

# Glossary

## Foundational

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Concepts of General Mechanics

**Acoustic/Phononic Systems:** Systems that manipulate material vibrations (phonons) to encode information in collective modes and perform computation via controlled phonon-phonon interactions.

**Acoustic Transducers:** Devices that convert electrical signals into sound waves and vice versa, used in QRC to generate or detect frequency patterns.

**Action Functional:** A mathematical functional mapping a system's "history" or path to a scalar value (the "action"). In General Mechanics, the principle of stationary action ( $\delta S = 0$ ) governs the Universal Relational Graph (URG)'s evolution by selecting the most probable computational histories. (Theory of General Mechanics, Section 12)

**AdS/CFT Correspondence:** A conjectured mathematical equivalence between a theory of gravity in higher-dimensional Anti-de Sitter (AdS) spacetime and a quantum field theory (Conformal Field Theory, CFT) without gravity on its lower-dimensional boundary. It realizes the Holographic Principle.

**Algorithmic Randomness:** A property of a sequence or object indicating high Kolmogorov complexity, meaning it cannot be significantly compressed or described by a shorter algorithm. In General Mechanics, it relates to the inherent unpredictability and complexity of the universe's computational states, arising from its computational irreducibility. (Theory of General Mechanics, Part II)

**Algorithm (QRC):** In Quantum Resonance Computing (QRC), an algorithm is an orchestrated sequence of frequency pattern manipulations, resonant interactions, and coherence shaping operations designed to achieve a specific computational outcome.

**Alcubierre Warp Drive:** A speculative solution to Einstein's field equations allowing apparent faster-than-light travel by contracting spacetime in front of a vessel and expanding it behind, theoretically requiring "exotic matter" with negative energy density. CWM (within GM) reinterprets this as a problem of engineering the vacuum medium by manipulating its energy density and properties. (Theory of General Mechanics, Section 32.2; Physical Interpretation of Mass and Spacetime, Part III)

**Analog Computing:** A computing paradigm that models problems using continuous physical phenomena (e.g., electrical, mechanical, hydraulic quantities). QRC is an advanced form leveraging the continuous, wave-like nature of reality for computation.

**Angular Frequency ( $\omega$ ):** A measure of rotational speed or oscillation rate, expressed in radians per unit time. It relates to standard frequency ( $\nu$ ) as  $\omega = 2\pi\nu$ .

**Anharmonicity:** In quantum mechanics, the deviation of a real-world oscillator from the idealized Quantum Harmonic Oscillator, resulting in non-uniform energy level spacing. In CWM, it leads to complex dynamics and, when managed (engineered anharmonicity), can be a computational resource or, when uncontrolled, a source of noise and decoherence. (Treatise on Clocks and Taxonomies, Section 31.7)

**Annihilation (Particle Physics):** The process where a particle and its antiparticle collide and convert into other particles or energy. In CWM, this is reinterpreted as destructive interference between two complementary frequency patterns within the universal medium, releasing concentrated energy or forming new patterns. (Theory of General Mechanics, Part II)

**Anthropic Principle:** The philosophical consideration that observations of the physical universe must be consistent with the conscious life that observes it. General Mechanics offers a non-anthropropic solution to the fine-tuning problem, suggesting the universe is self-tuning through Autaxys rather than being fine-tuned for observers.

**Antenna Hypothesis:** A speculative hypothesis within General Mechanics positing the brain as a dual-function transceiver sensitive to subtle fields, with the skull acting as a boundary condition shaping the brain's electromagnetic field. (Treatise on Clocks and Taxonomies, Section 34).

**Anthropocentrism:** The belief that value is exclusively human-centered, viewing all other beings and the natural world as mere means to human ends. CWM (within GM) explicitly aims to transcend this by advocating a post-anthropocentric communication praxis. (Treatise on Clocks and Taxonomies, Section 33.3)

**Antimatter:** Matter composed of antiparticles. In a frequency universe, antimatter particles are reinterpreted as patterns with complementary or inverse phase relationships to their matter counterparts, leading to mutual annihilation upon interaction.

**Anyons:** Exotic quasiparticles existing in two-dimensional systems, whose braiding in spacetime can encode quantum information in Topological Quantum Computing.

**Arithmetic Groups:** Discrete subgroups of Lie groups arising from number theory. In General Mechanics, emergent spacetime symmetries may relate to these groups on hyperbolic manifolds.

**Asymptotic Freedom:** A property of the strong nuclear force where quark interaction weakens at high energies, allowing quarks to move almost freely within a confined region.

**Atomic Clocks:** Highly precise timekeeping devices that measure time using atomic resonant frequencies, relevant for detecting minute variations in fundamental constants.

**Attributed Hypergraph:** A hypergraph where both vertices and hyperedges have associated data or properties (attributes). In General Mechanics, the Universal Relational Graph (URG) is an attributed hypergraph, with attributes representing fundamental physical properties.

**Attunement Protocol:** A principle within GM's post-anthropocentric praxis that reframes communication as resonance, where meaning emerges in the dynamic, feedback-driven process of mutual interaction, rather than simple information transmission. (Treatise on Clocks and Taxonomies, Section 33.3)

**Autaxic Lagrangian ( $\mathcal{L}_A$ )** A computable scalar function within General Mechanics that quantifies the “ontological fitness” or viability of any given universe state or evolutionary path. It acts as the ultimate fitness function, guiding the Universal Relational Graph (URG)'s evolution toward more stable, efficient, and persistent patterns through a variational principle. (Theory of General Mechanics, Section 16)

**Autaxic Trilemma:** The fundamental and irresolvable tension within Autaxys between three competing but globally synergistic imperatives: Persistence (P), Efficiency (E), and Novelty (N). This dynamic tension drives the universe's generative cycle and cosmic evolution. (Theory of General Mechanics, Section 16; Natural Units: Universe's Hidden Code, Section 7.1)

**Autaxys:** From the Greek *auto* (self) and *taxis* (arrangement), Autaxys is General Mechanics' posited inherent, irreducible principle of cosmic self-generation and self-organization. It is the universe's intrinsic “computational grammar” that perpetually guides the formation of more stable, efficient, and persistent patterns across all scales. (Theory of General Mechanics, Section 16; Natural Units: Universe's Hidden Code, Section 3.1)

**Autopoiesis:** A concept describing living cells as self-creating and self-sustaining systems through internal processes. In General Mechanics, autopoiesis is generalized to the cosmological scale as Autaxys, describing the universe's overall self-organization. (Theory of General Mechanics, Section 16)

**Baryon:** A composite subatomic particle made of three quarks (e.g., protons and neutrons). In a frequency universe, baryons are stable, complex standing wave patterns formed by the confinement and resonant interaction of three fundamental quark frequency patterns.

**Baryonic Tully-Fisher Relation:** An empirical law in astrophysics describing a tight correlation between a galaxy's baryonic mass (visible matter) and its asymptotic rotation velocity. This relation is naturally predicted by Modified Newtonian Dynamics (MOND) and integrated into CWM's explanation of Dark Matter phenomena. (Physical Interpretation of Mass and Spacetime, Section 23.3)

**Bekenstein Bound:** A universal upper limit on the entropy (information) that can be contained within any finite region of space with a finite amount of energy. Derived from black hole thermodynamics, this principle is fundamental to CWM's understanding of holographic information limits. (Physical Interpretation of Mass and Spacetime, Section 5; Formal Framework for a Non-Local Frequency-Based Reality, Section 8)

**Bekenstein-Hawking Entropy Formula:** A formula ( $S_{BH} = \frac{k_B A}{4l_P^2}$ ) that quantifies a black hole's entropy, explicitly showing it to be proportional to the area of its event horizon, not its volume. This formula is a cornerstone for the Holographic Principle in CWM. (Physical Interpretation of Mass and Spacetime, Section 5)

**Bell's Theorem:** A foundational theorem by John Stewart Bell stating that any physical theory based on local hidden variables (local realism) would produce statistical correlations measurably different from standard quantum theory's predictions. Its consistent experimental violation is a foundational postulate (Postulate I) of CWM, serving as the empirical refutation of local realism. (Formal Framework for a Non-Local Frequency-Based Reality, Postulate I, Section 1.1; Physical Interpretation of Mass and Spacetime, Section 1)

**Big Bang:** The prevailing cosmological model for the universe's earliest known periods. In this framework, it is reinterpreted as a primordial resonance and rapid expansion of the universal frequency medium.

**Big Crunch:** A hypothetical future scenario where gravity halts the universe's expansion, causing collapse into a high-density, high-temperature state. In this framework, it is reinterpreted as a recoherence of the frequency medium.

**Big Freeze:** A hypothetical future scenario where the universe's indefinite expansion leads to maximal frequency decoherence and dissipation of all patterns.

**Binding Problem:** The question in neuroscience and philosophy of mind of how disparate sensory information processed in different brain parts is unified into a single, coherent conscious experience.

**Bio-resonance:** The concept that biological systems exhibit specific resonant frequencies, which can be targeted for non-invasive diagnostics and therapies by manipulating frequency imbalances.

**Biophotons:** Ultra-weak photon emissions from all living systems, theorized by some to form a coherent field that could be the physical substrate of conscious awareness. CWM re-interprets these as biological manifestations of the universal medium, supporting emergent biological coherence. (Treatise on Clocks and Taxonomies, Section 29.2)

**Black Hole:** A region of spacetime where gravity is so strong that nothing, not even light, can escape. In CWM, a black hole is interpreted as an extreme concentration or recoherence of fundamental frequency patterns within the universal medium, leading to a breakdown of normal emergent spacetime properties and serving as a key probe for the medium's behavior. (Theory of General Mechanics, Part IV)

**Black Swan (Observation):** An event or phenomenon that lies outside the realm of normal expectations, because nothing in past experience or the prevailing theory would have predicted its possibility. Such observations challenge the very foundations of the existing paradigm. CWM frames modern anomalies as such critical disconfirmations. (Theory of General Mechanics, Part I)

**Bohmian Mechanics (Pilot-Wave Theory):** A deterministic, realist interpretation of quantum mechanics that posits definite particle trajectories guided by a physical pilot-wave. CWM adopts a similar ontology (physical wave inherently guiding particle-like concentrations) and integrates non-locality, aiming for greater relativistic consistency. CWM positions itself as overcoming Bohmian mechanics' historical weaknesses. (Critiquing Quantum Indeterminism's Foundations, Section 5; Outline Chapter 1.4.2, 7.3.1, 6.1)

**Born Rule:** The fundamental postulate in standard quantum mechanics defining the probability of obtaining a specific measurement outcome ( $P = |\psi|^2$ ). CWM explicitly seeks to *derive* the Born Rule from the energy-density principles of wave mechanics, rather than postulating it axiomatically. This moves it from an axiom to an emergent theorem. (Critiquing Quantum Indeterminism's Foundations, Section 2; Outline Chapter 3.2.2, 6.3)

**Boson:** A type of fundamental particle that mediates forces (e.g., photon, gluon, W/Z boson). In CWM, bosons are specific frequency patterns that facilitate interactions and energy exchange between other frequency patterns, allowing for collective coherent states within the universal medium. (Theory of General Mechanics, Part III)

**Bose-Einstein Condensates:** A state of matter where a dilute gas of bosons, cooled to near absolute zero, causes a large fraction of atoms to occupy the lowest quantum state, exhibiting coherent matter-wave properties. In this framework, it represents a macroscopic, highly coherent state of specific frequency patterns.

**Bootstrap Mechanism:** A self-consistency principle in physics and statistics where a system's fundamental laws or properties are determined by internal consistency requirements, rather than external parameters. In General Mechanics, it suggests the universe's fundamental constants might be fixed by its own self-consistency axiom.

**Boundary Conditions:** The specific physical constraints or values defining a system's or region's limits. In CWM, boundary conditions are crucial for understanding causality, stability, and scale hierarchy, particularly in the formation of stable waveforms (e.g., defining atomic orbitals as standing waves) and in macroscopic phenomena. (Treatise on Clocks and Taxonomies, Section 33.1)

**Casimir Effect:** A small attractive force between two close, parallel, uncharged conducting plates in a vacuum, providing empirical evidence for quantum vacuum fluctuations. In CWM, it is a direct consequence of the universal medium's resonant modes being modified by boundaries, confirming the medium's physical reality and dynamic nature. (Physical Interpretation of Mass and Spacetime, Section 6)

**Causal Emergence:** The phenomenon where a causal relationship may be stronger, more deterministic, or more informative at a macroscopic level than at the microscopic. In CWM, it describes how robust causal laws (e.g., classical mechanics) emerge from the Universal Relational Graph (URG)'s underlying probabilistic (or computationally irreducible) dynamics. (Theory of General Mechanics, Part IV)

**Causal Graph:** In the Wolfram Physics Project (and integrated into GM), the network of causal relationships between update events in a hypergraph, representing the flow of time and information. It defines the temporal evolution of the URG. (Theory of General Mechanics, Part IV)

**Causal Set Theory (CST):** A theory of quantum gravity that posits spacetime's fundamental structure as a discrete, partially ordered set of "spacetime atoms" or events, where all geometric notions are emergent. Used as a comparative formalism for the URG in CWM. (Theory of General Mechanics, Section 30.1)

**Cellular Automata:** Discrete computational models where space and time are discrete, and local interactions, guided by simple rules, can generate unbounded complexity. In CWM, they provide mathematical proof that macroscopic order can emerge from an underlying, discrete dynamic medium, supporting a process-based, bottom-up model of reality. (Theory of General Mechanics, Section 22.6)

**\*\*CEMI Field Theory (Conscious Electromagnetic Information Field Theory):\*\*** A theory proposing that consciousness arises from the brain's global electromagnetic field, which integrates neuronal information into a single, conscious whole.

**Chaitin's Incompleteness Theorem:** A result in algorithmic information theory relevant to the fundamental limits of what can be computed or formally proven about the complexity of objects from within a consistent axiomatic system (like the URG). (Theory of General Mechanics, Part II)

**Chaos Theory:** A field of mathematics and physics that studies complex, dynamic systems highly sensitive to initial conditions, often leading to seemingly random or unpredictable outcomes. It is essential for modeling complex, nonlinear frequency patterns.

**Charge (Electric):** A fundamental property of matter that determines its electromagnetic interactions. In a frequency universe, electric charge is interpreted as a specific, stable characteristic of a frequency pattern that dictates its interaction strength with electromagnetic frequency patterns.

**Chronotherapeutics:** Treatments (e.g., medical interventions) timed to align with the body's natural rhythms to maximize efficacy and minimize toxicity. This is a direct medical application predicted by CWM's redefinition of disease as "systemic dissonance." (Treatise on Clocks and Taxonomies, Section 6.1)

**Church-Rosser Property:** A property of a rewriting system (or lambda calculus) where if an expression can be rewritten in two different ways, both resulting expressions can be further rewritten to a common form. A system with this property is "confluent." General Mechanics' rewriting system is hypothesized to be non-confluent.

**Church-Turing Thesis:** The hypothesis that any function computable by an algorithm can be computed by a Turing machine. In General Mechanics, the universe is considered fundamentally computational, aligning with the strong form of this thesis and suggesting reality itself is a form of computation.

**Classical Mechanics:** The branch of physics that describes the motion of macroscopic objects. In CWM, classical mechanics is an *emergent approximation* of the underlying continuous wave dynamics at large scales and low energies, where individual wave phenomena average out. (Theory of General Mechanics, Introduction)

**Coherence (Wave):** The property of waves that enables stationary (or nearly stationary) interference patterns. In CWM, it refers to the stable, predictable phase relationship between different frequency patterns, essential for pattern formation, information processing, and the emergence of complex phenomena like consciousness. (Treatise on Clocks and Taxonomies, Chapter 2)

**Coding Theorem Method:** A method based on algorithmic probability that provides an upper bound approximation for Kolmogorov complexity by observing the output frequencies of all possible programs run on a universal Turing machine.

**Collective Excitations in Condensed Matter:** Emergent, collective quasiparticles (e.g., magnons, phonons, excitons) arising from strong interactions between atoms in solid-state materials, each with its own resonant behavior, offering a robust basis for encoding quantum information in QRC.

**Color Charge:** In quantum chromodynamics (QCD), a property of quarks and gluons that is analogous to electric charge but is responsible for the strong nuclear force. There are three "colors" (red, green, blue) and three "anti-colors." In a frequency universe, color charge would be interpreted as a specific, quantized phase or resonant property of quark and gluon frequency patterns that dictates their strong interactions.

**Complexity Tax:** A central concept in this paper, representing the measurable burden of abstraction, lack of physical intuition, and increased mathematical complexity (the proliferation of "epicycles") incurred for rigidly clinging to flawed foundational axioms in physics. (Thesis Statement, and throughout)

**Computational Amplitude:** In General Mechanics' sum-over-histories formulation, a complex-valued probability amplitude describing the transition from an initial to a final Universal Relational Graph (URG) state. It quantifies the strength of a computational pathway. (Theory of General Mechanics, Part II)

**Computational Irreducibility:** A property of computational processes where the only way to determine their future state is to run the computation itself, as no computational shortcut or simpler algorithm exists to predict their evolution. In General Mechanics, it provides a philosophical basis for the arrow of time and reality's inexhaustible complexity. (Theory of General Mechanics, Part II)

**Computational Substrate:** The physical medium or underlying system upon which computation is performed. In CWM, the universal medium is posited as the ultimate computational substrate, constantly processing information. (Theory of General Mechanics, Part III)

**Computational:** In General Mechanics, the universe is fundamentally a computational process, meaning its evolution involves continuous processing and updating of its internal state, akin to an algorithm executing its rules. (Theory of General Mechanics, Part III)

**Computability Limits:** The inherent boundaries on what can be computed or formally proven within a given computational system. In General Mechanics, the system's computational power implies it is subject to Gödel's incompleteness theorems and the uncomputability of Kolmogorov complexity for certain questions about its total state or future evolution. (Theory of General Mechanics, Part II)

**Compton Frequency ( $\omega_C$ )** The intrinsic oscillation rate of a stable waveform, directly related to its invariant inertial mass via the mass-frequency identity ( $m = \omega$ ). It is the fundamental "clock" of the particle-waveform. (Natural Units: Universe's Hidden Code, Section 4.1; Formal Framework for a Non-Local Frequency-Based Reality, Section 2.2)

**Compton Wavelength ( $\lambda_C$ )** The characteristic spatial extent of a particle's intrinsic oscillation, derived as the inverse of its mass in natural units ( $\lambda_C = 1/m$ ). (Natural Units: Universe's Hidden Code, Section 2.5.1)

**Confluence (Rewriting System):** A property of a rewriting system where if an expression can be rewritten in two different ways, both resulting expressions can be further rewritten to a common form. A system with this property is "confluent." General Mechanics' rewriting system is hypothesized to be non-confluent.

**Consciousness:** In Continuous Wave Mechanics, a macroscopic physical phenomenon corresponding to the formation of a topologically complex, self-sustaining, and highly integrated resonant pattern within the fundamental dynamic medium. The subjective quality of experience ("qualia") is the intrinsic, first-person informational state of this coherent, high-resonance pattern. (Treatise on Clocks and Taxonomies, Section 28)

**Conservation Laws:** Fundamental principles in physics stating that certain physical properties (e.g., energy, momentum, charge) remain constant in an isolated system. In a frequency universe, these laws arise from underlying symmetries and regularities in frequency pattern interactions and transformations.

**Consilience:** The principle that knowledge is unified and that evidence from disparate, independent fields can converge to support a single, powerful explanation.

**Conceptual Metaphor Theory:** A theory in cognitive linguistics (Lakoff & Johnson, 1980) stating that abstract concepts are understood by mapping them onto more concrete, familiar domains rooted in embodied experience. Essential for understanding the cognitive architecture of scientific language and its potential biases. (Treatise on Clocks and Taxonomies, Section 33.1)

**Continuous Manifold:** A mathematical space that is locally Euclidean (resembles flat space) but can be globally curved. In General Mechanics, a continuous manifold (like spacetime) is hypothesized to emerge as a macroscopic approximation from the discrete Universal Relational Graph (URG).

**Continuous Symmetries:** Symmetries that involve transformations that can vary continuously (e.g., rotations by any angle). In General Mechanics, these are hypothesized to emerge as approximate statistical properties of the discrete URG at large scales, potentially forming discrete subgroups (lattices) of continuous Lie groups.

**Continuous Wave Mechanics (CWM):** The proposed unified framework, a subset of the broader General Mechanics (GM) ontology, explicitly based on continuous wave dynamics in a universal medium. It seeks to replace the paradoxical postulates of QM and GR with a coherent, realist model built on principles of wave propagation, resonance, and interaction. (Term adopted in Abstract and throughout Outline).

**Copenhagen Interpretation:** The most widely accepted interpretation of quantum mechanics, primarily formulated by Niels Bohr and Werner Heisenberg. It posits that quantum systems exist in a superposition of states until measured, at which point the wave function “collapses” into a single definite state. It emphasizes the role of the observer and the probabilistic nature of quantum outcomes. General Mechanics offers an alternative reinterpretation of the measurement problem.

**Core Ontological Identity:** The foundational mathematical identity in General Mechanics,  $m = E = \omega$ , asserting that a particle’s mass, rest energy, and intrinsic angular frequency are fundamentally the same entity.

**Cosmic Anisotropy:** Any deviation from the statistical uniformity of the universe in different directions. CWM predicts such anisotropy must exist at a subtle level as a signature of the dynamic medium constituting a preferred reference frame. (Formal Framework for a Non-Local Frequency-Based Reality, Section 18.1)

**Cosmic Inflation:** A hypothetical period of extremely rapid expansion in the early universe, posited to solve cosmological problems (horizon, flatness). CWM suggests alternative explanations for these problems without requiring inflation. (Theory of General Mechanics, Introduction)

**Cosmic Microwave Background (CMB):** The faint afterglow of the Big Bang, uniform thermal radiation filling the universe, providing a snapshot of the early cosmos. In CWM, it is reinterpreted as a relic of a past, higher-frequency resonant state of the universal medium. (Theory of General Mechanics, Part I)

**Cosmic Redshift:** The phenomenon where light from distant galaxies shifts toward longer (redder) wavelengths due to the universe’s expansion. It is interpreted as the ongoing ‘tuning down’ or stretching of fundamental frequencies.

**Cosmic Web:** The large-scale structure of the universe, consisting of filaments and voids where galaxies are clustered. In a frequency universe, this could reflect large-scale patterns of coherence and density variations within the universal frequency medium.

**Cosmological Constant ( $\Lambda$ )** A term in Einstein’s field equations representing the vacuum energy density, related to the observed accelerated expansion of the universe (Dark Energy). In CWM, it relates to the intrinsic, pervasive background oscillations or frequency landscape of the universal medium. The “Cosmological Constant Problem” (vacuum catastrophe) is a major anomaly addressed by CWM. (Physical Interpretation of Mass and Spacetime, Section 3)

**Cosmological Constant Problem:** The monumental discrepancy between the theoretical vacuum energy density predicted by quantum field theory and the observed value of Dark Energy, often called the “vacuum catastrophe.”

**Coupling Constants:** Dimensionless numbers that determine the strength of fundamental forces. In CWM, they are interpreted as *emergent properties* reflecting the universal medium’s dynamic responsiveness to specific frequency pattern interactions. (Theory of General Mechanics, Part III)

**CP Violation:** A phenomenon in particle physics where the laws of physics are not perfectly mirror-symmetric under combined charge conjugation (C) and parity (P) transformations. CWM integrates this as a fundamental, possibly intrinsic, asymmetry in the universal medium's dynamic processing rules. (Theory of General Mechanics, Section 22.2)

**Curvature of Spacetime:** In General Relativity, the geometric property of spacetime that is responsible for the phenomenon of gravity. In CWM, this is explicitly rejected as fundamental; it is considered an *emergent macroscopic approximation* arising from the collective, statistical dynamics of frequency patterns in the universal medium. (Theory of General Mechanics, Part IV)

**d-regular:** A property of a graph or hypergraph where every vertex has the same degree (number of incident edges/hyperedges). This implies a uniform connectivity structure in the URG.

**Dangling Condition:** A constraint in graph rewriting formalisms (specifically the Double-Pushout approach) that prevents the deletion of a vertex if it would result in edges (or hyperedges) becoming unattached or “dangling.”

**Dark Energy:** A hypothetical form of energy proposed to explain the observed accelerating expansion of the universe. In a frequency universe, it could be reinterpreted as a pervasive, low-frequency background oscillation or a subtle, expansive property of the quantum vacuum's frequency medium itself, driving further decoherence and ‘tuning down’.

**Dark Matter:** A hypothetical form of matter proposed to explain anomalies in observed gravitational effects, which does not interact with light or other electromagnetic radiation. In a frequency universe, it could represent coherent frequency patterns that do not resonate or couple with observable baryonic matter frequencies, or exist at a different ‘harmonic’ not directly detectable by current means.

**Dark Sector:** The collective term for Dark Matter and Dark Energy, representing approximately 95% of the universe's energy density, whose nature remains unknown in the Standard Model.

**De Broglie Wavelength:** The wavelength associated with a particle, demonstrating wave-particle duality. In a frequency universe, it represents the spatial extent of a particle's intrinsic frequency pattern.

**Decoherence:** A process in quantum mechanics where a quantum system loses its “quantumness” (e.g., superposition, entanglement) through interaction with its surrounding environment. In CWM, it is interpreted as the dissipation or loss of stable phase relationships in a frequency pattern due to interaction with the noisy or incoherent environment. CWM treats decoherence as a natural and pervasive process *within* the continuous universal medium, leading to the emergence of classicality. (Theory of General Mechanics, Part IV)

**Degeneracy (Quantum):** When two or more distinct quantum states of a system have the same energy level. In CWM, this implies that multiple distinct frequency patterns can exist within the universal medium with equivalent energy content. (Theory of General Mechanics, Part II)

**Deterministic:** A property of a system where its future state is uniquely determined by its present state. CWM argues for an underlying deterministic reality of the universal medium's dynamics, despite apparent emergent randomness for local observers. (Critiquing Quantum Indeterminism's Foundations, Table 1)

**Diffraction:** The phenomenon that occurs when waves encounter an obstacle or aperture, causing them to bend around it and spread out. In CWM, it demonstrates the wave-like nature of fundamental patterns and how they interact with boundaries in the universal medium. (Theory of General Mechanics, Part IV)

**Digital Physics:** A speculative theoretical perspective that posits the universe is fundamentally a discrete computational system, or the output of a computer program. CWM aligns with this by proposing a computational ontology of reality, though its underlying *physical medium* is continuous. (Theory of General Mechanics, Part I)

**Digital-to-Analog Conversion (DAC):** The process of converting discrete digital signals into continuous analog signals. In QRC, this relates to how a user's digital input could be translated into specific frequency patterns to initiate computation.

**Dimensional Reduction:** In natural unit systems ( $c = \hbar = 1$ ), all physical dimensions can often be expressed solely in terms of a single base unit (e.g., Mass). CWM leverages this to show deep coherence and ontological equivalence between seemingly disparate physical quantities. (Natural Units: Universe's Hidden Code, Section 2.5.2)

**Dirac Equation:** The relativistic wave equation for the electron. Its prediction of Zitterbewegung (Schrödinger, 1930) is a key piece of empirical and theoretical evidence supporting the mass-frequency identity in CWM. (Physical Interpretation of Mass and Spacetime, Section 4)

**Discrete Lens:** A concept introduced by this author that the world *appears* quantized and discrete due to the limitations and intrinsic nature of our observational methods, conceptual tools, and mathematical models (e.g., combinatorial counting), even if the underlying physical reality is continuous. (Discrete Lens document itself; Outline Chapter 6.3)

**Discrete Metric Spaces:** A set of points where distances between them are defined, but the points themselves are discrete rather than continuous. In CWM, the large-scale spacetime continuum would *emerge* as a statistical approximation from an underlying discrete metric space defined on the Universal Relational Graph (URG). (Theory of General Mechanics, Part IV)

**Discrete Subgroup (Lattice):** A subgroup of a continuous Lie group where the elements are separated by discrete distances. In CWM, approximate continuous symmetries at large scales may statistically manifest as invariances under such discrete subgroups of emergent symmetries. (Theory of General Mechanics, Part IV)

**Dispersion:** The phenomenon where a wave's phase velocity depends on its frequency, causing different frequency components of a signal to travel at different speeds and spread out. In a frequency universe, it describes how frequency patterns can spread or deform.

**Distributed Computing:** A paradigm where computational tasks are spread across multiple interconnected computers. In Quantum Resonance Computing (QRC)—a technology enabled by CWM—this concept extends to leveraging widespread, naturally occurring frequency patterns and resonances across the continuous universal medium for large-scale computation. (Theory of General Mechanics, Part VII)

**Doppler Effect:** The change in frequency or wavelength of a wave in relation to an observer moving relative to the wave source. In CWM, it applies to how observed frequencies of patterns (like light from distant galaxies) are shifted due to relative motion, contributing to phenomena like cosmic redshift. (Theory of General Mechanics, Part II)

**Double-Pushout (DPO) / Single-Pushout (SPO):** Two primary algebraic formalisms for defining graph (or hypergraph) rewriting rules. DPO is more explicit and conservative regarding element creation/deletion, while SPO is simpler and more permissive. General Mechanics' Universal Relational Graph (URG) dynamics would be defined by one of these approaches.

**Downward Causation:** A concept in emergent systems where higher-level, emergent macroscopic structures or laws exert a causal influence on the lower-level microscopic dynamics from which they emerged. In CWM, emergent geometric or causal properties of spacetime could influence the URG's microscopic evolution. (Theory of General Mechanics, Part IV)

**Dual Response Principle:** In CWM's model of gravity, a foundational postulate stating that the presence of localized energy (mass) symmetrically alters *both* the effective permittivity and permeability of the universal medium (quantum vacuum). This leads to a dimensionless coupling constant of 2 in the derived refractive index. (Physical Interpretation of Mass and Spacetime, Section 6)

**Duality (Wave-Particle):** The concept in standard Quantum Mechanics that every particle or quantum entity may be described as existing in two contradictory states—either as a particle or as a wave. CWM rigorously resolves this by stating that the fundamental entity is *always* a waveform, with “particle” behavior being an emergent, localized aspect of that waveform's interaction. (Critiquing Quantum Indeterminism's Foundations, Section 1.3; Outline Chapter 4.1, 6.1)

**Effective Field Theories:** Theoretical frameworks in mainstream physics where fundamental constants and field properties are seen as emergent parameters from a deeper, more fundamental theory, valid within specific energy scales. CWM leverages this by reinterpreting Standard Model concepts as emergent from the universal medium. (Physical Interpretation of Mass and Spacetime, Section 3.2)

**Effective Information (EI):** A measure of the strength of a causal relationship in complex systems, quantifying how much information an intervention on a system's past state provides about its future state. Used in General Mechanics to formally define and quantify causal emergence. (Theory of General Mechanics, Part IV)

**Effective Photon Rest Mass:** A theoretical concept where photons, typically massless, acquire a tiny effective rest mass due to interactions with quantum fields or spacetime itself. Some theories propose discrepancies in this value could explain the Hubble Tension.

**Efficiency (Autaxic Trilemma):** One of the three core, competing imperatives of the Autaxic Trilemma. It represents the tendency to optimize processing, minimize computational cost, and find the most parsimonious and coherent solutions for the universe's self-organization. (Theory of General Mechanics, Section 16; Natural Units: Universe's Hidden Code, Section 7.1)

**Eigenstate:** A state of a quantum system that, when a specific observable is measured, yields a definite, consistent value (the eigenvalue) for that observable. In CWM, an eigenstate represents a stable, well-defined resonant frequency pattern of a waveform within the universal medium. (Critiquing Quantum Discreteness Foundations, Section 2.1)

**Eigenvalue:** The definite numerical value obtained when a physical quantity (observable) is measured on a system in an eigenstate. In CWM, eigenvalues correspond to the specific, quantized properties (e.g., energy, mass, momentum) associated with stable frequency patterns of waveforms. (Critiquing Quantum Discreteness Foundations, Section 2.1)

**Einstein's Field Equations (EFE):** The set of ten non-linear partial differential equations in General Relativity that describe how matter and energy (represented by the stress-energy tensor) determine the curvature of spacetime, and how this curvature, in turn, dictates the motion of matter and energy. In CWM, these equations are considered a *macroscopic approximation* of the underlying Universal Relational Graph (URG) dynamics. (Theory of General Mechanics, Part II; Physical Interpretation of Mass and Spacetime, Section 4.3)

**Elasticity:** An intrinsic, dynamic property of the universal medium, relevant for how it sustains, propagates, and responds to various forms of wave phenomena. It contributes to its effective tension and density. (Outline Chapter 4.1.1)

**Electric Charge:** A fundamental property of matter that determines its electromagnetic interactions. In CWM, electric charge is interpreted not as an abstract intrinsic property but as a specific, stable characteristic (e.g., a topological property or unique wave symmetry) of a frequency pattern that dictates its interaction strength with other

electromagnetic frequency patterns in the medium. (Theory of General Mechanics, Part II)

**Electricity:** The set of physical phenomena associated with the presence and motion of electric charge. In CWM, electricity is understood as the macroscopic manifestation of the dynamic interactions and propagation of charged frequency patterns within the universal medium. (Theory of General Mechanics, Part III)

**Electromagnetic Spectrum:** The range of all possible frequencies of electromagnetic radiation, from radio waves to gamma rays. In CWM, each part of the spectrum represents different vibrational modes and energy levels supported by the universal medium. (Theory of General Mechanics, Part II)

**Electromagnetic Wave:** A wave composed of oscillating electric and magnetic fields, propagating through space. In CWM, it is a self-sustaining frequency pattern of the universal medium that carries energy and information. (Theory of General Mechanics, Part II)

**Electron:** A stable, negatively charged elementary particle, a lepton. In CWM, an electron is specifically interpreted as a unique, stable resonant frequency pattern or three-dimensional standing wave (soliton-like) of the universal medium, characterized by its intrinsic frequency (mass), charge, and spin. (Theory of General Mechanics, Part III)

**Electroweak Interaction:** The unified description of the electromagnetic and weak nuclear forces. In CWM, it describes the specific frequency coupling mechanisms governing various particle decays and electromagnetic phenomena arising from interactions within the universal medium. (Theory of General Mechanics, Part III)

**Emergence:** The process where complex patterns, structures, and properties arise spontaneously from simpler interactions or components without explicit programming or central control. In CWM, all observed physical phenomena, including particles, forces, and spacetime, *emerge* from the dynamic interactions and coherent self-organization of fundamental frequency patterns within the universal medium. (Theory of General Mechanics, Part IV)

**Emergent Gauge Symmetries:** Symmetries (which typically imply conservation laws) that arise from redundancies in the description of a system's state, leading to internal, force-like interactions. In CWM, these could manifest as emergent internal symmetries of the URG's dynamics. (Theory of General Mechanics, Part IV)

**Emergent Gravity:** A research program that seeks to derive gravity from more fundamental, non-gravitational principles, often related to thermodynamics, information, and entanglement. CWM explicitly positions itself within this paradigm, deriving gravity from universal medium dynamics. (Physical Interpretation of Mass and Spacetime, Section 20)

**Emergent Properties:** Macroscopic properties or phenomena that arise from the collective behavior and interactions of simpler, underlying components, but are not properties of the individual components themselves. In CWM, these include spacetime, classical objects, and fundamental forces. (Theory of General Mechanics, Part IV)

**Energy:** In CWM, energy is ontologically equivalent to mass and intrinsic angular frequency ( $E = m = \omega$ ), representing the dynamic activity or vibrational content of a frequency pattern within the universal medium. It is the capacity for work, expressed as vibration. (Natural Units: Universe's Hidden Code, Section 3.2; Formal Framework for a Non-Local Frequency-Based Reality, Section 2.1)

**Entangled (Quantum):** A phenomenon where two or more quantum particles become linked such that their quantum states are interdependent, regardless of the distance separating them. In CWM, it is interpreted as instantaneous phase-coupling or resonant alignment of interconnected frequency patterns within the universal medium. (Critiquing Quantum Indeterminism's Foundations, Section 3.1)

**Entropic Gravity:** A theory proposing that gravity arises from changes in the information associated with the positions of material bodies, linking it to entropy and the Holographic Principle. CWM provides a more mechanistic grounding for this concept through its dynamic medium ontology. (Theory of General Mechanics, Part IV)

**Entropy:** A measure of disorder or randomness in a system. In CWM, it represents the degree of incoherence in a system's frequency patterns, or the thermalization of coherent information into a less ordered, more chaotic state within the universal medium. (Theory of General Mechanics, Part II)

**Epistemic Arrogance:** An excessive and unfounded certainty in one's own knowledge and ability to know, often coupled with the unjustified dismissal of dissenting views. It is frequently linked to anthropocentrism. CWM challenges this in its philosophical implications, advocating for intellectual humility. (Treatise on Clocks and Taxonomies, Section 33.3)

**Epistemological Limit:** A boundary of our current scientific knowledge or theoretical models, as opposed to an ontological truth (a fundamental, intrinsic feature) about reality itself. CWM rigorously identifies the Planck scale as an \*epistemological limit\*, where current theories break down, rather than an ontological "cosmic pixel." (Physical Interpretation of Mass and Spacetime, Section 3.1)

**Epistemology:** The philosophical study of knowledge, including its nature, scope, acquisition, and inherent limits. In General Mechanics, epistemology critically examines the boundaries of human understanding and scientific models. (Treatise on Clocks and Taxonomies, Part I)

**Epigenetic Reprogramming:** A biological process (e.g., using Yamanaka factors) that "reboots" aged cells to a more youthful epigenetic state, effectively rewinding their biological clock. CWM sees this as actively modifying a system's intrinsic temporal signature. (Treatise on Clocks and Taxonomies, Section 5.3)

**Error Correction (QRC):** In Quantum Resonance Computing (QRC), the process of maintaining the stability and coherence of critical frequency patterns against environmental noise or unwanted interactions. CWM relies on inherent self-organizing properties of resonant systems to achieve intrinsic robustness. (Theory of General Mechanics, Part VII)

**Evolutionary Principle:** The derived law in General Mechanics,  $\frac{d(m_{total}^2)}{dt} \geq 0$ , mathematically formulating the arrow of time as the non-decreasing evolution of the square of the system's total mass/energy variable 'm'. It connects thermodynamics to the fundamental dynamics of the universal medium. (Theory of General Mechanics, Section 12)

**Existence (Law of):** The derived law in General Mechanics, **EXISTENCE  $\equiv$  SELF-CONSISTENCY**, which identifies the mathematical property of self-consistency with the fundamental physical property of existence. It implies that a system can only exist if its dynamics are self-consistent within the URG framework. (Theory of General Mechanics, Section 13)

**Excitons:** Bound electron-hole pairs, a type of emergent, collective excitation in condensed matter. CWM sees these as specific localized waveforms or patterns of coherence. (Discrete Lens, Section 4.3)

**Extended Uncertainty Principle (EUP):** A modification of the Heisenberg Uncertainty Principle that suggests a minimum measurable length, often arising in speculative quantum gravity theories. Its predictions are relevant to reconciling quantum mechanics and general relativity, with relevance to the Hubble Tension. (Theory of General Mechanics, Part I)

**Falsifiability:** The capacity for a statement, theory, or hypothesis to be proven wrong by observation or experiment. CWM explicitly emphasizes its own falsifiability through specific, testable predictions. (Critiquing Quantum Indeterminism's Foundations, Section 4)

**Fenna-Matthews-Olson (FMO) Complex:** A photosynthetic pigment-protein complex found in green sulfur bacteria that has been experimentally shown to exhibit sustained quantum coherence during energy transfer. This serves as “black swan” evidence for CWM’s principles, indicating that life can harness inherent resonant properties. (Physical Interpretation of Mass and Spacetime, Section 26.1)

**Fermion:** A type of fundamental particle that obeys the Pauli exclusion principle (no two identical fermions can occupy the same quantum state). In CWM, fermions are distinct, stable frequency patterns that resist co-localization due to their inherent phase and spatial properties, preventing identical patterns from occupying the exact same resonant mode within the universal medium. (Theory of General Mechanics, Part III)

**Field (Physics):** In CWM, the universe’s fundamental constituents are continuous, fluid-like quantum fields that permeate all of spacetime. CWM posits a single, unified “meta-field” (the universal medium, or URG) as the ultimate source from which all other distinct fields (e.g., electromagnetic, electron, Higgs) emerge as dynamic patterns. (Theory of General Mechanics, Section 14)

**Fine-Structure Constant ( $\alpha$ ):** A fundamental physical constant that quantifies the strength of the electromagnetic interaction between elementary charged particles. In CWM, it is interpreted as an *emergent property* reflecting how easily the universal medium transmits and sustains electromagnetic frequency patterns. Its precise derivation from fundamental medium properties is a key CWM goal. (Formal Framework for a Non-Local Frequency-Based Reality, Section 3.2; Principle of Harmonic Closure, Section 4)

**Fine-Tuning Problem:** The observation that the fundamental constants and initial conditions of the universe appear to be precisely adjusted for the existence of life, leading to questions about their origin. CWM offers a non-anthropropic solution through the Autaxys principle, where constants are self-tuned. (Theory of General Mechanics, Section 16)

**Flavor (Quantum):** A quantum number distinguishing types of quarks and leptons (e.g., up, down, strange, charm, top, bottom quarks; electron, muon, tau leptons). In CWM, flavor is interpreted as a distinct, quantized resonant mode or internal frequency configuration of a fundamental frequency pattern. (Theory of General Mechanics, Part II)

**Flatness Problem:** A cosmological problem in the Big Bang model concerning why the universe’s spatial curvature is observed to be extremely close to zero (spatially flat). VSL cosmologies (aligned with CWM) offered solutions to this problem. (Physical Interpretation of Mass and Spacetime, Section 24.1)

**Floquet Theory:** A mathematical theory describing the behavior of systems under periodic driving, essential for understanding the quasi-energy states of parametrically driven quantum oscillators. It is critical for QRC. (Theory of General Mechanics, Part VII)

**Force:** In CWM, fundamental forces are *\*emergent phenomena\** arising from the interactions and symmetries of frequency patterns within the universal medium, or from the dynamic properties of the URG, rather than being mediated by abstract force carriers. (Theory of General Mechanics, Section 11 and 15.1)

**\*\*Formal Framework for a Non-Local Frequency-Based Reality:\*\*** A foundational document outlining CWM’s axiomatic base, including the primacy of non-locality, the invariance of energy relations, and the principle of natural units.

**Formalism for Resonant Computation:** A rigorous mathematical language needed to describe computation in driven, resonant quantum systems within the QRC framework.

**Fourier Analysis:** A mathematical method for decomposing a complex waveform into a sum of simpler sine and cosine waves. In CWM, it is a crucial tool to analyze and synthesize frequency patterns within the universal medium. (Theory of General Mechanics, Part III)

**Frame-Dragging:** An effect in GR where rotating masses drag spacetime around them. In CWM, this empirically confirms Mach's Principle, indicating inertia is a relational effect mediated by the dynamic universal medium. (Theory of General Mechanics, Section 17.2)

**Free Energy Principle (FEP):** A principle (Friston, 2010) stating that any self-organizing system must act to minimize its "surprise" or variational free energy, by creating a predictive model of its world. CWM incorporates FEP as a high-level manifestation of Autaxys. (Theory of General Mechanics, Section 16; Treatise on Clocks and Taxonomies, Section 28.1)

**Frequency and Mode Encoding:** A method in QRC where information is encoded digitally by the presence or absence of excitation in specific resonant modes of a quantum resonator.

**Frequency Domain:** A way of representing signals or functions as a function of frequency, rather than as a function of time. Essential for analyzing and manipulating frequency patterns in CWM. (Theory of General Mechanics, Part II)

**Frequency Impedance:** An intrinsic property of the universal medium that dictates how readily energy is exchanged and how stable frequency patterns (like particles) propagate and form within it. It is analogous to electrical impedance or a material's refractive index. (Outline Chapter 4.1.1)

**Frequency Microscopy:** A hypothetical advanced sensing technology that detects unique frequency signatures to image objects at subatomic scales or through obscuring media.

**Frequency Printing:** A hypothetical advanced QRC application where complex frequency fields are precisely orchestrated within a localized vacuum region to synthesize matter by forming and stabilizing inherent frequency patterns.

**Frequency-Based Ontology:** A core tenet of General Mechanics (and CWM) emphasizing that reality is fundamentally composed of dynamic, frequency-based patterns and processes operating within an active universal medium. (Theory of General Mechanics, Introduction)

**Fundamental Constants:** In General Mechanics, parameters (e.g., speed of light  $c$ , gravitational constant  $G$ , Planck constant  $\hbar$ ) typically considered immutable, are reinterpreted as emergent, macroscopic properties of the dynamic medium, potentially varying subtly across cosmic epochs or regions.

**Fundamental Force (Derived Law):** The derived law in General Mechanics,  $F = m_{char}^2$ , indicating that the strength of a fundamental interaction at a given scale is the square of the variable 'm' (mass/frequency).

**Gamma-Ray Bursts (GRBs):** Extremely energetic astrophysical phenomena. Used in experiments to detect minute, energy-dependent variations in the speed of light, which CWM predicts. (Outline Chapter 8.1)

**Gate-Based Model:** The dominant paradigm in quantum computing, conceptually analogous to classical computing, representing information in discrete quantum bits (qubits) and manipulating it through a sequence of quantum gates. QRC offers an alternative to this approach. (Theory of General Mechanics, Section 31.1)

**Gauge Symmetry:** A type of local symmetry in physics where the laws remain unchanged under transformations that can vary independently at each point in space. These symmetries are fundamental to modern particle physics, giving rise to fundamental forces. In CWM (within GM), emergent gauge symmetries could arise from redundancies

in the Universal Relational Graph (URG) state description, leading to internal, force-like interactions. (Theory of General Mechanics, Part IV)

**Gauge Symmetry Group:** A mathematical group (e.g.,  $SU(3) \times SU(2) \times U(1)$  for the Standard Model) that describes the fundamental symmetries underlying the interactions of particles and forces. In CWM, this group emerges from the underlying dynamics of the URG. (Theory of General Mechanics, Part IV)

**Gauge Theory:** A type of field theory in physics where the Lagrangian is invariant under local transformations of certain symmetry groups. It forms the mathematical foundation for the Standard Model. In CWM, it describes the symmetries and conservation laws governing transformations and interactions between frequency patterns. (Theory of General Mechanics, Part IV)

**General Mechanics (GM):** The overarching process-based, computational ontology of reality, which posits the universe as a single, unified, and fundamentally computational process. Continuous Wave Mechanics (CWM) is a specific framework (subset) within GM. (Theory of General Mechanics, Introduction)

**General Relativity (GR):** Albert Einstein's theory of gravity, describing gravity as a curvature of spacetime caused by mass and energy. In CWM, GR is explicitly critiqued for its complexity and reliance on local realism; its predictions are reinterpreted as an *emergent, macroscopic approximation* of the underlying URG dynamics. (Physical Interpretation of Mass and Spacetime, Part I; Outline Chapter 1.1.2.2, 3.4)

**Generalized Coordinates:** A set of independent parameters that uniquely specify a system's configuration. In General Mechanics, these are the attributes on the Universal Relational Graph (URG)'s vertices and hyperedges, serving as the variables upon which the Autaxic Lagrangian operates.

**Generative Cycle:** The formalized process within Autaxys operating on the Universal Relational Graph (URG), guided by the Autaxic Lagrangian, leading to the emergence of increasingly complex and stable structures throughout cosmic evolution. (Theory of General Mechanics, Section 16)

**Geometric Algebra (GA) / Clifford Algebra:** A mathematical framework that unifies scalars, vectors, and higher-grade objects into single "multivector" entities, providing a compact language for geometry and physics. General Mechanics may adopt it as the Universal Relational Graph (URG)'s fundamental algebraic structure.

**Geometric Description of Gravity:** The description of gravity in General Relativity as spacetime curvature. CWM explicitly rejects this as fundamental, proposing a simpler, refractive model based on medium properties. (Physical Interpretation of Mass and Spacetime, Section 1)

**Global State Encoding:** A method in Quantum Resonance Computing (QRC) where the computational state is encoded in the global pattern of excitations across the entire resonant spectrum of a quantum resonator, rather than in isolated qubits. (Theory of General Mechanics, Part VII)

**Gluon:** The elementary particle that mediates the strong interaction between quarks. In CWM, a gluon is interpreted as a specific resonant frequency pattern that mediates the powerful, nonlinear interactions binding quark frequency patterns together within the universal medium. (Theory of General Mechanics, Part IV)

**Gödel's Incompleteness Theorems:** Two theorems by Kurt Gödel demonstrating inherent limitations of formal axiomatic systems (e.g., that any consistent formal system powerful enough to formalize arithmetic cannot prove its own consistency). In General Mechanics, they imply fundamental limits to what can be known or proven about the complexity of the universe's computational states from within its own framework, leading to fundamental undecidability for certain questions. (Theory of General Mechanics, Part II)

**Goldilocks Problem:** In Quantum Resonance Computing (QRC), the challenge of finding or engineering physical systems with an optimal level of anharmonicity—sufficient for control and addressability, but not so large as to cause uncontrollable decoherence. (Treatise on Clocks and Taxonomies, Section 31.7)

**Grand Synthesis:** An alternative name for General Mechanics, emphasizing its unifying nature.

**Gravitational Constant ( $G$ )** A fundamental physical constant that determines the strength of the gravitational force. In CWM, it is interpreted as an *emergent parameter* reflecting the universal medium's responsiveness to energy-momentum, rather than a fundamental constant. Its value is derived within CWM. (Physical Interpretation of Mass and Spacetime, Section 7)

**Gravitational Limit ( $R_S$ )** The derived law in GM,  $R_S = 2m$ , showing that the geometric boundary associated with gravity (Schwarzschild Radius) is directly proportional to the variable 'm' (mass/frequency). This limit defines a critical density beyond which a region of the medium collapses. (Theory of General Mechanics, Section 8)

**Gravitational Lensing:** The bending of light by massive objects. In CWM, it is not interpreted as the bending of spacetime geometry, but as analogous to the refraction of light through a medium whose refractive index varies with the density of coherent frequency patterns. (Physical Interpretation of Mass and Spacetime, Section 7)

**Gravitational Time Dilation:** A phenomenon predicted by relativity where time passes more slowly for an observer in a stronger gravitational field. In CWM, it's explained as a physical slowing of atomic clocks' intrinsic oscillation frequencies when embedded in a denser medium, rather than spacetime itself warping. (Physical Interpretation of Mass and Spacetime, Section 8; Outline Chapter 5.3.3.1)

**Graviton:** A hypothetical elementary particle that mediates the force of gravity in theories of quantum gravity. In CWM, a graviton would be interpreted as a quantized, propagating frequency pattern of the gravitational field, representing the universal medium's most fundamental vibrational mode. (Theory of General Mechanics, Part IV)

**Gravity:** In General Mechanics, an emergent phenomenon, not a fundamental force, but a dynamic consequence of how mass-frequency patterns locally alter the surrounding medium's properties and processing dynamics, creating gradients that other patterns follow. This differs from the conventional view of gravity as a fundamental force or the curvature of spacetime itself.

**Hadron:** Any composite particle made of quarks held together by the strong force (e.g., baryons and mesons). In CWM, hadrons are interpreted as stable or unstable resonant standing wave patterns formed by the confinement of quark frequency patterns within the universal medium. (Theory of General Mechanics, Part III)

**Hamiltonian (Physics)** A mathematical function or operator representing a system's total energy, used in quantum mechanics to describe its evolution over time. In CWM, it describes the energy and dynamics of interacting frequency patterns within the universal medium. (Theory of General Mechanics, Part III)

**Harmonic Attenuation Constant ( $c$ )** The derivable geometric normalization constant within the POHC Damping Function,  $D(\rho, x) = \exp[-c \cdot |t_n| \cdot \log(x)]$ . It is a dimensionless factor of order unity, arising from the fundamental geometry of the NCG spectral triple rather than being a free parameter.

**Harmonic Resonance Computing (HRC):** A new computational paradigm proposed by General Mechanics, leveraging the resonant nature of reality to encode information in stable, collective resonant modes of an engineered physical medium. (POHC document)

**Harmonic Zoom Algorithm:** An algorithm derived from the PPA within the POHC framework that operates by detecting high-amplitude peaks in the vacuum's harmonic spectrum to rapidly identify prime factors, reducing computational complexity from sub-exponential to polynomial. (POHC document)

**Harmonics:** Integer multiples of a fundamental frequency. In CWM (a wave-based system), higher-order harmonics represent more complex or higher-energy vibrational modes of a fundamental pattern. (Treatise on Clocks and Taxonomies, Chapter 2)

**Health (in CWM)** A state of multi-level resonant coherence within a nested biological system. Disease is understood as systemic dissonance, a disruption in this harmony. (Treatise on Clocks and Taxonomies, Section 6.1)

**Heat:** Energy transferred from one system to another as a result of a temperature difference. In a frequency universe, heat transfer involves the incoherent transfer or dissipation of vibrational energy, leading to an increase in the randomness or range of frequency patterns.

**Heisenberg Uncertainty Principle:** A fundamental principle of quantum mechanics stating that certain pairs of conjugate physical properties, like position and momentum, cannot both be known to arbitrary precision simultaneously. In CWM, it reflects the inherent diffuseness and non-localization of frequency patterns, making precise, simultaneous measurement of conjugate variables impossible. (Physical Interpretation of Mass and Spacetime, Section 3.1)

**Higgs Boson:** A fundamental particle associated with the Higgs field, which gives mass to other elementary particles in the Standard Model. In CWM, it is reinterpreted as a specific resonant excitation or mode of the universal medium's mass-conferring property. (Theory of General Mechanics, Part IV)

**Higgs Mechanism:** The process by which elementary particles acquire mass through their interaction with the Higgs field in the Standard Model. In CWM, it is reinterpreted as the intrinsic 'frequency impedance' of the universal medium, determining how readily resonant patterns propagate and stabilize, thereby conferring inertia. (Natural Units: Universe's Hidden Code, Section 4.2)

**Hilbert Space:** An infinite-dimensional complex vector space used to represent the quantum states of a system in standard quantum mechanics. CWM critiques this as an abstract epicycle, fundamentally divorcing physics from real-world, intuitive spatial understanding. (Critiquing Quantum Discreteness Foundations, Section 3.2; Outline Chapter 3.2)

**Hilbert-Pólya Conjecture:** A mathematical conjecture stating that the imaginary parts of the Riemann zeros correspond to the eigenvalues of a Hermitian operator. The POHC identifies this operator as the Hamiltonian of the Quantum Vacuum ( $\hat{H}_U$ ). (POHC document)

**History ( $\gamma$ )** In General Mechanics' sum-over-histories formulation (similar to Feynman's path integral), a specific sequence of rewrite rule applications that transforms an initial Universal Relational Graph (URG) state into a final state. (Theory of General Mechanics, Section 16)

**Holographic Principle:** A principle positing that the complete description of a volume of space can be encoded on its lower-dimensional boundary. CWM leverages this for understanding ultimate information limits and the emergent nature of 3D space. (Physical Interpretation of Mass and Spacetime, Section 5; Formal Framework for a Non-Local Frequency-Based Reality, Section 8)

**Homochirality (of Biology)** The phenomenon where biological molecules exclusively utilize one of their two possible mirror-image forms. CWM explains this as an expected outcome of an optimizing, self-organizing system (Autaxys), driven by the universal medium's inherent asymmetry. (Physical Interpretation of Mass and Spacetime, Section 26.2; Treatise on Clocks and Taxonomies, Section 26.2)

**Homodyne Detection:** A standard technique in quantum optics where the signal from a quantum resonator is interfered with a strong classical laser beam. Used in QRC for phase-sensitive readout of quantum states. (Theory of General Mechanics, Part VII)

**Horizon Problem:** A cosmological problem in the Big Bang model concerning why distant, causally disconnected regions of the universe have the same temperature. VSL cosmologies (aligned with CWM) offered solutions to this problem. (Physical Interpretation of Mass and Spacetime, Section 24.1)

**Hubble Constant (H<sub>0</sub>)** The current rate of expansion of the universe. The “Hubble Tension”—a significant discrepancy in its measured value—is a major anomaly that CWM addresses. (Physical Interpretation of Mass and Spacetime, Section 3)

**Hubble Tension:** A statistically significant and persistent discrepancy between the value of the Hubble constant (H<sub>0</sub>) as measured from the early universe (via CMB) and the local, late-time universe (via supernovae). CWM interprets this as direct evidence of the universal medium’s evolving properties over cosmic time. (Physical Interpretation of Mass and Spacetime, Section 24)

**Hybrid Opto/Electro-Mechanical Systems:** Systems that couple mechanical resonators to optical or microwave cavities, allowing for control and readout of mechanical states using light or microwaves. These are promising candidates for QRC. (Theory of General Mechanics, Part VII)

**Hybrid Quantum Systems:** Computational architectures that combine different physical platforms to leverage their respective strengths in quantum computing. Relevant for QRC, which may use such architectures. (Theory of General Mechanics, Part VII)

**Hyperbolic Manifold:** A manifold with constant negative curvature. In CWM, the emergent geometry of spacetime is strongly suggested to be hyperbolic, linked to the URG’s global stability metric. (Theory of General Mechanics, Part IV)

**Hypergraph:** In the Wolfram Physics Project (and integrated into GM), a generalization of a graph where edges can connect any number of vertices. The Universal Relational Graph (URG) in CWM is conceptualized as a dynamic attributed hypergraph. (Theory of General Mechanics, Part IV)

**Hypergraph Laplacian:** A mathematical operator (matrix) defined for a hypergraph, generalizing the standard graph Laplacian. Its eigenvalues encode information about the hypergraph’s connectivity and stability, used in CWM to analyze the URG. (Theory of General Mechanics, Part IV)

**Hypergraph Rewrite Rules:** Formal rules ( $p : L \rightarrow R$ ) that specify how a pattern hypergraph ( $L$ ) within a host hypergraph ( $H$ ) can be replaced by a replacement hypergraph ( $R$ ), driving the evolution of the Universal Relational Graph (URG). These rules define the universe’s computational steps. (Theory of General Mechanics, Part IV)

$h_c$ : A fundamental dimensionless constant in General Mechanics, analogous to the Planck constant ( $\hbar$ ) in quantum mechanics. It is defined within the system’s axioms and governs the “quantumness” or stochasticity of the cosmic computation, influencing the Universal Relational Graph (URG)’s probabilistic evolution.

**In Silico Cosmology:** Computational experiments based on the Universal Relational Graph (URG) model that aim to robustly and generatively reproduce the key features of our universe (e.g., large-scale structure, fundamental constants). A computational validation path for CWM. (Theory of General Mechanics, Part II, Section 18; Outline Chapter 9.2)

**Inertia:** The resistance of any physical object to any change in its state of motion. In CWM, inertia is not an intrinsic property of mass but an *interaction effect* between a dynamic pattern (a waveform) and the surrounding universal medium, consistent with Mach’s Principle. (Theory of General Mechanics, Section 17.2)

**Inertial Frame of Reference:** In classical and relativistic physics, a frame of reference in which an object at rest remains at rest and an object in motion continues to move at a constant velocity unless acted upon by an external force. CWM predicts subtle violations of Lorentz Invariance, implying the universal medium might constitute a

fundamental preferred frame. (Formal Framework for a Non-Local Frequency-Based Reality, Section 18.1)

**Infinite Divisibility of Matter:** In CWM, this concept is naturally accommodated as the analytical resolution of ever-finer sub-harmonic structures and continuous dynamics intrinsically existing *within* a continuous waveform (particle). This directly contradicts the notion of discrete, indivisible quanta or point particles. (Outline Chapter 4.2.2)

**Information:** In CWM, information is a fundamental physical currency of reality, referring to the specific coherent pattern of frequency and phase relationships within the universal medium. It is intrinsically linked to mass and energy (via Landauer's Principle) and is primary to the emergence of physical reality. (Theory of General Mechanics, Section 6; Natural Units: Universe's Hidden Code, Section 6)

**Information Theory:** A mathematical framework for quantifying, storing, and communicating information. Applied in CWM to describe the complexity, redundancy, and efficiency of encoding and decoding information within frequency patterns and their interactions. (Theory of General Mechanics, Part III)

**Informational Threshold:** The critical point in cosmic evolution where a physical system's dynamics cease to be governed solely by the immediate laws of physics and begin to be directed by encoded, heritable information, thereby leading to the emergence of life. (Treatise on Clocks and Taxonomies, Section 4.1)

**Integrated Information Theory (IIT):** A theory of consciousness (Tononi, 2004) positing that consciousness is identical to a system's quantity of "integrated information," quantified by Phi ( $\Phi$ ). CWM synthesizes IIT into its Consciousness Postulate, linking integrated information to coherent resonant patterns. (Treatise on Clocks and Taxonomies, Section 28.1)

**Interference (Wave):** The phenomenon in which two or more waves superpose to form a resultant wave of greater, lower, or the same amplitude. Crucial for pattern formation and signal processing in CWM, explaining phenomena like the double-slit experiment. (Theory of General Mechanics, Part III)

**Interferometry:** A technique that uses the interference of waves (e.g., light waves) to make precise measurements, relevant for detecting subtle frequency patterns and validating CWM (e.g., in tests for Lorentz Violation). (Theory of General Mechanics, Part VII)

**Intrinsic Clock:** In CWM, an entity's complete temporal signature—a comprehensive, four-dimensional description of its existence as a process in time, composed of a fundamental frequency, hierarchical harmonies (nested cycles), and its overall lifespan. This serves as a universal classificatory tool. (Treatise on Clocks and Taxonomies, Section 2.2)

**Josephson Junctions:** Superconducting electronic components that exhibit unique quantum mechanical properties. Used in Quantum Flux Parametrons (QFP) and superconducting circuits for QRC. (Theory of General Mechanics, Part VII)

**k-uniform:** A property of a hypergraph where every hyperedge has the same cardinality (connects the same number of vertices). This implies a consistent level of relational complexity in the URG.

**Kaluza-Klein Theory:** A theoretical framework (Kaluza, 1921; Klein, 1926) that reformulates General Relativity in higher dimensions, yielding both Einstein's equations for gravity and Maxwell's equations for electromagnetism. CWM uses this as strong support for unifying forces within a single, higher-dimensional universal medium. (Theory of General Mechanics, Section 22.3)

**Kerr Nonlinearity:** A nonlinear optical or circuit phenomenon where the refractive index or resonant frequency of a medium changes with the intensity of light or electromagnetic field. Crucial for creating stable phase states in Kerr Parametric Oscillators (KPOs) for QRC. (Theory of General Mechanics, Part VII)

**Kerr Parametric Oscillator (KPO):** A nonlinear quantum resonator that can be stabilized into a quantum superposition of two coherent states with opposite phases, often called a “Schrödinger cat state.” Used in Quantum Resonance Computing (QRC). (Theory of General Mechanics, Part VII)

**Kinematic:** Pertaining to motion, typically without reference to mass or force. In GM, a particle’s internal motion (Zitterbewegung) is a kinematic origin for its mass and spin.

**Kinetic Energy:** The energy an object possesses due to its motion. In CWM, it is the energy associated with the propagation or dynamic change of a frequency pattern. (Theory of General Mechanics, Part II)

**Klein-Gordon Equation:** The relativistic wave equation for spin-0 particles. It incorporates the Compton frequency, providing theoretical support for the mass-frequency identity. (Theory of General Mechanics, Section 15)

**Kolmogorov Complexity:** A measure of an object’s algorithmic complexity, defined as the length of the shortest computer program that can generate that object. Relevant for defining the “simplicity” axiom and understanding computability limits in General Mechanics. (Theory of General Mechanics, Part II)

**Koide Formula:** An empirical, unexplained relation between the masses of the three charged leptons (electron, muon, tau). In POHC, it is reinterpreted not as numerology, but as a robust empirical law reflecting deeper geometric or algebraic relationships between lepton generations, a direct signature of dynamical stability governed by  $\varphi$ . (POHC document)

**Lagrangian (Physics):** A mathematical function that describes a physical system’s dynamics, typically defined as kinetic energy minus potential energy. In CWM (within GM), the Autaxic Lagrangian ( $\mathcal{L}_A$ ) quantifies the “ontological fitness” or viability of universe states and guides its evolution through a variational principle. (Theory of General Mechanics, Section 16)

**Lambda-Cold Dark Matter ( $\Lambda$ CDM) Model:** The standard cosmological model that describes the universe as composed of ordinary matter, cold dark matter, and dark energy. CWM critiques its anomalies and reliance on Dark Matter/Energy as ad-hoc additions. (Physical Interpretation of Mass and Spacetime, Section 2)

**Lamb Shift:** A small shift in the energy levels of atoms, providing empirical evidence for the quantum vacuum’s existence and activity. CWM interprets this as a property of the universal medium. (Physical Interpretation of Mass and Spacetime, Section 3.2)

**Landauer’s Principle:** A principle (Landauer, 1961) stating that the irreversible erasure of one bit of information from a physical system necessarily dissipates a minimum amount of heat ( $E \geq k_B T \ln 2$ ) into the environment. This demonstrates information is fundamentally physical and linked to energy, supporting CWM’s unification of mass, energy, and information. (Natural Units: Universe's Hidden Code, Section 27.4)

**Lattice (Discrete Subgroup):** A discrete subgroup of a continuous Lie group where the elements are separated by discrete distances. In CWM, emergent continuous symmetries at large scales may manifest as statistical invariances under such discrete subgroups. (Theory of General Mechanics, Part IV)

**Law of Existence:** The derived law in General Mechanics, **EXISTENCE  $\equiv$  SELF-CONSISTENCY**, which identifies the mathematical property of self-consistency with the fundamental physical property of existence. It implies that a system can only exist if its dynamics are self-consistent within the URG framework. (Theory of General Mechanics, Section 13)

**Laws of Physics:** In CWM, these are explicitly *not* externally imposed rules but are \*emergent, self-consistent grammar\* or consequences of a single, unitless optimization principle (the Principle of Least Action) governing the universe’s dynamic, computational process. (Theory of General Mechanics, Section 12)

**Lepton:** A class of fundamental fermions that includes electrons, muons, taus, and their corresponding neutrinos. In CWM, leptons are interpreted as stable, fundamental frequency patterns that do not experience the strong nuclear force. (Theory of General Mechanics, Part III)

**Lie Group:** A group that is also a differentiable manifold, allowing for the description of continuous symmetries (e.g., rotations, translations). In CWM, emergent continuous symmetries are hypothesized to arise from the URG's statistical behavior. (Theory of General Mechanics, Part IV)

**Light-Matter Interaction:** The way light (photons) interacts with matter (atoms, electrons). In CWM, this is understood as the resonant coupling and energy exchange between specific photon frequency patterns and matter particles' intrinsic frequency patterns within the universal medium. (Theory of General Mechanics, Part II)

**Linear Approximation (QM):** CWM posits that the linear, non-relativistic quantum dynamics of QM emerge only as an approximation in specific low-energy, low-density regimes. The full underlying dynamics are non-linear, deterministic, and locally causal within the universal medium. (Outline Chapter 7.2.2)

**Lissajous Figures:** Patterns generated by the superposition of two or more simple harmonic motions, often used in QRC to visualize complex frequency interactions. (Theory of General Mechanics, Part III)

**Lived Body:** A phenomenological concept (Merleau-Ponty, 1962) asserting that the observer in science is not an abstract, disembodied mind, but a "lived body" that is lived and through which we primarily engage with the world. CWM integrates this into its epistemology. (Treatise on Clocks and Taxonomies, Section 33.2)

**Local Realism:** The classical intuition that objects have definite properties independent of measurement and that influences cannot travel faster than light. CWM's foundational critique: it has been empirically falsified by Bell tests. (Formal Framework for a Non-Local Frequency-Based Reality, Postulate I)

**Locality:** The principle that an event can only be influenced by its immediate infinitesimal surroundings, with effects propagating continuously at a finite speed. CWM argues this is an *effective approximation* at macroscopic scales, not a fundamental principle of reality. (Physical Interpretation of Mass and Spacetime, Section 1)

**Loop Quantum Gravity (LQG):** A theory of quantum gravity that quantizes spacetime itself, predicting that geometric quantities like area and volume have discrete spectra. Used as a comparative formalism for the URG. (Theory of General Mechanics, Section 30.1)

**Lorentz Invariance:** The principle that the laws of physics are the same for all inertial observers, a core tenet of Special Relativity. CWM predicts subtle, energy-dependent violations of Lorentz invariance. (Formal Framework for a Non-Local Frequency-Based Reality, Section 18.1; Outline Chapter 8.1)

**Lorentz Invariance Violation (LIV):** Any deviation from the principle of Lorentz invariance. CWM predicts its existence at a subtle, energy-dependent level due to the dynamic universal medium, serving as a key falsifiable prediction. (Formal Framework for a Non-Local Frequency-Based Reality, Section 18.1; Outline Chapter 8.1)

**Lorentzian Manifold:** A mathematical space that locally resembles Minkowski spacetime, used in General Relativity to describe spacetime. In CWM, emergent spacetime is hypothesized to be a Lorentzian manifold, emerging from the URG's dynamics. (Theory of General Mechanics, Part IV)

**Lucas Primality Constraint:** A filter within the POHC stating that a  $\phi^p$  harmonic can only manifest as a stable, free particle if its corresponding Lucas Number ( $L_p \approx \phi^p$ ) is also prime. If  $L_p$  is composite, the state is "fundamentally decomposable" and cannot exist in isolation, explaining quark confinement. (POHC document)

**Mach's Principle:** The idea (Ernst Mach, 1893) that inertia is not an intrinsic property of an object but a relational effect determined by the object's interaction with all other matter in the universe. CWM provides a physical mechanism for this through the dynamic universal medium. (Theory of General Mechanics, Section 17.2)

**Magnons:** Quantized spin waves in magnetic materials, a type of emergent, collective excitation in condensed matter. CWM sees these as specific localized waveforms or patterns of coherence. (Discrete Lens, Section 4.3)

**Many-Worlds Interpretation (MWI):** A prominent interpretation of quantum mechanics (Everett, 1957) where all possible outcomes of a quantum measurement occur in branching, parallel universes. CWM critiques its ontological extravagance and its difficulties in deriving the Born Rule. (Critiquing Quantum Indeterminism's Foundations, Section 6; Outline Chapter 7.3.2)

**Mapping Problems to Resonances:** A crucial theoretical task in QRC, requiring an algorithmic procedure for translating abstract computational problems into the physical control parameters required for a QRC to solve them.

**Mass as Frequency:** The fundamental identity in CWM ( $m = \omega$ ) where a particle's mass is ontologically equivalent to its intrinsic angular frequency. This is a core CWM postulate. (Formal Framework for a Non-Local Frequency-Based Reality, Section 2.2; Natural Units: Universe's Hidden Code, Section 3.2)

**Mass-Energy Equivalence ( $E = mc^2$ ):** Albert Einstein's famous equation (1905) establishing the interconvertibility of mass and energy. This is a foundational equation used to derive the mass-frequency identity in CWM. (Formal Framework for a Non-Local Frequency-Based Reality, Postulate II)

**Mass-Frequency Identity ( $m = \omega$ ):** The core ontological postulate of Continuous Wave Mechanics, stating that mass is ontologically equivalent to the intrinsic angular frequency of a stable, resonant process. This is derived in natural units. (Formal Framework for a Non-Local Frequency-Based Reality, Section 2.1)

**Matter:** In CWM, matter is an \*emergent phenomenon\*, understood as stable, localized, resonant frequency patterns or wave packets within the universal medium, rather than fundamental, discrete “stuff.” (Theory of General Mechanics, Part III)

**Matter-Wave:** The concept that matter exhibits wave-like properties, as described by the de Broglie wavelength. In CWM, all matter is *fundamentally* a wave (a stable frequency pattern or wave packet). (Theory of General Mechanics, Part II)

**Maximum Information Content ( $\mathcal{I}_{max}$ ):** The derived law in GM,  $\mathcal{I}_{max} = 4\pi m^2$ , showing that the maximum information that can be associated with a variable ‘m’ (mass/frequency) is proportional to its square. This links information to the physics of gravitational limits. (Theory of General Mechanics, Section 8)

**Maximum Speed (Speed of Light):** The derived law in GM,  $L/T = 1$ , stating that the maximum speed is the system's own inherent causal processing rate (one unit of space per one unit of time). This reinterprets the speed of light as the fundamental clock speed of causality and information transfer within the cosmic computation. (Theory of General Mechanics, Section 13)

**Maxwell's Equations:** A set of four partial differential equations (Maxwell, 1865) forming the foundation of classical electromagnetism. In CWM, they describe the behavior and propagation of electromagnetic frequency patterns within the universal medium. (Physical Interpretation of Mass and Spacetime, Section 3.2)

**Measurement Effect:** In quantum mechanics, the process by which observing or interacting with a quantum system causes its wave function to collapse. CWM reinterprets this as a physical process of “resonant locking.” (Theory of General Mechanics, Part III)

**Measurement Problem:** The unresolved issue in quantum mechanics concerning how a quantum system's superposition of states ‘collapses’ into a single, definite outcome upon observation. CWM solves this with “resonant locking.” (Critiquing Quantum Discreteness Foundations, Section 3; Outline Chapter 3.3, 6.2)

**Medium-Dependent Properties:** CWM asserts properties like the speed of light and gravitational constant are emergent, medium-dependent. (Physical Interpretation of Mass and Spacetime, Section 3.2; Outline Chapter 5.3.3)

**Meson:** Any composite subatomic particle made of a quark and an antiquark. In CWM, mesons are interpreted as short-lived, unstable resonant frequency patterns formed by the interaction of a quark and antiquark frequency pattern within the universal medium. (Theory of General Mechanics, Part III)

**Meta-field:** In General Mechanics, the single, unified medium (URG) that is the ultimate source of all other distinct fields observed in the universe. (Theory of General Mechanics, Part III)

**Meta-Law of Dynamics:** The derived law in General Mechanics,  $\delta(\text{dimensionless number}) = 0$ , demonstrating that all physical laws are emergent from a single optimization principle acting on a pure number. (Theory of General Mechanics, Section 12)

**Metaphor:** A fundamental feature of the human conceptual system where abstract or unfamiliar domains are understood by mapping them onto more concrete, familiar domains rooted in embodied experience. CWM uses metaphor (e.g., “orchestra”) to structure understanding. (Treatise on Clocks and Taxonomies, Section 33.1)

**Metaphoric Matrix:** A principle within General Mechanics’ post-anthropocentric praxis advocating for the use of systemic and process-oriented metaphors over object-based ones to restructure thought. (Treatise on Clocks and Taxonomies, Section 33.3)

**Metamaterials:** Engineered materials that derive properties from their designed structure rather than composition, allowing for specific resonant responses to frequency patterns, useful for QRC architectures.

**Metric Space:** A set equipped with a distance function (metric) that defines the distance between any two elements in the set. In CWM, the emergent spacetime metric arises from the URG. (Theory of General Mechanics, Part IV)

**Microtubules:** Cylindrical protein lattices within neurons, proposed by Orch-OR theory as structures for quantum processing in the brain.

**Minimum Scale (Planck Length):** The derived law in GM,  $L_P = \sqrt{2}$ , representing the minimum possible length scale where a system’s quantum scale equals its gravitational scale. CWM reinterprets Planck scale as epistemological limit, not ontological floor. (Theory of General Mechanics, Section 13; Physical Interpretation of Mass and Spacetime, Section 3.1)

**Modified Newtonian Dynamics (MOND):** A phenomenological theory (Milgrom, 1983) that modifies Newton’s laws of gravity or inertia at extremely low accelerations to explain galactic rotation curves without dark matter. CWM explains MOND as an *effective, macroscopic force law* of the universal medium. (Physical Interpretation of Mass and Spacetime, Section 23.3)

**Molecular Vibrational and Rotational Modes:** The collective, quantized motions of constituent atoms in polyatomic molecules, each with characteristic resonant frequencies, proposed as a basis for encoding qubits in QRC.

**Momentum:** The derived law in GM,  $p = \sqrt{m^2 - m_0^2}$ , representing the component of the total variable ‘m’ (mass/frequency) that is distinct from its rest-state value. (Theory of General Mechanics, Section 10)

**Montgomery-Odlyzko Law:** An empirical law revealing that the statistical distribution of the spacings between Riemann zeros is identical to that of the eigenvalues of random Hermitian matrices from the Gaussian Unitary Ensemble (GUE). The POHC identifies this as the spectral signature of the quantum vacuum. (POHC document)

**Muon:** An unstable elementary particle, a lepton, heavier than an electron. The “Muon g-2 Anomaly” is a major test for CWM’s medium response. (Physical Interpretation of Mass and Spacetime, Section 3)

**Muon g-2 Anomaly:** A persistent discrepancy between the experimentally measured and theoretically predicted anomalous magnetic moment of the muon. CWM reinterprets this as a frequency-dependent medium response, a “dispersion measurement” of the universal medium. (Physical Interpretation of Mass and Spacetime, Section 25)

**Natural Unit Systems:** Systems of units where fundamental physical constants (e.g., the speed of light  $c$ , Planck’s constant  $\hbar$ ) are set to 1, simplifying equations and revealing fundamental relationships. CWM uses these to reveal hidden relations ( $m=\omega$ ). (Natural Units: Universe’s Hidden Code, Section 2)

**Neutrino:** A fundamental, very light, neutral lepton that interacts only via the weak force and gravity. Used in experiments to test Lorentz Violation. (Outline Chapter 8.1)

**Neutron:** A neutral subatomic particle, a baryon, found in atomic nuclei. In a frequency universe, a neutron is a complex, stable standing wave pattern resulting from the coherent interaction of three quark frequency patterns (one up, two down).

**Newtonian Physics:** See Classical Mechanics.

**Newton’s Laws of Motion:** Three fundamental laws forming the basis of classical mechanics. In CWM, emergent approximations of underlying frequency dynamics. (Theory of General Mechanics, Part I)

**Neuromorphic Computing:** A computing paradigm that seeks to build hardware mimicking the brain’s architecture of interconnected, nonlinear neurons and synapses. QRC can utilize this with ‘neuronal’ resonators. (Theory of General Mechanics, Part VII)

**Noetherian (Rewriting System):** A property of a rewriting system indicating that there are no infinite sequences of rule applications; it is “terminating.” General Mechanics’ system is hypothesized to be non-terminating, designed for ongoing evolution.

**Non-Commutative Geometry (NCG):** A mathematical framework (Connes, 1994) that describes spaces where coordinates cease to be simple numbers and instead become non-commuting operators, suggesting a fundamental fuzziness at the Planck scale. CWM may use this to describe Planck-scale granularity of the URG. (Theory of General Mechanics, Section 30.2)

**Non-confluent (Rewriting System):** A property of a rewriting system where the choice of rule application fundamentally alters the future trajectory, meaning different paths do not necessarily lead to a common final state. URG is hypothesized as non-confluent. (Theory of General Mechanics, Part IV)

**Non-determinism:** The property of a system where, given the same input or state, there can be multiple possible next states or outcomes. URG has fundamental non-determinism resolved by variational principle. (Theory of General Mechanics, Part IV)

**Non-Linear Dynamics:** A field of mathematics that studies complex, dynamic systems highly sensitive to initial conditions, often leading to seemingly random or unpredictable outcomes. Essential for modeling CWM’s universal medium. (Theory of General Mechanics, Part II)

**Non-Linear Wave Equation:** Fundamental law of motion for the universal medium in CWM. Generates stable waveforms. (Outline Chapter 5.1)

**Nonlinear Optical Materials:** Materials whose optical properties (e.g., refractive index) change in response to light intensity. They are used in QRC to create tunable, nonlinear interactions between frequency patterns.

**Non-locality:** A feature of quantum mechanics where two or more particles become linked such that measurement of one instantaneously influences the other, regardless of spatial separation. CWM explains this as intrinsic property of a single, interconnected medium. (Formal Framework for a Non-Local Frequency-Based Reality, Postulate I)

**Non-terminating (Rewriting System):** A property of a rewriting system indicating that it runs indefinitely, continuously evolving without reaching a final, stable state. URG is hypothesized as non-terminating, modeling ongoing cosmic evolution. (Theory of General Mechanics, Part IV)

**Non-trivial (Autaxic Axiom Clause):** A clause within General Mechanics' foundational axiom implying that the universe must be the simplest *non-trivial* system satisfying self-consistency conditions, invoking a principle of economy. (Theory of General Mechanics, Section 16)

**Novelty (Autaxic Trilemma):** One of the three imperatives of the Autaxic Trilemma, representing the tendency to explore new configurations, generate new information, and increase complexity. (Theory of General Mechanics, Section 16; Natural Units: Universe's Hidden Code, Section 7.1)

**Null Geodesics:** The path of light in GR. CWM critiques this as a feature of a falsified local model. (Formal Framework for a Non-Local Frequency-Based Reality, Section 3.3)

**Null Hypothesis (H<sub>0</sub>):** The prevailing paradigm of modern fundamental physics, comprising General Relativity and the Standard Model, which General Mechanics posits is foundationally incoherent. (Theory of General Mechanics, Part I)

**Observable (Quantum):** A physical property of a quantum system that can be measured. In CWM, corresponds to specific, stable resonant frequency patterns. (Critiquing Quantum Discreteness Foundations, Section 2.1)

**Observer Effect:** In quantum mechanics, the idea that the act of observation or measurement itself influences the state of the system being observed. CWM reinterprets this as the interaction between a macroscopic, coherent frequency pattern (the observer/measurement apparatus) and a microscopic, less coherent frequency pattern (the quantum system), leading to a specific resonant mode dominating.

**Occam's Razor:** A philosophical principle stating that among competing hypotheses that predict equally well, the one with the fewest assumptions should be selected. CWM aims for parsimony. (Theory of General Mechanics, Part II)

**Octonions:** The largest of the four normed division algebras, with 8 dimensions. The POHC posits that the vacuum's algebraic structure is based on Octonions, providing 8 primal algebraic degrees of freedom. (POHC document)

**Objective Reduction (OR):** A physical process proposed by Roger Penrose in Orch-OR theory, where quantum superpositions spontaneously and objectively collapse due to gravitational self-energy. CWM critiques Orch-OR's mechanism but agrees with emergent collapse. (Treatise on Clocks and Taxonomies, Section 29.1)

**Ontological Equivalence:** A philosophical assertion that two or more concepts or entities are fundamentally the same, not merely proportional or related. Core to CWM ( $m=\omega$ ). (Formal Framework for a Non-Local Frequency-Based Reality, Section 2.2)

**Ontological Fitness:** A quantifiable measure within General Mechanics (via the Autaxic Lagrangian) of how well a given state of the universe aligns with the principles of Autaxys (Persistence, Efficiency, Novelty), guiding its evolution. (Theory of General Mechanics, Section 16)

**Ontological Truth:** A fundamental feature of reality itself, as opposed to an epistemological limit of our knowledge. (Physical Interpretation of Mass and Spacetime, Section 3.1)

**Ontology:** The study of being or existence; a philosophical framework that defines the fundamental nature of reality. CWM proposes process-based ontology. (Theory of General Mechanics, Part III)

**Operant Intentionality:** A phenomenological concept (Merleau-Ponty) describing the body's primary and pre-reflexive engagement with the world, establishing a dynamic rapport that precedes abstract thought. CWM integrates this into epistemology. (Treatise on Clocks and Taxonomies, Section 33.2)

**Operator (Quantum):** A mathematical entity that acts on a quantum state to yield a new state or a measured value (observable). CWM critiques as abstract epicycle. (Critiquing Quantum Discreteness Foundations, Section 2.1; Outline Chapter 3.1)

**Orchestrated Objective Reduction (Orch OR):** A theory of consciousness proposed by Roger Penrose and Stuart Hameroff, suggesting consciousness arises from quantum computations in microtubules terminated by objective reduction. CWM critiques it but incorporates its principles. (Treatise on Clocks and Taxonomies, Section 29.1)

**Origin of Mass:** The derived law in GM,  $m \in \{\text{solutions to } \delta S = 0\}$ , stating that the existence of matter is a mathematical necessity of the system's own dynamics. (Theory of General Mechanics, Section 13)

**Oscillation:** Repetitive variation, typically in time, of some measure about a central value or between two or more different states. The fundamental basis of a frequency universe. (Theory of General Mechanics, Part II)

**Pair Production:** The creation of a particle and its antiparticle from a photon or other neutral boson. In CWM, spontaneous formation of complementary frequency patterns. (Theory of General Mechanics, Part I)

**Parallel Processing:** A method of computing where multiple calculations or processes are executed simultaneously. In QRC, inherent due to continuous medium. (Theory of General Mechanics, Part VII)

**Parametric Excitation:** A phenomenon where a system's oscillation is induced or amplified by modulating a system parameter at a specific frequency, typically twice its natural resonant frequency. Used in QRC. (Theory of General Mechanics, Part VII)

**Parametric Oscillator-Based Amplification:** A highly effective readout strategy in QRC that involves using a second parametric oscillator as a pre-amplifier to amplify small quantum signals into large, measurable classical signals. (Theory of General Mechanics, Part VII)

**Parametron:** An early computing device invented by Eiichi Goto in 1954. It encoded binary states by exploiting the stable phase of oscillation within a resonant circuit, serving as a historical precursor to QRC. (Theory of General Mechanics, Part VII)

**Particle Generations:** The existence of three distinct sets of fundamental fermions (e.g., electron, muon, tau) in the Standard Model. In CWM, fundamental frequency patterns at different 'harmonic' states. (Theory of General Mechanics, Part IV)

**Particle (in CWM):** An *emergent phenomenon* understood as a localized, stable, resonant pattern (e.g., a wave packet or soliton) within the dynamic medium, rather than a fundamental, discrete object. (Outline Chapter 4.2.1)

**Path Integral Formulation:** A formulation of quantum mechanics that expresses the probability amplitude for a particle to go from one point to another as a sum over all possible paths between the points. In CWM, reinterpreted as summation over all possible frequency evolutions. (Theory of General Mechanics, Part II)

**Pathology (in CWM):** A loss of coherence, coordination, or harmony within a nested biological system. Disease is systemic dissonance. (Treatise on Clocks and Taxonomies, Section 6.1)

**Pattern Graph Schemata:** Meta-rules for rewriting systems, allowing operations on structures of arbitrary size. Used in URG. (Theory of General Mechanics, Part IV)

**Perceptron:** A foundational concept in artificial intelligence, a type of artificial neural network exhibiting parallels in its operational principles with QRC's frequency-based interactions. (Theory of General Mechanics, Part VII)

**Persistence (Autaxic Trilemma):** One of the three imperatives of the Autaxic Trilemma, representing the tendency for stable, self-reinforcing patterns and processes to endure over time. (Theory of General Mechanics, Section 16; Natural Units: Universe's Hidden Code, Section 7.1)

**Phase (Wave):** The position of a point in time (or space) on a waveform cycle relative to another point. Crucial for understanding interference, coherence, and information encoding in CWM. (Theory of General Mechanics, Part II)

**Phase Encoding:** A method in QRC using phase of quantum oscillation for binary info. (Theory of General Mechanics, Part VII)

**Phase Factor:** A complex number (phasor) whose phase is determined by the action of a particular history in the sum-over-histories formulation. Dictates interference. (Theory of General Mechanics, Part II)

**Phase Space:** A multi-dimensional space in which all possible states of a system are represented, with each possible state corresponding to one unique point in the phase space. In CWM, describes range of possible frequency patterns. (Theory of General Mechanics, Part II)

**Phased Arrays:** Arrays of antennas or transducers that can steer a beam of energy by controlling the relative phases of signals emitted from each element. Used in QRC for frequency patterns. (Theory of General Mechanics, Part VII)

**Phenomenological Ground:** A principle within General Mechanics' post-anthropocentric praxis that grounds communication in direct, present-moment experience to dissolve the subject-object dualism. (Treatise on Clocks and Taxonomies, Section 33.3)

**Phi ( $\Phi$ ) (in IIT):** In Integrated Information Theory (IIT), a measure of integrated information, quantifying the extent to which a system's causal structure is irreducible to the sum of its parts. (Note: This refers specifically to the IIT concept, not the golden ratio.)

**\*\*Phi ( $\phi$ , the Golden Ratio):\*\*** Mathematically the "most irrational" number, approximately 1.618. In POHC, it acts as a fundamental stability modulus, organizing the vacuum's harmonic structure to prevent resonant collapse, thereby allowing for stable, hierarchical complexity at the "edge of chaos." (POHC document)

**Phonon:** A collective excitation in a periodic, elastic arrangement of atoms or molecules, such as in solids and some liquids. Analogous to photons, they are quantized vibrations, relevant for acoustic/phononic systems.

**Photon:** The quantum of the electromagnetic field, the elementary particle of light and all other forms of electromagnetic radiation. In CWM, a discrete, localized, self-propagating frequency pattern of the universal medium. Its mass is frequency-dependent. (Physical Interpretation of Mass and Spacetime, Section 5; Formal Framework for a Non-Local Frequency-Based Reality, Section 2.3)

**Physical Determinism of the Prime Numbers:** A foundational document outlining the POHC's claim that prime numbers are the spectral signature of the quantum vacuum.

**Physical Interpretation of Mass and Spacetime:** A foundational document outlining CWM's model of gravity as refraction and its reinterpretation of mass.

**Physics (in CWM):** The study of the emergent properties and dynamics of the Universal Relational Graph (URG) and its frequency patterns. (Theory of General Mechanics, Part III)

**Planck Area:** The square of the Planck length ( $l_P^2$ ), which defines the ultimate "pixel size" for information storage on the holographic screen according to the Holographic Principle. (Physical Interpretation of Mass and Spacetime, Section 27.1)

**Planck-Einstein Relation ( $E = h\nu$ ):** A fundamental equation (Planck, 1900; Einstein, 1905) in quantum mechanics that quantifies the energy of a quantum of light (photon) in terms of its frequency, with Planck's constant as the proportionality factor. Foundational for mass-frequency identity. (Formal Framework for a Non-Local Frequency-Based Reality, Postulate II)

**Planck's Constant ( $h$ ):** A fundamental physical constant that relates the energy of a quantum of light (photon) to its frequency. In CWM, a key proportionality factor establishing quantized nature of energy and fundamental relations. (Natural Units: Universe's Hidden Code, Section 1.2)

**Planck Length:** An unimaginably small distance (approx.  $1.6 \times 10^{-35}$  meters) derived from fundamental constants. CWM interprets as *epistemological limit*, not ontological floor. (Physical Interpretation of Mass and Spacetime, Section 3.1; Formal Framework for a Non-Local Frequency-Based Reality, Section 13)

**Planck Mass:** The unit of mass in the system of natural units known as Planck units. In CWM, represents highest possible mass for a single fundamental frequency coherent pattern. (Natural Units: Universe's Hidden Code, Section 2.4.1)

**Planck Scale:** The energy, length, and time scales at which quantum gravitational effects are expected to become significant. CWM interprets as region where classical continuum models break down. (Physical Interpretation of Mass and Spacetime, Section 3.1)

**Planck Time ( $t_p$ ):** The smallest possible meaningful unit of time. Interpreted as period of highest fundamental frequency. (Natural Units: Universe's Hidden Code, Section 2.4.1)

**POHC (Prime Harmonic Ontological Construct):** A comprehensive synthesis of a novel theoretical framework that posits a universe built on a single, unified, computational, and resonant process, where the quantum vacuum acts as a universal resonator whose properties are fundamentally constrained by  $\pi$  and  $\phi$ . (POHC document)

**Point-Like Particles:** The traditional conception of fundamental particles as dimensionless points in space. Challenged by CWM's process ontology. (Outline Chapter 4.2.1)

**Potential Energy:** The energy an object possesses due to its position or configuration. In CWM, energy stored in configuration of frequency patterns. (Theory of General Mechanics, Part II)

**Prime Harmonic Hypothesis (PHH):** A hypothesis within the POHC stating that the idealized mass-frequencies of fundamental fermions (quarks and leptons) are not arbitrary but follow a geometric progression relative to the electron:  $m_f / m_e = \phi^p$ , where  $p$  is a prime number, the "Harmonic Index." (POHC document)

**Principle of Harmonic Closure:** A foundational document outlining the POHC's derivation of the fine-structure constant and particle mass spectrum.

**Probabilistic Landscape:** The range of possible outcomes for a system, each with an associated probability. CWM focuses on characterizing this landscape due to computability limits. (Theory of General Mechanics, Part II)

**Process Ontology:** A philosophical view that reality is fundamentally dynamic and that change and becoming are the primary, irreducible features of reality, rather than static substances. Core of CWM. (Theory of General Mechanics, Section 14)

**Product of Hyperbolic Tangents of Spectral Gaps:** A global stability metric of the form  $\prod_i \tanh(\lambda_i)$ , where  $\lambda_i$  are eigenvalues of the hypergraph Laplacian. In CWM, suggests hyperbolic emergent geometry. (Theory of General Mechanics, Part IV)

**Problem of Time:** An issue in quantum gravity where time often disappears from the fundamental equations. CWM suggests time is emergent. (Theory of General Mechanics, Part IV)

**Proto-properties:** In General Mechanics (drawing from related formalisms), fundamental, quantized attributes assigned to the Universal Relational Graph (URG)'s primitive elements (vertices and hyperedges), from which all observable physical properties are claimed to emerge. (Theory of General Mechanics, Part III)

**Proton:** A stable, positively charged subatomic particle, a baryon, found in atomic nuclei. In CWM, complex, stable standing wave pattern of quark frequencies. (Theory of General Mechanics, Part III)

**Proton Radius Puzzle:** A persistent discrepancy in the measured size of the proton. The POHC interprets this as a fundamental challenge to QED calculations or lepton-proton interactions, requiring a deeper understanding of particle substructure or modified interactions with the vacuum medium. (POHC document)

**Provocation (Einstein):** Einstein's simplicity mandate challenges current complexity. (Outline Chapter 1.1.2)

**Pulsars:** Highly magnetized, rotating neutron stars. Type I-C systems in Resonant Complexity Framework. (Treatise on Clocks and Taxonomies, Section 3.3)

**Qualia:** The intrinsic, subjective, first-person informational states or phenomenal qualities of conscious experience. In CWM, the intrinsic feel of information integrated in a conscious resonant pattern. (Treatise on Clocks and Taxonomies, Section 28.1)

**Quantization (in CWM):** The process by which a physical quantity is restricted to discrete values. In CWM, arises from the inherent resonant properties and impedance of the universal medium, forcing energy and patterns into stable, discrete modes; an \*emergent property of stability\*, not fundamental. (Outline Chapter 4.3)

**Quantization Tension:** A new physical principle within the POHC where the system "snaps" from an ideal continuous  $\phi^p$  value to the nearest stable, discrete harmonic state, explaining small deviations in particle masses. (POHC document)

**Quantum (in CWM):** A discrete, irreducible unit or excitation of a field. In CWM, a stable frequency pattern. (Theory of General Mechanics, Part III)

**Quantum Biology:** Field investigating quantum phenomena in biology. Supports CWM's integration of life and physics. (Treatise on Clocks and Taxonomies, Section 28.2)

**Quantum Coherence:** Wave function maintains definite phase relationship. CWM requires this for pattern formation, especially in consciousness. (Treatise on Clocks and Taxonomies, Section 26.1)

**Quantum Chromodynamics (QCD):** Theory of strong nuclear force. In CWM, describes nonlinear resonant dynamics of quark confinement. (Theory of General Mechanics, Part IV)

**Quantum Decoherence:** Loss of quantum properties due to environmental interaction. In CWM, dissipation of stable phase relationships due to noisy environment. (Theory of General Mechanics, Part IV)

**Quantum Dots and Artificial Atoms:** Nanoscale semiconductor structures. QRC candidates. (Theory of General Mechanics, Part VII)

**Quantum Electrodynamics (QED):** Relativistic quantum field theory of electromagnetism. In CWM, details precise frequency interactions. (Theory of General Mechanics, Part IV)

**Quantum Error Correction (QEC):** Schemes to protect quantum information. CWM-QRC offers intrinsic robustness. (Theory of General Mechanics, Part VII)

**Quantum Entanglement:** Particles linked regardless of distance. In CWM, instantaneous phase-coupling or resonant alignment of interconnected frequency patterns. (Critiquing Quantum Indeterminism's Foundations, Section 3.1)

**Quantum Field Theory (QFT):** Theoretical framework merging QM, SR, and classical field theory. CWM critiques QFT's abstract vacuum and volumetric information postulate. (Physical Interpretation of Mass and Spacetime, Section 5)

**Quantum Flux Parametron (QFP):** Superconducting device using subharmonic phase-locking. QRC precursor. (Theory of General Mechanics, Part VII)

**Quantum Gravity:** Hypothetical field uniting gravity and QM. CWM is a candidate theory. (Theory of General Mechanics, Part I)

**Quantum Harmonic Oscillator (QHO):** Idealized quantum system. Theoretical basis for QRC. (Theory of General Mechanics, Part VII)

**Quantum Jumps:** Abrupt transitions between energy states. In CWM, rapid, discrete shifts in resonant frequency patterns. (Theory of General Mechanics, Part III)

**Quantum-Limited Measurement:** Measurement techniques pushing to quantum limits. Essential for QRC. (Theory of General Mechanics, Part VII)

**Quantum Logic Gate:** Basic quantum circuit. In QRC, reinterpreted as engineered nonlinear interaction between frequency patterns. (Theory of General Mechanics, Part VII)

**Quantum Mechanics (QM):** Fundamental theory for atomic/subatomic behavior. In CWM, an \*emergent, statistical description\* of underlying probabilistic frequency dynamics of the URG. (Theory of General Mechanics, Introduction)

**Quantum Measurement Problem:** How superposition collapses to single outcome. CWM solves this with "resonant locking." (Critiquing Quantum Discreteness Foundations, Section 3; Outline Chapter 3.3, 6.2)

**Quantum Non-Demolition (QND) Measurement:** Determines system state without disturbing it. Used in QRC. (Theory of General Mechanics, Part VII)

**Quantum Plenum:** Concept in CWM describing dynamic, energetic substrate constituting vacuum. (Outline Chapter 4.1.1)

**Quantum Resonance Computing (QRC):** Novel computational paradigm leveraging continuous, wave-like nature of reality. (Theory of General Mechanics, Part VII; Treatise on Clocks and Taxonomies, Section 31)

**Quantum State:** Mathematical description of quantum system. In CWM, configuration of frequency and phase relationships within universal medium. (Theory of General Mechanics, Part III)

**Quantum Tunneling:** Particle passes through energy barrier. In CWM, frequency pattern "leaking" through impedance barrier. (Theory of General Mechanics, Section 22.4)

**Quantum Vacuum:** Lowest energy state of a quantum field. In CWM, a dynamic, active, and information-rich universal medium. (Natural Units: Universe's Hidden Code, Section 4.2)

**Quantum Vacuum's Harmonic Order:** A foundational document outlining the POHC's identification of the quantum vacuum as the universal resonator whose spectral signature is the Riemann zeros.

**Quantum Viscosity:** Hypothetical intrinsic 'graininess' or 'quantum friction' of the quantum vacuum. (Theory of General Mechanics, Part II)

**Quark Confinement:** Quarks never observed in isolation. Explained by nonlinear resonant behavior of strong force in CWM. (Theory of General Mechanics, Section 22.3)

**Quark:** Fundamental elementary particle. In CWM, fundamental, confined frequency patterns within composite particles. (Theory of General Mechanics, Part III)

**Qubit:** Basic unit of quantum information. QRC conceptualizes as tunable, stable resonant frequency pattern. (Theory of General Mechanics, Part VII)

**Radin, Dean:** Researcher in consciousness studies, whose work on RNGs and consciousness is relevant to CWM's consciousness postulate.

**Random Number Generators (RNGs):** Devices producing random sequences. CWM speculatively offers a physical mechanism for anomalous correlations with consciousness. (Treatise on Clocks and Taxonomies, Section 28.3)

**Reduced Planck Constant ( $\hbar$ ):** Planck's constant divided by  $2\pi$ . Used in fundamental relations in natural units. (Natural Units: Universe's Hidden Code, Section 1.2)

**Refractive Index:** Measure of how light propagates through a medium. In CWM, locally altered by mass-energy, forming basis of gravity model. (Physical Interpretation of Mass and Spacetime, Section 6)

**Relational (in CWM):** Properties and existence defined by relationships/interactions between elements. (Theory of General Mechanics, Part III)

**Relativity (Special/General):** See Special/General Relativity.

**Renormalization:** Mathematical procedure to remove infinities in QFT. CWM reinterprets as a process of 'coherence filtering'. (Theory of General Mechanics, Part II)

**Renormalization Group (RG):** A mathematical framework in QFT describing how physical parameters (like coupling constants) change with the energy scale. In POHC, RG corrections are applied to the bare value of  $\alpha$  at the Planck scale to obtain its low-energy value. (POHC document)

**Reservoir Computing:** Neuromorphic paradigm using nonlinear dynamical system. QRC can function as a quantum reservoir. (Theory of General Mechanics, Part VII)

**Resonance Cascade:** Chain reaction of resonant interactions. Leads to complexity in QRC. (Theory of General Mechanics, Part II)

**Resonance Spectroscopy:** Measures system's response to external signal to get spectrum. Used in QRC readout. (Theory of General Mechanics, Part VII)

**Resonance (in CWM):** Phenomenon where a system oscillates with maximum amplitude at certain frequencies. Key principle for energy transfer, pattern formation, and stability of particles. (Treatise on Clocks and Taxonomies, Chapter 2)

**Resonant Complexity Framework:** Novel taxonomic framework unifying all phenomena, from particles to organisms, based on continuous spectrum of resonant complexity. (Treatise on Clocks and Taxonomies, Abstract)

**Resonant Locking:** CWM's physical mechanism for wave function collapse, where two wave systems deterministically settle into a new, stable, shared resonance. (Outline Chapter 6.2.2)

**Riemann Hypothesis:** A mathematical conjecture stating that all non-trivial zeros of the Riemann Zeta function lie on the critical line with real part  $1/2$ . The POHC claims to provide a physicalist resolution to this hypothesis. (POHC document)

**Riemann Zeta Function:** A complex function of central importance in number theory, whose non-trivial zeros are conjectured to lie on the critical line. Its zeros are identified as the spectral signature of the quantum vacuum in POHC. (POHC document)

**Riemannian Manifold:** A smooth manifold equipped with a Riemannian metric, allowing for the measurement of distances and angles. In CWM, the smooth, continuous spacetime of General Relativity is hypothesized to emerge as a macroscopic approximation of the discrete, dynamic Universal Relational Graph (URG), potentially as a Riemannian (or Lorentzian) manifold.

**Ruliad:** In Wolfram Physics Project, entangled abstract object encompassing all computational rules. GM aims to select a specific universe from this via Autaxys. (Theory of General Mechanics, Part IV)

**Scharnhorst Effect:** Hypothetical prediction that photons travel faster in Casimir cavity. Theoretical proof-of-concept for vacuum engineering in CWM. (Physical Interpretation of Mass and Spacetime, Section 3.2; Outline Chapter 32.1)

**Schrödinger Equation:** Mathematical equation for quantum state evolution. CWM reinterprets as describing evolution of frequency patterns. (Theory of General Mechanics, Part I)

**Schrödinger-Poisson Equations:** Coupled equations for ultralight dark matter. Aligns with CWM's wave nature of galactic halos. (Physical Interpretation of Mass and Spacetime, Section 23.1)

**Schumann Resonances:** Global electromagnetic resonances in Earth's atmosphere. QRC could leverage as ambient frequencies. (Theory of General Mechanics, Part VII)

**Second Law of Thermodynamics:** Entropy non-decreasing. In CWM, macroscopic expression of computation's logical irreversibility. (Theory of General Mechanics, Section 12)

**Self-Consistency:** Foundational principle in GM. Identified with existence. (Theory of General Mechanics, Section 13)

**Self-Organization:** System spontaneously forms organized structure. In CWM, arises from nonlinear interactions and resonant feedback loops. (Theory of General Mechanics, Part III)

**Selberg Trace Formula:** Powerful mathematical tool relating Laplacian spectrum to geodesics. In CWM, suggests hyperbolic emergent geometry. (Theory of General Mechanics, Part IV)

**Semi-harmonics:** Frequencies not simple integer multiples of fundamental. In QRC, represent noise and error, or computational resources. (Treatise on Clocks and Taxonomies, Section 31.7)

**SH0ES Team:** Measures local Hubble constant. Their discrepancy (Hubble Tension) is key anomaly for CWM. (Physical Interpretation of Mass and Spacetime, Section 3)

**Shortcuts to Adiabaticity (STA):** Quantum control techniques for fast, precise manipulation. Crucial for QRC. (Theory of General Mechanics, Part VII)

**Sigma-8 Tension:** A discrepancy in the  $\Lambda$ CDM model quantifying the amplitude of matter fluctuations on an 8-megaparsec scale, where early-universe predictions of clumpiness conflict with late-universe observations. (POHC document)

**Simplicity (Autaxic Axiom Clause):** Implies the universe is the *simplest* non-trivial system. (Theory of General Mechanics, Section 16)

**Singularity (Physics):** Point of infinite density/curvature. In CWM, extreme concentration of frequency patterns, breakdown of normal spacetime. (Theory of General Mechanics, Part II)

**Single-Pushout (SPO):** One of the primary algebraic formalisms for defining graph (or hypergraph) rewriting rules, simpler and more permissive than DPO. General Mechanics' URG dynamics could be defined by this approach.

**Skyrmions:** Topological solitons that arise in the theory of pions and are used to construct models of baryons like protons and neutrons, serving as an example of particle-like entities emerging from field theories.

**Socratic Turn:** Principle in GM's post-anthropocentric praxis advocating for inquisitive communication. (Treatise on Clocks and Taxonomies, Section 33.3)

**Soliton:** Self-reinforcing, localized wave emerging from nonlinear equations. Key candidate for fundamental particle representations in CWM. (Theory of General Mechanics, Section 19)

**Solvable Sectors:** Restricted classes of initial states, rewrite rules, or parameter values within a complex system for which its evolution becomes analytically or computationally tractable. Studying these simplified cases can provide insights into the full system's behavior in General Mechanics.

**Space (in CWM):** An *emergent property* of the dynamic medium. Dimensions correspond to degrees of freedom in the URG. (Theory of General Mechanics, Section 20)

**Space-Like Separated:** Events too far apart for light to connect. Relevant for non-locality. (Critiquing Quantum Indeterminism's Foundations, Section 3.4)

**Spacetime (in CWM):** An *emergent property* of the dynamic, interacting frequency patterns of the universal medium. (Theory of General Mechanics, Section 20)

**Spacetime Curvature:** See Curvature of Spacetime.

**Spacetime Scale:** The derived law in GM,  $L = T = \frac{1}{m}$ , showing characteristic scales of Space and Time are derived as inverse of 'm'. (Theory of General Mechanics, Section 7)

**Special Relativity (SR):** Einstein's theory. CWM considers SR an *emergent approximation* valid at scales where underlying frequency dynamics average out. (Theory of General Mechanics, Part I)

**Spectral Diffusion:** Phenomenon where quantum dot resonant frequencies fluctuate. (Theory of General Mechanics, Part VII)

**Spectral Gap:** Difference between consecutive eigenvalues of hypergraph Laplacian. Quantifies URG structural stability. (Theory of General Mechanics, Part IV)

**Spin (Physics):** Intrinsic angular momentum. In CWM, a fundamental, quantized rotational or helical frequency pattern. (Theory of General Mechanics, Part III)

**Spin Foam:** In LQG, higher-dimensional structure representing history of quantum spacetime. (Theory of General Mechanics, Part IV)

**Spin Networks:** In LQG, graphs describing quantized "chunks" of space. (Theory of General Mechanics, Part IV)

**Spontaneous Symmetry Breaking:** System's underlying laws possess symmetry, but ground state does not. CWM suggests this for emergent symmetries. (Theory of General Mechanics, Part IV)

**Standard Model of Particle Physics:** Describes fundamental particles/forces. In CWM, a classification system for stable resonant patterns. Its anomalies are key targets. (Physical Interpretation of Mass and Spacetime, Part I)

**Standing Wave:** Stationary wave pattern. Many fundamental particles modeled as stable standing waves in CWM. (Theory of General Mechanics, Section 19)

**Statistical Category Error:** Planck's flaw of applying discrete counting to continuous energy. (Outline Chapter 2.2.2)

**Statistical Independence:** Assumption in Bell's Theorem that detector settings aren't correlated with particle properties. Rejected by Superdeterminism. (Critiquing Quantum Indeterminism's Foundations, Section 7.1)

**Stochastic Electrodynamics (SED):** Explains quantum phenomena classically via background ZPF. CWM critiques its failures but learns from its successes. (Critiquing Quantum Discreteness Foundations, Section 4.3; Outline Chapter 7.1)

**Stoney Units:** Historically significant natural units. (Natural Units: Universe's Hidden Code, Section 2.6.1)

**Strong CP Problem:** A problem in QCD concerning why the strong nuclear force does not violate CP symmetry, despite being allowed by the theory. The POHC resolves this as a consequence of the system's inherent self-consistency, where the  $\theta$  parameter in QCD must be zero. (POHC document)

**Subject-Object Split:** Foundational dualism in Western philosophy. CWM aims to dissolve this. (Treatise on Clocks and Taxonomies, Section 33.3)

**Sum-over-Histories Formulation:** Quantum mechanical approach. CWM adopts to describe URG's probabilistic evolution. (Theory of General Mechanics, Part II)

**Superconducting Circuits:** Electronic circuits exhibiting quantum properties. QRC candidate. (Theory of General Mechanics, Part VII)

**Superdeterminism:** Preserves local, deterministic reality by rejecting statistical independence. CWM critiques its complexity tax. (Critiquing Quantum Indeterminism's Foundations, Section 7.1; Outline Chapter 7.3.3)

**Superposition:** Quantum principle of existing in multiple states. In CWM, a diffuse, non-localized excitation of a quantum field where multiple frequency patterns coexist. (Theory of General Mechanics, Part I)

**Symmetry (Physics):** Property remaining unchanged under transformation. In CWM, reflects underlying regularities and constraints on frequency patterns. (Theory of General Mechanics, Part III)

**Tau (Particle):** Unstable lepton. Its anomalous magnetic moment is a key test for CWM. (Physical Interpretation of Mass and Spacetime, Section 25.2; Outline Chapter 8.2)

**Temperature:** Average kinetic energy. In CWM, reflects average kinetic energy of collective frequency patterns. (Theory of General Mechanics, Part II)

**Tensor Calculus:** Complex mathematics of GR. CWM replaces with simpler wave propagation math. (Outline Chapter 3.4)

**Theoretical Development (CWM):** Urgent focus on unified non-linear wave equations. (Outline Chapter 9.1)

**Thermodynamics:** Physics of heat and energy. In CWM, describes large-scale behavior of frequency patterns. (Theory of General Mechanics, Part III)

**Time Field:** Theoretical concept of time as dynamic field. Some theories link to Hubble Tension. (Physical Interpretation of Mass and Spacetime, Section 3.2)

**Time (in CWM):** An *emergent property* of the universe's computational process, representing the irreversible unfolding of cosmic computation ( $T = 1/m$ ). (Theory of General Mechanics, Section 20)

**Time Dilation:** Predicted by relativity. In CWM, local stretching/compression of fundamental frequency rates of universal medium. (Physical Interpretation of Mass and Spacetime, Section 8; Outline Chapter 5.3.3.1)

**Time-Energy Uncertainty:** Relates uncertainty in energy to time. CWM uses this to show time is not rigid background. (Theory of General Mechanics, Section 22.4)

**Topological Property/Charge:** Characteristic of field configurations that ensures stability. In CWM, ensures robustness of frequency patterns. (Theory of General Mechanics, Part IV)

**Topological Quantum Computing (TQC):** Radical QC approach encoding info in topological properties. QRC offers alternative. (Theory of General Mechanics, Part VII)

**Trans-physical:** Realm beyond conventional physical space. Holographic Principle suggests this. (Physical Interpretation of Mass and Spacetime, Section 27.3)

**Transactional Interpretation (TIQM):** Uses advanced/retarded waves to resolve quantum paradoxes. CWM critiques its complexity. (Critiquing Quantum Indeterminism's Foundations, Section 7.2; Outline Chapter 7.3.4)

**Transducer:** Device converting energy. Used in QRC. (Theory of General Mechanics, Part VII)

**Treatise on Clocks and Taxonomies:** Document outlining Resonant Complexity Framework. Integrated for concepts of clocks, emergent complexity, consciousness.

**Tubulin Protein Subunits:** Protein components of microtubules. Proposed by Orch-OR theory as qubits. (Treatise on Clocks and Taxonomies, Section 29.1)

**Tunable Lasers:** Lasers whose output wavelength can be adjusted. Used in QRC. (Theory of General Mechanics, Part VII)

**Turing Complete:** Property of computational system simulating any algorithm. Wolfram Physics Project's Rule 110 is Turing complete. (Theory of General Mechanics, Section 22.6)

**Ultralight Dark Matter (ULDM):** Extremely light bosonic particles behaving as coherent waves. CWM incorporates as wave nature of galactic halos. (Physical Interpretation of Mass and Spacetime, Section 23.1)

**Ultraviolet Catastrophe:** Classical physics prediction of infinite power at short wavelengths. CWM traces quantization to methodological shortcut resolving this. (Critiquing Quantum Discreteness Foundations, Section 2.1; Outline Chapter 2.1)

**Unification (Physics):** Effort to describe all forces/particles within single framework. Core goal of CWM. (Theory of General Mechanics, Part I)

**Unified Field Theory (UFT):** Theoretical framework unifying all fundamental forces/particles. GM aims to be one. (Theory of General Mechanics, Part IV)

**Unified Non-Linear Wave Equation:** Core theoretical development for CWM's universal medium. (Outline Chapter 5.1)

**Universal Hamiltonian ( $\hat{H}_U$ ):** In General Mechanics, total energy/dynamics of URG. In POHC, identified as the Hilbert-Pólya operator, whose eigenvalues are the Riemann zeros. (Theory of General Mechanics, Part II; POHC document)

**Universal Medium:** Single, continuous, dynamic, energetic substrate for all physical phenomena in CWM. (Outline Chapter 4.1)

**Universal Relational Graph (URG):** In General Mechanics, fundamental evolving network of abstract relationships constituting dynamic, computational medium. (Theory of General Mechanics, Part II)

**Unruh Effect:** Accelerating observer perceives vacuum as thermal bath. Supports inertia as interaction with vacuum fluctuations. (Theory of General Mechanics, Section 22.1)

**Vacuum Energy:** Energy density of vacuum. In CWM, relates to universal medium's background oscillations. (Theory of General Mechanics, Section 9)

**Vacuum Engineering:** Manipulating vacuum properties (e.g., permittivity, permeability). CWM suggests this is possible, with implications for advanced propulsion. (Theory of General Mechanics, Section 32)

**Vacuum Permeability ( $\mu_0$ ):** Physical constant quantifying vacuum's permission of magnetic field. Determines speed of light. (Physical Interpretation of Mass and Spacetime, Section 3.2)

**Vacuum Permittivity ( $\epsilon_0$ ):** Physical constant quantifying vacuum's resistance to electric field. Determines speed of light. (Physical Interpretation of Mass and Spacetime, Section 3.2)

**Vacuum Polarization:** The process in quantum electrodynamics where a strong electric field creates virtual electron-positron pairs that briefly separate and then annihilate. CWM reinterprets this as the energy-dependent modification of the vacuum's effective impedance due to the screening effect of virtual particles. (Physical Interpretation of Mass and Spacetime, Section 25.1; POHC document)

**Variational Free Energy:** Minimized by self-organizing systems. FEP. (Theory of General Mechanics, Part III)

**Variational Principle:** Mathematical principle deriving dynamics by minimizing/maximizing action. Governs URG evolution. (Theory of General Mechanics, Part II)

**Variable Speed of Light (VSL) Cosmologies:** Theories where speed of light was higher in early universe. CWM leverages as precedent for evolving constants. (Physical Interpretation of Mass and Spacetime, Section 24.1)

**Velocity:** Rate of position change. In CWM, rate and direction of propagation of frequency patterns. (Theory of General Mechanics, Part II)

**Virtual Particles:** Transient, fleeting interactions within quantum vacuum. In CWM, momentary, unstable excitations of vacuum's frequency field. (Theory of General Mechanics, Part I)

**Von Neumann Bottleneck:** CPU/memory bottleneck in traditional computers. QRC aims to overcome. (Theory of General Mechanics, Part VII)

**W and Z Bosons:** Mediate weak nuclear force. In CWM, specific, short-lived resonant frequency patterns. (Theory of General Mechanics, Part III)

**Wave Equation:** Describes wave propagation. Central to modeling frequency patterns in CWM. (Theory of General Mechanics, Part II)

**Wave Function ( $\Psi$ ):** Mathematical description of quantum state. In CWM, describes amplitude and phase of frequency patterns. (Theory of General Mechanics, Part I)

**Wave Packet:** Localized 'lump' of wave energy. All particles understood as stable wave packets in CWM. (Theory of General Mechanics, Section 19)

**Wave-Particle Duality:** Quantum concept. CWM resolves by stating all matter/energy is *fundamentally* a wave. (Theory of General Mechanics, Section 14; Outline Chapter 4.2.1, 6.1)

**Wavelength ( $\lambda$ ):** Spatial period of a wave. Characterizes frequency patterns. (Theory of General Mechanics, Part II)

**Weak Nuclear Force:** Responsible for radioactive decay. In CWM, describes specific interaction between frequency patterns. (Theory of General Mechanics, Part III)

**WIMP (Weakly Interacting Massive Particle):** A hypothetical class of particles that are candidates for dark matter, interacting only through gravity and the weak nuclear force.

**Wolfram Physics Project (WPP):** Models reality as hypergraph evolution. CWM uses its formalism for the URG. (Theory of General Mechanics, Section 30.1)

**Yang-Mills Mass Gap Problem:** A Millennium Prize Problem in mathematics and physics concerning the existence of a mass gap in Yang-Mills theory. The POHC claims to resolve this by reinterpreting “mass gap” as an emergent environmental effect of confinement, arising from the medium’s impedance to low-frequency color-charged modes, rather than a fundamental property of the underlying gapless medium. (POHC document)

**Zero-Point Energy:** Lowest possible energy of quantum system. In CWM, fundamental energetic foundation of frequency universe. (Theory of General Mechanics, Part III)

**Zero’s Journey: From Math to Physics:** A foundational document outlining the POHC’s concept of “asymptotic zero.”

**Zitterbewegung:** “Trembling motion” of electron. In CWM, fundamental “computational clock cycle” of elementary particle, underpinning  $m=\omega$ . (Physical Interpretation of Mass and Spacetime, Section 4; Natural Units: Universe's Hidden Code, Section 4.1)

## Bibliography |

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Of course. Here is the comprehensive bibliography generated from all the provided documents, with full citations for the referenced works and a complete list of the internal documents that form the basis of the theory. |

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