relic abundance of dark photon dark matter. J Sci Conf Proc. 2018.
28. Shi YH, et al. Quantum simulation of hawking radiation and curved spacetime with a superconducting on-chip black hole. Nature Communications. 2023;14:3263.
29. Yan F, et al. Tunable coupling scheme for implementing high-fidelity two-qubit gates. Physical Review Applied. 2018;10:054062.
30. Schneider S, et al. Interaction of coherent electromagnetic waves with relativistic electrons in a medium. Nature. 1974;250:643-645.
31. Jow DL, et al. Re-evaluating evidence for Hawking points in the CMB. J Cosmol Astropart Phys. 2020;2020:021.
32. Hawking SW. Black hole explosions? Nature. 1974;248:30.
33. Leaver EW. An analytic representation for the quasi-normal modes of kerr black holes. Proc Math Phys. 1985;402:285-298.
34. Penrose R. Before the big bang: an outrageous new perspective and its consequences for particle physics. Proceedings of the International School of Subnuclear Physics. 2006;45:17-34.
35. Big Bang theory. Nature Physics.2019;15:1103.
36. Einstein A. Die feldgleichungen der gravitation [The field equations of gravitation]. Proc Royal Soc B. 1915;844-847.
37. Linde A. Particle physics and inflationary cosmology. Contemp Phys. 1990;5:1-362.