Magnetic Space Cosmology: From Quantum Entanglement to Gravity, an Integrated Reinterpretation of Physical Reality

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Abstract

Modern physics stands on two great pillars, General Relativity and Quantum Mechanics, yet fundamental challenges such as the quantum measurement problem, quantum gravity, and dark matter/energy remain unresolved. This paper originates from the premise that these problems may stem from our conventional views on 'space' and 'interaction', and proposes a new theoretical paradigm: **Magnetic Space Cosmology (MSC)**. MSC postulates that the universe is fundamentally filled with an energy-less medium called **'Magnetic Space (M)'**, that all physical entities are topological clusters of **'elemental charges'**, and that all interactions are mediated through the **'Magnetic Wave (MW)'** generated by the motion of these entities in M and through changes in M's local **'Magnetic Density (ρ_M)'**. Within this integrated framework, quantum entanglement is reinterpreted as the manifestation of 'phase information' in correlated Magnetic Waves, gravity as a 'weakening' phenomenon of Magnetic Density, and other forces like electromagnetism and the strong force as the direct action of Magnetic Waves. MSC moves beyond the abstraction of existing theories to offer a more causal and intuitive picture of the universe, opening a path toward a fundamental understanding of the nature of physical reality.

Keywords: Gravity, Quantum Entanglement, Quantization, Unified Theory, Magnetic Space Cosmology (MSC), Double-Slit Experiment, Electromagnetism, Wave-Medium Interaction, Causal Interpretation, Foundations of Physics.

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1 Introduction: Cracks in Modern Physics and the Need for a New Paradigm

The two great achievements of 20th-century physics, General Relativity (GR) governing the macroscopic world and Quantum Mechanics (QM) describing the microscopic world, are monumental triumphs of human intellect. However, behind their dazzling success lies a deep 'fissure'—a fundamental incompatibility that prevents their unification, along with conceptual puzzles inherent to each theory.

Quantum mechanics challenges our intuition about reality and causality with its 'measurement problem,' where the act of observation determines the physical state, and with 'quantum entanglement,' a non-local correlation. General relativity described spacetime as a dynamic geometric structure but loses its explanatory power in extreme situations like the singularity of a black hole or the beginning of the Big Bang. Furthermore, the nature of dark matter and dark energy, estimated to constitute 95% of the universe, remains a mystery, strongly suggesting that our current physical theories are incomplete.

These fundamental problems may not be solvable by merely modifying individual theories. The root of the issue might lie in our most basic assumptions about **space**, the 'stage' where physical phenomena occur, and the 'interaction' of the actors on that stage.

This paper, starting from this critical awareness, proposes **'Magnetic Space Cosmology (MSC)'** as a new alternative that transcends the existing paradigm. The core claims of MSC are as follows: The universe is fundamentally composed of a single type of entity, **'elemental charges ($\psi^{\pm}$)'**, and an energy-less medium they form, the **'Magnetic Space (M)'**. And all forces and phenomena, including electromagnetism, the strong force, and gravity, are mediated through changes in the local properties of this medium, namely the **'Magnetic Density (ρ_M)'**.

This paper will first explain the three core principles of MSC—the medium (M), the entities ($\psi^{\pm}$ and MW), and the mechanism (the change in ρ_M). It will then demonstrate how these new principles provide an integrated and intuitive reinterpretation of some of physics' most representative puzzles: the double-slit experiment and non-locality in quantum mechanics, and the nature of gravity. Finally, it will offer new insights into the origin of 'quantum' phenomena and conclude by discussing the theory's significance and future tasks. Detailed glossaries, in-depth analyses of individual phenomena, a preliminary mathematical formalism, and philosophical implications are provided in the appendices.

2 The Core Principles of MSC

MSC introduces three fundamental concepts to describe the universe, corresponding to the stage, the actors, and the directing style of the cosmic play. (For details, see Appendix A).

2.1 The Fundamental Medium: Magnetic Space (M)

MSC posits that the 'vacuum' is not literal 'emptiness'. Instead, all of space is filled with a fundamental, energy- and mass-less medium: **Magnetic Space (M)**.

- **Energy-less Medium:** M's own energy-momentum tensor is zero ($T_{\mu\nu}(M) = 0$). This means M is a passive background that 'mediates' interactions and 'propagates' waves, but does not itself generate or store energy. This fundamentally avoids the problems associated with traditional aether theories.
- **Magnetic Density (ρ_M):** M is characterized by a scalar state value called 'Magnetic Density (ρ_M)'. ρ_M is a physical quantity representing the structural stability or wave-transmission efficiency of M. ρ_M can vary locally depending on the distribution of external energy (matter), and this variation is the source of all physical phenomena.

2.2 The Fundamental Entities: Elemental Charges & Magnetic Waves (The Actors)

In the world of MSC, the only 'actors' are the **elemental charges ($\psi^{\pm}$)**.

- **Elemental Charges ($\psi^{\pm}$):** The most fundamental constituents of the universe are discrete 'elemental charges' with integer units of ± 1. They are more fundamental entities than the quarks or leptons of the Standard Model.
- **Charge Clusters:** All particles we know (electrons, protons, neutrons, etc.) are stable **'charge clusters'** formed by these elemental charges combining in specific numbers and 3D topological arrangements (Φ). The type and mass of a particle are determined by the internal structure of this cluster (see Appendix B.11).
- **Magnetic Wave (MW):** When a charge cluster (particle) is in motion, its energy creates a wave in the surrounding M medium. This is the **Magnetic Wave (MW)**. The MW is the actual mediator of interaction that transmits energy through the M medium, and it is the origin of all field phenomena we observe.

2.3 The Core Mechanism: Force and Spacetime as Density Variation

The dynamics of MSC are expressed through the interaction between M and MW, especially through the density variation of M. This is the engine of MSC.

- **Magnetic Wave as Interaction:** All interactions are fundamentally the process of an MW generated by one entity (particle) being transmitted through the M medium to another entity (see Appendix B.1).

- **Gravity as Density Weakening:** One of the most central claims of MSC is that **"gravity is the phenomenon of Magnetic Density (ρ_M) weakening itself."** When matter (charge clusters) is densely packed, forming a high energy density, the structural stability of the surrounding M medium is degraded, causing ρ_M to decrease locally. The spatial gradient of this ρ_M ($\nabla\rho_M$) produces an effect that attracts other particles or waves, which is what we perceive as 'gravity'. That is, $g \propto -\nabla\rho_M$ (see Appendices B.3, C.5).

- **Medium State as Spacetime:** Einstein's 'curved spacetime' is reinterpreted in MSC as a geometric representation of the local density (ρ_M) distribution state of the M medium. The curvature of space is not an abstract mathematical concept but a concrete reality of a physical medium's density variation.

3 Reinterpreting Key Puzzles: The Explanatory Power of MSC

These three core principles offer a surprisingly intuitive and unified explanation for some of the deepest mysteries in physics. Here, we demonstrate the explanatory power of MSC through three representative cases.

3.1 The Heart of Quantum Mechanics: The Double Slit and Quantum Entanglement

- **Double-Slit Experiment:** The particle passes through only one slit. However, the **Magnetic Wave (MW)** generated by the particle's motion, as a wave, passes through both slits and creates an interference pattern. When the particle reaches the screen, its position is probabilistically determined by this MW interference pattern (energy density distribution). The act of 'observation' is a thoroughly causal process where a separate MW emitted by the measuring device **physically disturbs** the particle's MW, thereby destroying the interference pattern. Mysterious concepts like wave-particle duality or collapse by observation are not needed (see Appendix B.8).

- **Quantum Entanglement:** An entangled particle pair is defined as 'a pair of Magnetic Waves (MWs) generated from a single source, perfectly correlated in phase.' This phase information is inherently shared throughout the M medium. Therefore, when the phase of one wave is revealed to be a specific value through measurement (interaction), the phase of the other wave, which was correlated from the beginning, must inevitably be revealed as a correlated value. This is not superluminal information transfer but a natural wave phenomenon, akin to **"two actors sharing a single blueprint, performing their predetermined roles on separate stages"** (see Appendix B.9).[6]

3.2 Redefining Gravity: Starlight Bending and Black Holes

- **Starlight Bending:** A massive body like the Sun creates a high energy density around it, which lowers the Magnetic Density (ρ_M) in its vicinity. When starlight (an electromagnetic wave, i.e., an MW) passes through this region of low ρ_M, its path bends, just as light refracts when passing through air of different densities. Einstein's 'spacetime curvature' is reinterpreted in MSC as the concrete physical phenomenon of a change in the 'effective refractive index' of the M medium (see Appendix B.7).

- **Black Holes:** The center of a black hole is where mass is so extremely compressed that the surrounding energy density approaches infinity. This causes the surrounding ρ_M to converge to its theoretical minimum of 0. This $\rho_M \to 0$ **state is precisely the 'Magnetic Vacuum (MV)'**. The MV is a physical state where the M medium itself collapses, making wave propagation impossible and causing time to stop. This provides a physical reality to the mathematical concept of a 'singularity' in GR (see Appendices A, B.3).[10]

3.3 The Origin of the 'Quantum': Reinterpreting the Photoelectric Effect

How does MSC explain the photoelectric effect, which gave birth to the concept of the 'quantum'? It is not because light consists of discrete packets of energy (photons).

- In MSC, the photoelectric effect is a phenomenon where a high-frequency Magnetic Wave (MW) interacts with an electron (a charge cluster) in a metal. The electron is bound by a certain energy (the work function) due to its interaction with the atomic nucleus.

- Only an MW above a certain threshold frequency can deliver a sufficiently strong **'resonance' or 'impact'** in a short time to overcome this binding energy and eject the electron. An MW with a lower frequency, even if it transfers energy, has a weaker force and only causes the electrons to vibrate collectively (the thermal radiation effect), failing to eject individual electrons.

- Therefore, 'quantization' is not a property of energy itself being discrete, but a **'threshold effect'** where the interaction between a wave and matter produces a discrete outcome only when specific conditions are met. The 'quantum' is a result of interaction, not a property of energy (see Appendix B.12).[14]

4 Discussion and Future Work

As presented in this paper, Magnetic Space Cosmology (MSC) shows the potential to unify quantum, gravitational, and electromagnetic phenomena into a single, intuitive,

and causal picture of 'the interaction of entities ($\psi^{\pm}$) and waves (MW) on an energy-less medium (M)'. This offers new solutions to many of the conceptual puzzles of existing physics.

Of course, MSC is still in a conceptual and qualitative stage. For this theory to attain full scientific status, a rigorous mathematical formulation and the ability to make quantitative predictions are essential (see Appendix C).

The most critical and urgent next step toward completing the theory is to **"explain the hydrogen atom, the simplest and most important system, using the principles of MSC."** Defining the proton and electron with MSC's 'charge cluster' model and mathematically deriving the stable energy level spectrum of the hydrogen atom ($E_n = -13.6\ \text{eV}/n^2$) from their interaction will be the first and most important test for the theory.

If this task is successfully completed, MSC could emerge as a powerful alternative to string theory or other quantum gravity theories. Furthermore, MSC has the extensibility to encompass broader domains such as consciousness, memory, and life phenomena, opening the possibility for new intellectual inquiry that blurs the boundaries between physics and philosophy (see Appendix E).

5 Conclusion

Magnetic Space Cosmology (MSC), through its bold hypothesis that the universe consists of an energy-less medium, 'Magnetic Space,' and interacting 'elemental charges' and 'Magnetic Waves' upon it, offers new solutions to the fundamental problems of modern physics. By reinterpreting the non-intuitiveness of quantum mechanics, its inconsistency with gravity, and the very origin of the 'quantum' concept under the single, unified principle of 'medium-wave interaction,' MSC opens a path to a deeper, more integrated understanding of the universe. Although the arduous process of rigorous mathematical formulation and experimental verification lies ahead, the new paradigm presented by MSC has the potential to become a significant milestone in humanity's quest to step closer to the true nature of physical reality.

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A Glossary of Key MSC Terms (New in v2)

This appendix defines and explains the core terminology essential for understanding Magnetic Space Cosmology (MSC). Each term is intricately linked to the others, forming a single, coherent theoretical framework.

I. The Fundamental Constituents of the Universe

1. **Magnetic Space (M or MS):**
    - **Definition:** A fundamental physical medium that fills the entire universe seamlessly, devoid of energy and mass ($T_{\mu\nu}(M) = 0$). It replaces the conventional concept of 'vacuum' and signifies a 'non-empty space.'
    - **Role:** Serves as a passive background (stage) that 'mediates' all physical interactions and 'propagates' all waves. M itself does not generate forces, but its local state changes are the source of all forces.
2. **Elemental Charges ($\psi^{\pm}$):**
    - **Definition:** The most fundamental and discrete material entities constituting the universe. They possess an integer unit charge of ± 1 and are postulated to be more primordial than the quarks or leptons of the Standard Model.
    - **Property:** Possess the inherent ability to release their energy into the surrounding M medium in the form of a wave through intrinsic **'vibration'**.

II. Principles of Phenomena and Interaction

1. **Magnetic Wave (MW or Ψ_m):**
    - **Definition:** A wave generated in the M medium when an 'elemental charge' or its composite, a 'particle,' vibrates or moves.
    - **Role:** The sole means of carrying energy and momentum and practically mediating all interactions (forces). Light, electromagnetic fields, etc., that we observe are all different manifestations of MWs.
2. **Magnetic Density (ρ_M or σ_M):**
    - **Definition:** A scalar physical quantity representing the local state of the M medium. It indicates the structural stability of M or its efficiency in wave propagation.
    - **Property:** Decreases exponentially as the surrounding energy density (U_{EM}) increases ($\rho_M \propto \exp(-\gamma \cdot U_{\text{EM}})$). This **'density attenuation due to energy density'** is the origin of gravity.
3. **Wavefront:**

- **Definition:** The leading edge of an MW propagating through the M medium.
- **Significance:** The only physical reality in MSC corresponding to the **'present' or 'instant'**. All matter and phenomena are interference patterns of waves momentarily formed and dissipated on this wavefront.

III. Reconstruction of Matter and Forces

1. **Charge Cluster:**
    - **Definition:** A stable structure formed by 'elemental charges ($\psi^{\pm}$)' combining in a specific number and a 3-dimensional **topological arrangement (Φ)**.
    - **Significance:** All known particles, such as electrons, protons, and neutrons, are forms of these 'charge clusters.' The type, mass, spin, and other properties of a particle are determined by this internal structure. Internally, it forms a 'Magnetic Vacuum (MV)' state where ρ_M is nearly zero.
2. **Unification of Forces:** The four fundamental forces are different modes of state change in the M medium.
    - **Gravity:** Static Density Variation of the M medium. A phenomenon of the spatial gradient ($\nabla\rho_M$) of ρ_M induced by energy density.
    - **Electromagnetism:** Dynamic Wave Propagation in the M medium. A phenomenon of an MW generated by an accelerating charge propagating through the M medium.
    - **Strong Force:** Topological Confinement within a 'charge cluster.' The force that maintains a stable topological arrangement (Φ).
    - **Weak Force:** Topological Transition of a 'charge cluster.' The process of one stable topological arrangement reconfiguring into another.

IV. Reinterpretation of Quantum Phenomena and Cognition

1. **Quantum Mechanics:**
    - **Definition:** "The study of the total interaction that an MW, generated by a single vibrating particle, forms with all other particles (waves) throughout the universe via the M medium."
    - **Significance:** Quantum phenomena are not mysterious properties of isolated particles but a description of the 'relationship' a single node (particle) has with the vast wave network (the universe).
2. **Wave Function (ψ):**
    - **Definition:** A complex function describing the **physical state (amplitude, phase)** of a particle's MW, not an abstract probability amplitude.

- $|\psi|^2$**:** The energy density when an MW forms a stable standing wave in a specific region. It represents not the 'probability' of finding the particle, but the 'energy distribution' where the particle can exist most stably.

3. **Magnetic Vacuum (MV) and Local Time Stagnation:**

   - **Definition:** An extreme state where the density of M, ρ_M, converges to zero. It forms inside charge clusters or at the center of a black hole.
   - **Property:** The M medium collapses, making wave propagation impossible, and with no energy change, the flow of time nearly halts.
   - **Role: Memory** is explained as the mechanism by which information from past wavefronts (MW patterns) is physically imprinted within a charge cluster through this 'local time stagnation.'

4. **Consciousness:**

   - **Definition:** The process of momentarily perceiving the ever-advancing wavefront of the MW.
   - **Significance:** Consciousness is not a fixed entity but the interaction itself between a specific complexity of MW patterns (a self-recognition loop) on the M medium and the wavefront. "The world does not exist; it is perceived by consciousness on the wavefront."

V. Elemental Charges ($\psi^{\pm}$) and Charge Clusters

This section details the 'elemental charges,' the source of all matter in MSC, and the 'charge cluster' structural models they form.

1. **The Primordial Particle: Elemental Charge ($\psi^{\pm}$)**

   - The most fundamental constituents of the universe are massless or have extremely small mass and are discrete 'elemental charges' with an integer unit of ± 1. All composite particles are generated from combinations of these two types of particles. They are considered more primordial entities than the quarks or leptons of the Standard Model.

2. **The Charge Cluster Model**

   - All known particles (protons, neutrons, leptons, etc.) are described as 'charge clusters' in which elemental charges are combined in a specific number and a particular 3D topological arrangement (Φ). These charge clusters are understood as condensed and stabilized groups of waves within Magnetic Space, with their stability maintained through internal electrical interactions and a dynamic equilibrium with M-space.

- **Proton:** As the most stable baryon with a +1 charge, it is proposed to have a tetrahedron-based structure composed of five +1 particles and four -1 particles. This geometric symmetry provides a physical origin for the extreme stability of the proton.
- **Neutron:** Electrically neutral, it is proposed to have a hexagram (Star of David) structure composed of six +1 particles and six -1 particles. This structure is less symmetric than the tetrahedral structure, representing a 'metastable' state that is less stable than the proton. This structural asymmetry implies a tendency to transition to the more stable proton structure even without external conditions, which is the inherent possibility of beta decay.
- **Leptons:**
  - **Electron (e^-):** As the lightest charged lepton, it is a charge cluster with the simplest and most stable topological arrangement of a specific number of ± 1 elemental charges.
  - **Muon (μ^-) and Tauon (τ^-):** They have the same external charge as the electron but possess a greater mass by being composed of a larger number of internal elemental charges, having a more complex topological arrangement (Φ), or by distorting the surrounding Magnetic Space density more significantly.
  - **Neutrino (ν):** An electrically neutral lepton with a net internal charge effect of zero. However, it is explained to participate in the weak interaction and have a tiny mass due to a specific asymmetric topological arrangement. Neutrino oscillation can be naturally interpreted as a transition phenomenon between different topological arrangement states.

3. **Connection to Quantum States**

- This structural model of particles is directly linked to the interpretation of quantum phenomena discussed in Section IV. The existence of an electron in a specific state around an atomic nucleus is the result of the magnetic wave (MW) of the electron (a 'charge cluster') interacting with the M-space around the nucleus (another charge cluster) to form a stable standing wave. The probability density of finding a particle at a certain location ($|\psi|^2$) or the quantized energy levels emerge as a result of this wave interference, the detailed interpretation of which is covered in **Section IV, "Reinterpretation of Quantum Phenomena and Cognition."**

B Reinterpretation of Major Physical Phenomena in Magnetic Space Cosmology

MSC reinterprets various phenomena described in existing physics through the concepts of Magnetic Space and Magnetic Waves.

B.1 Electromagnetic Interaction

In Magnetic Space Cosmology (MSC), electromagnetic interaction is fundamentally reinterpreted in a way that differs from conventional electromagnetic theory. The core idea is that all electromagnetic phenomena are explained through a fundamental medium called **'Magnetic Space (M)'** and the **'Magnetic Waves (MW)'** that propagate within it.

- **Role of Magnetic Space (M):** MSC posits that the universe is not empty space but is filled with 'Magnetic Space (M),' a fundamental, energy-less medium with an intrinsic 'magnetic' property. M does not possess energy or force directly but serves as the fundamental background and mediator for the existence and propagation of electromagnetic phenomena. M can be described as a scalar field ($M(x^\mu) = M_0 + \delta M(x^\mu)$) that is uniform and continuous throughout the universe, and it can be locally altered by external factors (matter distribution, energy density, etc.).
- **Generation and Propagation of Magnetic Waves (MW):** In MSC, all elementary particles and interactions are understood as various forms or interference patterns of 'Magnetic Waves (MW)' occurring within M space. A particle with energy, such as an **Electron**, generates a wave-like disturbance in the surrounding M medium during its motion (spin, orbit, etc.), which is the MW. This MW receives a portion of the electron's energy and propagates through the energy-less M medium. The MW satisfies a basic linear wave equation ($(\nabla^2 - \frac{1}{v_m^2}\frac{\partial^2}{\partial t^2})\Psi_m = J(x,t)$), with a propagation speed v_m generally identified with the speed of light (c).
- **Interaction Mechanism:** When an MW reaches another electron (B), the MW interacts directly with electron B, transferring its energy to it, which in turn changes the motional state of electron B. This change in motion or the resulting force effect is perceived by an external observer as a **macroscopic phenomenon (e.g., an electric field effect or electric current)**.
- **Reinterpretation of Electric (E) and Magnetic (B) Fields:**
  - **Magnetic Field (B):** The macroscopically observed magnetic field is interpreted as the collective pattern of MWs formed in the M medium or as representing the rotational/vectorial properties of the MW. For example, the rotating magnetic field around a current-carrying conductor is explained as being formed by the intrinsic rotational motion (spin) of individual electrons interacting with M, exciting micro-magnetic field patterns (micro-MWs), which then collectively accumulate through M.

- **Electric Field (E):** The electric field is reinterpreted in two aspects:
  1. **Primordial Aspect:** The fundamental intrinsic energy or potential of an electron that can generate an MW.
  2. **Resultant Aspect:** A physical quantity describing the resulting force effect or the change in the motional state of an electron when an MW reaches and interacts with it. That is, the electric field is not a separate entity created first to mediate the interaction, but rather an indicator describing the situation in which an electron is set in motion by the action of an MW.

- **Consistency with Existing Physical Laws:** MSC maintains the mathematical forms of existing electromagnetic laws, such as Maxwell's equations or the Lorentz force law, without modification. M does not appear explicitly in these equations because M itself is not a field that contributes directly to energy or force. Instead, M is described as implicitly playing the role of a fundamental 'background' or 'medium' in which the B-field can exist and propagate. It is suggested that the properties of the medium (permittivity $\epsilon(M)$ and permeability $\mu(M)$) may depend on the state of M, meaning M modulates electromagnetic phenomena by changing the parameters of the medium rather than providing energy or force directly. Ohm's Law is also reinterpreted. While conventionally, the electric field (E) is seen as moving charges to form a current (J), MSC explains that the MW transfers energy to electrons, causing them to move, and this collective movement of electrons appears as the current (J). The observed electric field (E) here is a resultant effect describing the situation where electrons move due to the action of the MW.

- **Key Implications and Differences:** The fundamental mediator of electromagnetic interaction is the process of an energy-carrying MW propagating through an energy-less M medium. It attempts to explain electromagnetic interactions as a physical and causal process without the abstract concept of 'virtual photon exchange' from existing theories. It views all processes as having a clear time delay (retardation) and causal relationship. It also connects to information storage and consciousness, suggesting that in the MV (M→0) state, time stops as energy change (E=0) ceases, allowing for a memory mechanism where information from past waves is physically imprinted as material patterns.

In summary, MSC explains electromagnetic interaction as a process where a charged particle generates a **Magnetic Wave (MW)** in a medium called **Magnetic Space (M)**, and this MW directly interacts with other particles, transferring energy and generating force. The conventional electric and magnetic fields are reinterpreted as properties of this MW or as phenomena resulting from its interaction. [7]

B.2 Formation of Rotating Magnetic Field Around a Conductor

In Magnetic Space Cosmology (MSC), the formation of a rotating magnetic field around a conductor is causally reinterpreted through the interaction between the universe's fundamental medium, 'Magnetic Space (M)', and the microscopic properties of electrons, differing from conventional electromagnetic theory.

- **Limitations of Conventional Explanation:** Conventional electromagnetism (Ampere's law, Biot-Savart law) successfully describes quantitatively the formation of a magnetic field around a current-carrying conductor, but it lacks a fundamental causal explanation for *why* the magnetic field forms a rotating pattern that envelops the conductor. Space is often treated as a passive 'stage' for phenomena.

- **Role of Magnetic Space (M):** MSC posits that the universe is not empty space but is filled with 'Magnetic Space (M)', a fundamental, energy-less medium with an intrinsic 'magnetic' property. The observed magnetic field (B) is interpreted as a phenomenon that appears when a 'source', such as a current or a changing electric field, interacts with and 'excites' this fundamental Magnetic Space (M). Thus, M serves as the fundamental mediator for the existence and propagation of the B-field.

- **Intrinsic Rotational Motion (Spin) of Electrons and M Interaction:** MSC assumes all electrons have intrinsic rotational motion (spin and orbital motion). This rotation uses a part of the electron's intrinsic energy to continuously 'excite' microscopic magnetic field patterns (micro-MWs) in the surrounding M medium. It is suggested that this interaction can induce a weak axial polarity along the electron's axis of rotation. This polarity carries no energy or charge but could be a factor in determining the electron's spatial orientation.

- **Current Flow and Electron Alignment:** When a current flows in a conductor, free electrons move collectively in one direction, and under the influence of an external field, their microscopic polarities or rotation axes tend to partially align in a specific direction.

- **Collective Accumulation of Micro-MW Patterns and Macroscopic Magnetic Field Formation:** The micro-magnetic field patterns (micro-MWs) excited in the surrounding M by individual electrons can interact complexly and cancel each other out inside the conductor. However, as the aligned electrons move, in the region of Magnetic Space (M) outside the conductor, the micro-MW patterns related to each electron's direction of rotation constructively superpose and accumulate in a coherent direction (e.g., a rotational direction). This stable wave/structural pattern, collectively formed and accumulated on the M medium, is what manifests as the macroscopic rotating magnetic field (B) we observe enveloping the conductor. Therefore, the external B-field is interpreted not simply as a

result of the current, but as a wave-like/structural pattern collectively manifested on the energy-less M medium by the rotational properties of aligned electrons.

- **Relationship with Existing Physical Laws:** MSC maintains the mathematical forms of existing electromagnetic laws, such as Maxwell's equations or the Lorentz force law. M does not appear explicitly in these equations because M itself is not a field that contributes directly to energy or force. Instead, M is described as implicitly playing the role of a fundamental 'background' or 'medium' in which the B-field can exist and propagate.
- **Implications and Future Work:** This model attempts to provide a more microscopic and causal understanding by explaining the origin of the magnetic field not as a result of macroscopic current, but as a collective effect arising from the interaction of the intrinsic rotational energy (spin) of individual electrons with the energy-less M medium. To complete this theory, future work will require the quantification of the electron's rotation-M interaction, characterization of the microscopic polarity, and the development of experimental verification methods, such as measuring magnetic field changes through controlled electron spin alignment or detecting MW amplification effects in superconductors. [8]

B.3 Gravity

In Magnetic Space Cosmology (MSC), gravity is reinterpreted in a manner vastly different from traditional gravitational theories. Crucially, instead of explaining gravity as the geometric curvature of spacetime, MSC defines it as a local state change of the universe's fundamental medium, 'Magnetic Space (M)', specifically, the weakening of 'Magnetic Density (σ_M)'.

- **Fundamental Cause of Gravity: Weakening of Magnetic Density:** In regions where mass is accumulated (e.g., the core of stars or planets), the electromagnetic waves emitted from the constituent particles superpose and interfere, forming a **very high electromagnetic wave energy density ($E_{EM}(r)$)**. This high energy density is assumed to locally reduce the structural coherence of Magnetic Space, i.e., the **Magnetic Density (σ_M)**. This is analogous to how loud noise shatters the quietness of the air, where powerful electromagnetic energy fluctuations disturb the stable state of Magnetic Space. An empirical model is proposed where the magnetic density (σ_M) decreases exponentially with the local electromagnetic wave energy density ($E_{EM}(r)$): $\sigma_M(r) = \sigma_0 \cdot \exp(-\gamma \cdot E_{EM}(r))$. Here, γ is the 'cohesion resistance coefficient' or 'sensitivity coefficient' of Magnetic Space.
- **Formation of Gravitational Field: Magnetic Density Gradient:** The **spatial gradient of the magnetic density ($\nabla\sigma_M$)** thus formed condenses the paths of waves. This acts similarly to how light bends when passing through media with different refractive indices, being macroscopically observed as an attractive phenomenon between masses. It is proposed that the gravitational acceleration ($g(r)$)

is proportional to the spatial rate of change of the inverse of magnetic density: $g(r) \propto -\nabla(1/\sigma_M(r)) = \nabla\sigma_M(r)/\sigma_M(r)^2$. This equation implies that the gravitational effect is strong in regions where the rate of change of magnetic density is large or where the magnetic density itself is very low (i.e., the density weakening is severe).

- **Reinterpretation of Spacetime Curvature:** Einstein's concept of 'spacetime curvature' is interpreted within MSC as the concrete physical reality of the paths of waves and particles changing due to the density variation (magnetic density gradient) of Magnetic Space. That is, it is not spacetime itself that changes, but the physical properties of the medium, Magnetic Space.
- **Black Holes and Magnetic Vacuum (MV):** The center of a black hole is interpreted as a **Magnetic Vacuum (MV) state ($\mathbf{M \to 0}$)**. In this state, the magnetic density (σ_M) converges to zero, causing the effective volume occupied by matter to contract to zero, density to diverge to infinity, and strong gravity to arise. It is also believed that light cannot propagate and energy change ceases, causing time to stop. This explains features similar to the black hole singularity in general relativity and is suggested to provide clues for resolving the singularity problem.
- **Role of Magnetic Space (M):** M plays the role of mediating and regulating gravitational interaction, but M itself is assumed to have no energy. Energy is attributed to matter (particles) and the fields through which they interact (e.g., the electromagnetic field), while M is merely the background medium where the existence, transformation, and transfer of this energy occur.

MSC attempts to provide an integrated explanation of gravity, electromagnetic phenomena, and the nature of space by understanding gravity not as an intrinsic property of mass, but as a phenomenon arising from the accumulation of electromagnetic energy due to mass, which in turn changes the physical properties of Magnetic Space. [10]

B.4 Time

In Magnetic Space Cosmology (MSC), time is reinterpreted in a unique way that differs from traditional physics. In brief:

- **Essence of Time:** In MSC, time is not an independently existing absolute dimension. Instead, it is defined as a phenomenon arising from the dynamic progression of Magnetic Waves (MW), which constitute all physical phenomena in the universe, and the cognitive perception of this progression by consciousness.
- **The Present and the Flow of Time:** The 'present' or 'moment' we experience is a stable interference state formed by the ever-advancing 'wavefront' of a Magnetic Wave. Since past wavefronts have already passed and vanished (existing only in

memory) and future wavefronts have not yet arrived, what truly exists is only the 'present wave state' experienced by consciousness. The flow of time is the process of these momentary wavefronts unfolding continuously, and time itself is understood as the irreversible process of the Magnetic Wave's progression.

- **Relationship between Time and Energy:** MSC views energy and time as deeply intertwined. **Energy is considered a dynamic quantity expressed as the product of the amount of wave change ($\Delta\Psi$) and the time interval over which that change occurs (Δt), i.e.,** $E = \Delta\Psi \cdot \Delta t$. This implies that if there is no change, there is no energy exchange, and therefore, time does not flow.

- **Irreversibility of Time (Arrow of Time):** The fundamental reason why time flows in only one direction is that the interaction of Magnetic Waves is intrinsically irreversible. When multiple Magnetic Waves meet, interfere, and diffuse, an asymmetric change and cumulative loss of initial phase information occur, making it impossible for the mixed waves to return to their exact original state. To explicitly incorporate this irreversibility into physical laws, a **'Time Directionality Function'** $\Theta(t)$ is proposed. Similar to the Heaviside step function, $\Theta(t)$ models irreversibility by forcing a specific physical process to begin at t=0 and proceed only in the future direction (t > 0).

- **Time Stoppage in the Magnetic Vacuum (MV) State:** In the Magnetic Vacuum (MV) state where Magnetic Space (M) approaches zero (M $\rightarrow$ 0), electromagnetic activity ceases, resulting in no energy change ($\Delta E = 0$). This absence of change is linked to the **stoppage of the flow of time ($d\tau = 0$)**, which is described as conceptually similar to the phenomenon of time stopping at the singularity inside a black hole.

- **Role of Consciousness:** Consciousness is defined as the act of capturing the wavefront of a Magnetic Wave to construct reality. Standard time may be considered a construct of shared consciousness or a macroscopic average effect, rather than the intrinsic time flow of individual systems. [13]

B.5 Big Bang and Supernovae

Magnetic Space Cosmology (MSC) reinterprets the Big Bang and supernova phenomena through state changes of the fundamental medium of the universe, **Magnetic Space (M)**.

Big Bang MSC interprets the Big Bang differently from the conventional explanation of the universe starting from an extremely hot, dense point and expanding.

- **Primordial Magnetic Vacuum (MV) State:** It is hypothesized that the primordial universe before the Big Bang might have been in a vast Magnetic Vacuum

(M 0) state. In this state, without M as the interaction mediator, matter and energy would have existed in a potential form.

- **Magnetic Density Fluctuation and Wave Generation:** For some reason (e.g., amplification of quantum fluctuations or interaction with an external region), an extreme imbalance or sudden disturbance of local Magnetic Density occurred within this quiescent Magnetic Space.
- **Magnetic Wave (MW) Generation and Energy Release:** This initial large-scale disturbance generated powerful **Magnetic Waves (MW)** that began to spread in all directions, which is interpreted as the event marking the beginning of the universe. In this process, the potential electromagnetic forces of matter were activated, releasing immense energy associated with the standard electromagnetic field energy. MSC likens this to the "collapse of the Magnetic Vacuum."
- **Reinterpretation of Cosmic Expansion:** The expansion of the universe is explained as the phenomenon of the primordial Magnetic Waves, generated at the Big Bang, continuously spreading through the M medium.

Supernovae MSC also explains supernova explosions as local state changes of Magnetic Space.

- **Local Magnetic Vacuum (MV) Formation:** In the final stages of a massive star's evolution, a local region, such as the star's core, can temporarily enter a Magnetic Vacuum ($M \to 0$) state. In this MV state, matter collapses into that region, and interactions are suppressed.
- **MV Collapse and Energy Release:** When this MV state becomes unstable and transitions back to an $M > 0$ state, the suppressed electromagnetic interactions of matter are reactivated, leading to an explosive release of immense energy.
- **Energy Release Mechanism:** The energy released in a supernova corresponds to the reconfiguration energy of the collapsed matter and is suggested to be related to the Poynting vector flux or interaction with currents. MSC attempts to explain supernova explosions with a mechanism distinct from the conventional gravitational collapse model.[1]

B.6 The Casimir Effect

Magnetic Space Cosmology (MSC) reinterprets the Casimir effect—the attraction between two uncharged metal plates in a vacuum—differently from conventional Quantum Field Theory (QFT).

Conventional Explanation (QED): QED explains that a vacuum is filled with quantum fluctuations of virtual particles constantly being created and annihilated. In the space between the plates, certain wavelength modes of these fluctuations are restricted, leading to a lower energy density than outside, thus causing an attractive force.

MSC's Reinterpretation:

- **Role of Magnetic Space (M):** MSC assumes the universe is composed of **'Magnetic Space (M),' an energy-less fundamental medium** that is filled with an intrinsic 'magnetic' property. M facilitates the propagation of electromagnetic waves.
- **Generation of Real Electromagnetic Waves:** Electrons inside a conductor, due to activities like their intrinsic spin motion or thermal vibrations, continuously emit minute, real electromagnetic waves. These waves are not confined within the conductor but can spread into the vacuum outside through M.
- **Wave Interference and Mode Restriction:** In the confined M space between two parallel conductor plates, the electromagnetic waves emitted from both plates superpose and interfere. Consequently, only wave modes of specific wavelengths (λ, e.g., satisfying the condition $d = n\lambda/2$) can form stable standing waves, while other wavelengths are canceled out or become unstable. In contrast, the M space outside the plates has no such restrictions, allowing all modes of waves to exist.
- **Source of the Force:** As a result, the average energy density of the real electromagnetic waves present in the M medium *inside* the plates becomes lower than that in the M medium *outside* the plates. This spatial imbalance in wave energy density acts as the cause of the macroscopic attractive force (the Casimir force) between the two plates. MSC interprets this not as a result of static vacuum energy, but as a dynamic wave interference phenomenon occurring within the M medium.
- **Temporal Directionality:** This process follows a clear temporal sequence and causal relationship: from the moment electrons begin to generate waves (t=0) to the time the waves propagate through M (t>0).
- **Photon Concept Unnecessary:** MSC argues that it is not necessary to assume virtual particles or vacuum quantum fluctuations of QFT to explain the Casimir effect, explaining the phenomenon solely through the interaction between real electromagnetic waves and the M medium. This suggests a possibility to avoid some conceptual difficulties of QED, such as the problem of infinite divergence.

In conclusion, MSC explains the Casimir effect as the interference of real electromagnetic waves within an energy-less M medium and the resulting energy density imbalance, suggesting this could be indirect physical evidence supporting the existence of M. Precise comparison between MSC's quantitative predictions and experimental results is presented as an important future research task. [4]

B.7 Starlight Bending (Gravitational Lensing Effect)

Magnetic Space Cosmology (MSC) offers a new interpretation of the starlight bending phenomenon, made famous by Sir Arthur Eddington's 1919 solar eclipse observation, which differs from conventional General Relativity (GR).

Conventional Explanation (General Relativity, GR)

- Einstein's GR explains gravity as a geometric property where mass and energy curve the surrounding 4D spacetime.
- Light (photons) travels along the shortest path in this curved spacetime, the geodesic, which is why its path appears bent.
- Eddington's 1919 observation quantitatively confirmed GR's prediction (a bending angle of about 1.75 arcseconds for light passing by the Sun), and it is accepted as crucial evidence for GR.

MSC's Reinterpretation MSC explains starlight bending not as a geometric distortion of spacetime itself, but as a wave-optical effect caused by a local state change of the energy-less fundamental medium, 'Magnetic Space (M)'.

- **Change in Magnetic Space (M):** A massive body like the Sun locally alters the state of the surrounding energy-less M medium. This change makes the M medium act as if it has a spatially varying effective refractive index ($n_M(x)$).
- **Wave Phase Shift and Diffraction:** Light (electromagnetic wave) emitted from a distant star travels in a straight line through the M medium by default. However, when passing through the altered M region near the Sun, different parts of the wavefront experience different path lengths or propagation speeds, undergoing minute phase delays or slight diffraction.
- **Wavefront Reconstruction:** The light waves that passed on either side of the Sun meet again on the far side and superpose, causing interference. According to Huygens' principle, secondary wavelets generated from each point of the phase-modulated wavefront interfere to form a new wavefront.
- **Apparent Direction Change:** Due to the phase difference induced by the altered M state around the massive body, the propagation direction of the reconstructed wavefront subtly deviates from its original direction. As a result, to an observer, the light appears to have come from a different point (an apparent position) next to the Sun.
- **Causal Time Sequence:** This entire process follows a clear temporal sequence and causal relationship: starlight emission (t=0), propagation through M (t>0), wave interference/reconstruction due to passing through the altered M near the massive body, and arrival at the observer.

Key Differences and Predictions

- **GR:** Explains that gravity physically bends the path of light through the geometric curvature of spacetime.
- **MSC:** Explains that gravity causes the apparent direction of light to change due to wave interference and reconstruction effects resulting from a change in the refractive index of the energy-less M medium.
- **Consistency of Prediction:** MSC can predict the same starlight bending angle as GR (about 1.75 arcseconds). However, its fundamental physical mechanism is differentiated by being based on a medium theory rather than spacetime geometry.
- MSC's interpretation is that "Light does not bend because spacetime is curved, but it *appears* to bend when passing through an altered medium." [5]

B.8 The Double-Slit Experiment

Magnetic Space Cosmology (MSC) reinterprets the double-slit experiment differently from the interpretations of conventional quantum mechanics.

Conventional Quantum Mechanical Explanation (Copenhagen Interpretation)
In conventional quantum mechanics, the double-slit experiment is explained as follows:

- **Wave-Particle Duality:** Quantum objects like electrons or photons sometimes behave like particles (detected at a single point on the screen) and sometimes like waves (forming an interference pattern).
- **Superposition Principle:** Before being observed, a particle is described as being in a state of passing through both slits simultaneously ($\psi = \psi_1 + \psi_2$).
- **Interference:** The wave functions that pass through the two slits superpose and interfere, forming a periodic probability distribution (interference pattern) on the screen.
- **Observation and Wave Function Collapse:** The act of measuring which slit the particle passed through destroys the superposition state, causing the wave function to instantaneously **'collapse'** into a single state corresponding to the measurement result. This makes the interference effect disappear, leaving only a particle-like pattern. The role of 'observation' and the physical mechanism of 'collapse' are subjects of debate.

MSC's Reinterpretation MSC explains the double-slit phenomenon without assuming the intrinsic duality of particles or wave function collapse, but through the interference of a 'Magnetic Wave (MW)' generated in a medium called 'Magnetic Space (M)' by the motion of a particle (a classical particle).

1. **When there is no observation: Formation of an interference pattern**
    - **Particle Emission and MW Generation:** An individual **particle (a pure particle)** emitted from a light source or an electron gun travels along one specific path towards the slits. During its motion, this particle generates a wave-like disturbance in the surrounding energy-less M medium, i.e., a **Magnetic Wave (MW)**.
    - **Particle and MW Passing Through the Slits:** The particle itself passes through only one of the two slits, like a classical particle. However, the MW, which has wave properties and spreads out from the particle, passes through *both* slits.
    - **MW Interference:** The MWs that pass through the two slits superpose in the M region behind the slits, causing classical wave interference (constructive/destructive interference).
    - **Particle Detection and Pattern Formation:** It is assumed that the particle, upon reaching the screen, interacts with this MW interference pattern and has a higher probability of being detected in regions where the MW energy density is high. As this process is repeated, a wave-like interference pattern that reflects the MW interference pattern appears on the screen.
2. **When there is an observation: Formation of a particle pattern**
    - **Operation of Observation Device and EM Wave Emission:** When an observation device (e.g., a photon scattering device) is placed near the slits to 'check' the particle's path, this device itself emits **electromagnetic waves (EM waves)** or physically interacts with the particle.
    - **Physical Disturbance of the MW:** The core claim of MSC is that the EM waves emitted from the observation device physically interact with the MW generated by the particle, absorbing, scattering, or severely disturbing the MW.
    - **Disappearance of Interference and Particle Detection:** When the MW is disturbed or dissipated, it can no longer form a coherent interference pattern behind the slits. Without the guidance or influence of the MW, the particle simply travels along the path corresponding to the slit it passed through and reaches the screen.
    - **Result:** When many particles accumulate, **two distinct bands (a particle-like pattern)** appear, with no interference pattern.

3. **Key Differences and Advantages**

   - **Avoiding Wave-Particle Duality:** MSC avoids the counter-intuitive concept of duality by explaining wave properties not as an intrinsic attribute of the particle, but as a characteristic of the MW generated by the particle's motion in the energy-less M medium.
   - **Physical/Causal Explanation for the Measurement Problem:** 'Observation' is clearly explained not as an abstract wave function collapse, but as a physical interference (disturbance) phenomenon between the measurement device and the particle's MW. This is an attempt to understand the measurement process within the framework of causal and local physical laws.
   - **Temporal Directionality:** This entire process follows a clear temporal sequence and causal relationship: particle emission (t=0), MW generation and propagation (t>0), passing through the slits, formation or disturbance of the interference pattern, and arrival at the screen.

In conclusion, MSC presents the view that "the interference pattern is not the trace of the particle itself, but the trace of the wave left by the particle." This is an attempt to resolve the puzzles of conventional quantum mechanics and provide a more intuitive physical explanation. [6]

B.9 Quantum Entanglement

Magnetic Space Cosmology (MSC) reinterprets the phenomenon of Quantum Entanglement differently from conventional quantum mechanics. This phenomenon, which Einstein called "spooky action at a distance," is explained in MSC not as faster-than-light information transfer, but as the manifestation of an 'intrinsic phase correlation' shared by waves from the moment of their creation within the fundamental medium, 'M-Space'.

MSC's Reinterpretation of Quantum Entanglement:

- **Separation of a Single Magnetic Wave System:** MSC views an entangled particle pair (e.g., an entangled photon pair) as originating from a single 'Magnetic Wave (MW)' system from the outset. For example, when a single high-energy photon (a magnetic wave) passes through a non-linear crystal and splits into two lower-energy magnetic waves, it is assumed that not only energy and momentum but also specific 'phase information' (e.g., a constant phase difference like $\phi_1 + \phi_2 =$ constant or $\phi_1 - \phi_2 =$ constant, $\Delta\phi$) is perfectly imprinted within M-Space from the moment of creation. This phase correlation is maintained synchronously through the continuity of M-Space, even as the two waves become physically distant.
- **Propagation and Property Manifestation of the Waves:** These two separated Magnetic Waves (MWs) propagate through M-Space along different paths.

- **Measurement and Correlation Manifestation:**
  - The act of observer A measuring one of the magnetic waves (MW A), for example, by measuring its polarization, is the process where the 'intrinsic phase property' of MW A is 'manifested' through interaction with the measurement. This is interpreted as a physical and causal process, different from the 'wave function collapse' of conventional quantum mechanics.
  - The moment the phase of MW A is manifested (e.g., polarization X), the phase of MW B is already determined by its phase correlation ($\Delta\phi$) with MW A. Therefore, when MW B is measured (e.g., polarization Y), it always shows a predictable correlation.
- **Reinterpretation of Non-locality:** MSC does not see this phenomenon as information being transmitted faster than light, where the measurement of one wave 'determines' the state of the other. Instead, it is interpreted as the two magnetic waves having possessed correlated intrinsic properties from the start, and these properties are revealed independently but correlatively at their respective locations. In other words, non-locality arises from the ability of the M-Space medium itself to 'remember' and maintain the phase correlation across space from the moment of wave creation.

In conclusion, MSC attempts to provide a more intuitive and causal physical understanding by explaining quantum entanglement as the 'dynamic interference and phase manifestation of Magnetic Waves' within M-Space, without abstract concepts like 'intrinsic properties of particles' or 'wave function collapse'. [12]

B.10 Information Storage and Consciousness

Magnetic Space Cosmology (MSC) reinterprets the phenomena of information storage and consciousness from a perspective different from conventional physics.

Information Storage (Memory) MSC explains information storage as a physical phenomenon occurring in a special state called the **'Magnetic Vacuum (MV)'**.

- **Storage Mechanism:** Information is stored by being encoded as specific configurational patterns of matter (molecular arrangements, electron arrangements, etc.) in **microscopic MV regions ($\mathbf{M \to 0}$ state)** within a system like the brain.
- **Role of the MV:** In the MV state, since the Magnetic Space (M) medium is absent or converges to zero, electromagnetic activity ceases, leading to a state with no energy change ($\Delta E = 0$). This absence of change is linked to the **stoppage of the flow of time ($\partial I/\partial t = 0$)**, which is believed to allow the stored electron arrangement patterns to be preserved stably over long periods without external disturbance.

- **Matter-Based Information:** The information itself exists within the patterned matter, and the quantum uncertainty principle ($\Delta x \Delta p \geq \hbar/2$) may impose a limit on the stability of the stored information. MSC connects this to local energy and time stagnation phenomena, suggesting a possible mechanism for memory where information from past waves is physically imprinted.

Consciousness MSC posits that consciousness arises from the dynamic progression of Magnetic Waves (MW) and the process of perceiving it.

- **Definition:** Consciousness is defined as the **'momentary perception' that moves along the irreversible wavefront of a Magnetic Wave**. It is the act of recognizing the wave interference pattern formed by the current wavefront.
- **Self-Awareness Process:** Consciousness is not a fixed entity but a kind of self-awareness or state-awareness process occurring at the forefront of the wave. Since past wavefronts have already passed and future wavefronts have not yet arrived, consciousness can only directly experience the wave state of 'here and now'.
- **Role of Magnetic Space:** The Magnetic Space (M) medium can modulate the strength of neural interactions ($J \propto M$), but it is not seen as the direct cause of consciousness itself. It is assumed that as M converges to zero, interactions disappear.
- **Connection with Memory:** Consciousness perceives the continuity and direction of time more richly by comparing and connecting the currently advancing wavefront with the **traces of past waves (memory)**, which are stored as a phenomenon of local time stagnation inside charge clusters.
- **Thought and Free Will:**
  - **Thought:** Understood as the process where the current consciousness activates past memories (stored wave information) and explores new connections between them, simulating various scenarios.
  - **Free Will:** Can be interpreted as a selective tendency towards the stability of the system among multiple wave interference paths. It is considered a probabilistic yet patterned decision that emerges as a result of complex wave interference.
- **Nature of Reality:** MSC views matter itself as a momentary phenomenon of a wave, and the reality we experience is reinterpreted as the wavefront of the current wave captured by consciousness. Ultimately, MSC presents the radical conclusion that **"The world does not exist. Only the consciousness that perceives the wavefront of the magnetic wave exists,"** emphasizing the interdependent relationship between matter and consciousness. [13]

B.11 Constitution of Matter (Charge Clusters)

In Magnetic Space Cosmology (MSC), matter is understood as **'charge clusters'** formed by the assembly of the most fundamental constituents called **'elemental charges'**.

- **Elemental Charges ($\psi^{\pm}$):** The most fundamental constituents of the universe, having zero or extremely negligible mass and possessing integer unit charges of ± 1. They can have spin (e.g., spin-1/2 fermions or spin-0 bosons) and are considered to exist as wave-like forms within M-Space. They are regarded as more fundamental entities than the quarks or leptons of the Standard Model.
- **Charge Cluster Model: All known particles, such as protons, neutrons, and leptons, are described as 'charge clusters' composed of a specific number of elemental charges (N_+ positive, N_- negative) and a specific 3D topological arrangement (Φ).** The stability of a charge cluster is determined by the electric attraction/repulsion between its internal elemental charges, spin interactions, and the interaction energy with Magnetic Space (M-Space).
- **Composition of Protons and Neutrons:** Protons and neutrons can be composed of specific multiples of elemental charges. For example, a proton could be represented as Cluster($N_+ = 8n, N_- = 2n$) and a neutron as Cluster($N'_+ = 6m, N'_- = 6m$), where n and m are specific multiples. The observed charge (e.g., +1e for a proton) is linked to these internal charge effects multiplied by a normalization constant (k). An increase in the value of n or m increases the number of internal elemental charges, raising the complexity and energy density of the internal structure, which explains the increase in particle mass.
- **Composition of Leptons (Electrons, Muons, Tauons, Neutrinos):**
  - **Electron (e^-):** The lightest charged lepton charge cluster, with a specific number of ± 1 elemental charges and a stable topological arrangement (Φ_e).
  - **Muon (μ^-) and Tauon (τ^-):** Have the same external charge as the electron but explain their greater mass through a larger number of internal elemental charges, a different topological arrangement ($\Phi_{\mu/\tau}$), or a greater energy distortion of the Magnetic Space density ($\Delta\rho_M$).
  - **Neutrino (ν):** An electrically neutral lepton with a total internal charge effect of zero, but it participates in the weak interaction and has a tiny mass due to a specific asymmetric topological arrangement (Φ_ν). The neutrino's mass is attributed to the minute **Magnetic Space density distortion ($\Delta\rho_M$)** of this charge cluster, and neutrino oscillation can be explained as a transition between different topological arrangement states.
- **Origin of Mass:** The mass of a particle is directly related to the density change it induces in the surrounding Magnetic Space (M), specifically, a local density decrease (density deficit, $\Delta\rho_M < 0$). The high electromagnetic field energy density

(U_{EM}) around a charge cluster lowers the Magnetic Space density (ρ_M) in that region, and the total amount of this 'Magnetic Space density deficit' manifests as inertial and gravitational mass. This presents an alternative explanation to the Higgs mechanism. [11]

B.12 Photoelectric Effect and Thermal Radiation (Integrated Reinterpretation)

Magnetic Space Cosmology (MSC) provides a unified explanation for the photoelectric effect and thermal radiation effect, which are treated as separate phenomena in conventional physics, by describing them as a continuous spectrum of the same fundamental principle.

1. **Conventional Physics Interpretation**
    - **Photoelectric Effect:** The phenomenon where electrons are immediately ejected when light (photons) of a certain threshold frequency or higher hits a metal surface, explained by Einstein through the **particle nature of light (the photon concept)**.
    - **Thermal Radiation Effect:** The phenomenon where light (electromagnetic wave) is absorbed by an object, increasing its temperature, which is proportional to the total energy (intensity) of the light and explained by classical electromagnetic wave theory.
    - Conventional theory has limitations in treating these two phenomena with different physical mechanisms.
2. **MSC's Integrated Reinterpretation** MSC posits that the universe is filled with an **energy-less fundamental medium, 'Magnetic Space (M)'**, and all interactions are mediated through **'Magnetic Waves (MW)'** occurring within this M space. The photoelectric effect and thermal radiation effect are explained by the difference in how MWs interact with the electron collective within matter.
    - **Thermal Radiation Effect:** Low-frequency (long-wavelength) electromagnetic waves reach the electron collective inside a material through M and induce vibrations. This vibrational energy spreads throughout the material, converting into thermal energy and raising the temperature, without ejecting electrons.
    - **Photoelectric Effect:** High-frequency (short-wavelength) electromagnetic waves reach individual electrons on the material's surface through M, causing a topological resonance or a strong impact. In this case, the electron can escape its bound state and be ejected to the outside, following the local magnetic density change in M space. MSC believes it is not necessary to explicitly introduce Einstein's 'photon' concept to explain the photoelectric effect.

3. **Continuity of the Two Phenomena:**

    - MSC explains that when thermal radiation becomes extremely intense, the thermal ionization phenomenon, where electrons are ejected, occurs, which can lead to fire through chemical reactions. This shows that low-frequency thermal radiation and high-frequency photoelectric effect are continuous phenomena resulting from the same wave-like energy density change and the imbalance of magnetic space.

In conclusion, MSC reinterprets the photoelectric effect and thermal radiation effect as the same light-matter interaction appearing differently depending on the frequency spectrum of the wave and the response intensity of the material's electron collective/individual electrons, thereby bridging the theoretical gap in existing physics and offering a more intuitive understanding. [14]

B.13 Resemblance (Heredity) and Quantum Entanglement

Magnetic Space Cosmology (MSC) provides a unified explanation for **'genetic resemblance'** in biology and **'quantum entanglement'** in physics as essentially the same mechanism demonstrating non-local correlation of information. The core of MSC is that the universe is filled with an energy-less fundamental medium, **'Magnetic Space (M-Space)'**, and all information and interactions are transmitted via **'Magnetic Waves (MW)'** propagating within this M-Space.

1. **Reinterpretation of Quantum Entanglement (Intrinsic Phase Correlation)**

    - An entangled particle pair (e.g., a photon pair) is defined in MSC as a pair of Magnetic Waves (MWs) originating from a single source (parent photon) and being perfectly phase-correlated.
    - The two MWs propagate in different directions through M-Space but share an initial phase relationship, such as '$\phi_A + \phi_B = \text{constant}$', from the moment of creation.
    - Measurement is the process where the intrinsic phase property of one MW is manifested. The other MW already possesses a correlated phase, so it's not that the measurement of one MW determines the state of the other faster than light, but that both MWs had correlated intrinsic properties from the start, and these properties are revealed independently but correlatively at their respective locations.
    - The M-Space medium itself plays the role of non-locally 'remembering' and maintaining this phase correlation ('script') from the moment of wave creation.

2. **Reinterpretation of Genetic Resemblance (Intrinsic Information Correlation)**

    - DNA is defined not merely as a sequence of chemical bases, but as a **highly stable 'intrinsic Magnetic Wave (MW) interference pattern'** that carries vast biological information, such as amino acid sequences or protein structures.
    - The process of reproduction is the replication and transfer of the parent DNA's MW pattern to the offspring, at which point the offspring's MW pattern acquires a perfect **'information correlation'** with the parent's MW pattern.
    - The phenomenon of an offspring resembling its parents' traits (e.g., eye color, appearance) is explained as the sequential manifestation over time of this 'information correlation' imprinted in the DNA MW pattern.
    - **Mutation** is a phenomenon where external strong 'impact waves' like UV radiation or certain chemicals physically destroy and irreversibly alter the stable MW pattern of the DNA itself.
    - **Epigenetics** is a phenomenon where 'surrounding background waves' such as nutrition or stress resonate or interfere with the DNA's MW pattern, reversibly regulating the expression of specific genes.

3. **Unifying Principle**

    - MSC asserts that resemblance and entanglement can be unified under a single beautiful principle: **'a phenomenon where information-carrying waves from a single source maintain their correlation through a medium and manifest their properties across spacetime.'**
    - This suggests that information is not abstract but a concrete physical quantity imprinted in the structure and phase of a wave, and that particles, DNA, and living organisms are all various manifestations of wave patterns unfolding on the single medium of M-Space. [15]

B.14 Cosmic Expansion and Dark Energy/Dark Matter

Magnetic Space Cosmology (MSC) reinterprets cosmic expansion, dark energy, and dark matter from a new perspective different from conventional physics. MSC attempts to explain them not as new particles or forms of energy, but as a result of changes in the **'density of Magnetic Space (ρ_M or σ_M)'**.

Cosmic Expansion and Dark Energy (Accelerated Cosmic Expansion and Dark Energy) MSC explains dark energy as an intrinsic expansionary pressure arising from the overall dynamics of the Magnetic Space density (ρ_M) on a cosmic scale, or from the potential ($V(\rho_M)$) of ρ_M itself.

- **Diffusion of Primordial Magnetic Waves:** MSC reinterprets the Big Bang as the creation event of primordial magnetic waves, and explains the expansion of the universe as the continuous diffusion of these waves through the Magnetic Space (M) medium.
- **Change in ρ_M and Expansion:** If the average magnetic density of the entire universe ($\langle\sigma_M\rangle$) changes over time (e.g., gradually increasing or decreasing), this could affect the spatial properties of the entire universe, leading to a change in the expansion rate.
- **Intrinsic Expansionary Pressure:** If Magnetic Space itself has an **intrinsic 'elasticity' or 'repulsive force'** that tends to expand, this property could cause accelerated expansion like that attributed to dark energy. That is, if the average magnetic density decreases below a critical point at a certain stage of cosmic evolution, or if the rate of change of ρ_M follows a specific pattern, this could act like a negative pressure, causing the accelerated expansion of the universe.
- **Connection with Electromagnetic Wave Resonance Stability:** A higher ρ_M (or lower electromagnetic field energy density U_{EM}) could decrease the resonance stability of electromagnetic waves, affecting their propagation speed or inducing the expansion of space itself.
- **Mathematical Representation:** The dynamics of ρ_M could be described by a field equation like $\Box\rho_M + dV(\rho_M)/d\rho_M = S(\psi^{\pm}, A_\mu, ...)$, and a specific form of $V(\rho_M)$ is suggested to mimic the effect of a cosmological constant. This is an attempt to reinterpret dark energy not as a separate matter or energy distributed in the universe, but as a change in the global properties or the dynamic behavior of the fundamental medium, Magnetic Space.

Dark Matter MSC explains the additional gravitational effects observed on galactic and cluster scales (galaxy rotation curves, gravitational lensing, etc.) as local non-uniformities in the ρ_M distribution.

- **Local Non-uniformity of ρ_M:** If a certain region forms a 'low-density region' or 'depression structure' with a lower magnetic density than its surroundings, this region would affect the motion of surrounding matter or the path of light as if an invisible mass were present.
- **'Equivalent Gravitational Effect':** This is not due to actual dark 'matter' particles, but an **'equivalent gravitational effect' induced by the structural distortion of the Magnetic Space density**.
- **Theoretical Parsimony:** MSC claims that by reducing dark energy and dark matter to properties of a single physical entity, Magnetic Space, theoretical parsimony can be increased.

This interpretation by MSC maintains consistency with the core concept of redefining gravity as the 'weakening of magnetic density' and offers new insights into one of the major unresolved problems of modern physics: dark matter and dark energy. [11]

B.15 The Unified Field Theory: An Integrated Reconstruction of the Four Fundamental Forces(New in v2)

Magnetic Space Cosmology (MSC) posits that the four fundamental interactions in nature (gravity, electromagnetism, the strong force, and the weak force) are not fundamentally separate entities but are rather different **'modes of state variation'** exhibited by a **single physical entity: 'Magnetic Space (M)'**. Instead of introducing new dimensions or particles for the unification of forces, this represents a new paradigm that seeks to explain everything through the dynamic properties of 'space' itself—the stage on which forces manifest. By reconstructing each force as a different class of phenomenon within the M medium, MSC suggests a path toward a unified field theory.

1. **Gravity: The 'Static Density Variation' Mode of the M Medium**
   In MSC, gravity is the most fundamental and universal interaction, originating from static changes in the properties of the M medium.

   - **Mechanism:** When matter (a charge aggregate) concentrates to form a high local energy density (U_{EM}), the structural stability of the surrounding M medium is compromised, leading to a weakening of its magnetic density (ρ_M). This creates a 'static' density gradient in the M medium.
   - **Force Manifestation:** Other matter or waves tend to 'flow' along this density gradient, i.e., from regions of high ρ_M to low ρ_M. This is the essence of what we experience as the attractive force of gravity. In other words, gravity is an effect of space itself, created by the **density gradient of the M medium ($\nabla\rho_M$)**.
   - **Characteristics:** This interaction affects the entire M medium, making it a long-range force. As it is not a dynamic process of energy propagation, it is classified as a **static** force. Einstein's 'curved spacetime' is reinterpreted as a geometric representation of the 'M medium with varying density.'

2. **Electromagnetism: The 'Dynamic Wave Propagation' Mode of the M Medium**
   Electromagnetism is a dynamic interaction that transfers energy, manifesting as a 'wave' phenomenon propagating on the M medium.

   - **Mechanism:** When a charged particle (a charge aggregate) undergoes accelerated motion, it uses its energy to generate a wave in the surrounding M medium, namely a **Magnetic Wave (MW)**. This MW carries energy and momentum, propagating through the M medium at the speed of light.

- **Force Manifestation:** When this MW reaches another charged particle and interacts with it, it transfers its energy and momentum, thereby changing the particle's state of motion. This is the essence of the electromagnetic force. The electric field (E) and magnetic field (B) are simply different ways of expressing the vectorial properties of the force carried by this MW.
- **Characteristics:** This interaction is also a long-range force because its mediating particle has no mass (as the MW is a vibration of the M medium). However, since it involves the propagation of a wave carrying energy, it is a **dynamic** force.

3. **Nuclear Forces (Strong/Weak): The 'Topological Confinement' Mode within the M Medium**
   The two nuclear forces are not macroscopic phenomena of the entire M medium but are reduced to the internal dynamics of discrete structures, or 'charge aggregates,' formed locally within the M medium.

   - **Strong Interaction:**
     - **Mechanism:** The strong force is the force by which a 'charge aggregate' maintains its unique and stable three-dimensional topological configuration (Φ). It is a matter of the structure's 'topological stability.'
     - **Force Manifestation (Quark Confinement):** If external energy attempts to tear a part of this structure away, that energy is immediately used to create a new elementary charge pair, restoring the broken topological structure and forming a new 'complete' aggregate. This property of being unable to destroy topological completeness is the very essence of the strong nuclear force.
     - **Characteristics:** This force operates only within the extremely small region of the charge aggregate's interior, making it a short-range force. As it is a force that 'maintains' a structure, it is **confining**.
   - **Weak Interaction:**
     - **Mechanism:** The weak force is the process of 'phase transition' itself, where one stable topological configuration of a charge aggregate (Φ_1) transforms into another type of stable topological configuration (Φ_2).
     - **Force Manifestation (Particle Decay):** The decay of a neutron into a proton is a phenomenon where the neutron's topological configuration overcomes a certain energy barrier and structurally rearranges into the more stable topological configuration of a proton. The W/Z bosons emitted in this process are **transient energy packets (MW packets)** that appear during this topological rearrangement.
     - **Characteristics:** This interaction also occurs at a very short range and is a transitional process that changes the type of particle rather than 'mediating' a force. It is called the 'weak' interaction because this transition occurs rarely, governed by quantum mechanical probability.

4. **The Principle of Unification: Different Expressions of a Single Medium** Thus, MSC unifies the four fundamental forces of nature as different dimensional state changes of a single entity, 'Magnetic Space (M).'

    - **Gravity & Electromagnetism:** Macroscopic, continuous state changes of the entire M medium (static density variation vs. dynamic wave propagation).
    - **Strong & Weak Forces:** Microscopic, discrete dynamics of local structures within the M medium (topological stability vs. topological transition).

    This is akin to studying a single environment, the ocean (M medium), and observing its massive tides and currents (gravity), the waves on its surface (electromagnetism), the internal physiology of a specific lifeform within it (strong force), and the evolution of that lifeform (weak force). All phenomena are ultimately just different scales and modes of phenomena occurring within the single environment of the 'ocean.'[16]

B.16 A Physical Reinterpretation of the Schrödinger Equation(New in v2)

The Schrödinger equation ($\hat{H}\psi = E\psi$), the core of quantum mechanics, describes the state of a particle with a wave function (ψ) and predicts its probabilistic behavior with astonishing accuracy. However, fundamental questions about the physical reality of the wave function itself and the origin of probability remain matters of interpretation. Magnetic Space Cosmology (MSC) reinterprets this equation not as an abstract mathematical tool but as a physical equation describing the actual interaction between a 'charge aggregate' (particle) and 'Magnetic Waves' (MW) within a physical medium, the 'Magnetic Space (M).'

1. **The Physical Reality of the Wave Function (ψ) and Probability ($|\psi|^2$)** In MSC, the wave function and probability are no longer abstract concepts.

    - **The Physical Reality of the Wave Function (ψ):** The wave function $\psi(x)$ represents the physical state of the Magnetic Wave (MW) that a particle (charge aggregate) generates and maintains at position x through its intrinsic motion (like spin) and interaction with the external environment. That is, $\psi(x)$ is a complex function that describes the local **'amplitude and phase of vibration'** of the M medium.
    - **The Origin of Probability ($|\psi|^2$) - The Condition for a Stable Standing Wave:** $|\psi|^2$ does not represent the 'probability of finding' the particle at a certain position, but rather the **'energy density' or 'stability of interference' when the MW forms a stable standing wave** at that location. A particle does not exist randomly; it tends to reside in regions of the M space where it can form a low-energy, stable standing wave structure. Therefore,

a place where $|\psi|^2$ is high is the most stable region for the particle to exist, which in turn leads to it being found there most probably.

2. **Physical Correspondence of Each Term in the Schrödinger Equation**
MSC interprets each term of the Schrödinger equation as representing a specific physical process occurring within the M medium.

$$\left[-\frac{\hbar^2}{2m}\nabla^2 + V(x)\right]\psi(x) = E\psi(x)$$

- **Kinetic Energy Term ($-\frac{\hbar^2}{2m}\nabla^2$): 'Tension Energy' of the Inherent Wave**
This term is not the abstract kinetic energy of a particle but describes the physical properties of the MW generated by the particle itself. The greater the particle's momentum (p), the shorter the wavelength (λ_{MW}) of the generated MW (de Broglie's relation). A shorter-wavelength wave is spatially more 'tautly' curved, and $\nabla^2\psi$ represents precisely this **'spatial curvature' or 'tension' of the wave**. Therefore, the entire kinetic energy term signifies the **'tension energy of the wave'** required to maintain this 'taut' wave state.
- **Potential Energy Term V(x): 'Interference Energy' with External Waves**
This term represents the force a particle experiences from its surroundings, but its physical reality is the sum total of the 'interference' effects that the particle's MW experiences with all other MWs constituting the environment. MSC proposes an expanded form of this potential term, breaking it down into more specific physical components:

$$V_{\text{total}}(r,t) = V_{\text{core}}(r) + V_{\text{EM\_interference}}(r,t) + V_M(r)$$

(a) $V_{\textbf{core}}(r)$**:** The core interaction potential of the system. In the case of a hydrogen atom, this is the fundamental interaction between the electron's MW and the strong, stable background MW formed by the nucleus (proton).

(b) $V_{\textbf{EM\_interference}}(r,t)$**:** The interference effect with external background waves. Spacetime is filled with countless electromagnetic waves (MWs), including the cosmic microwave background. This term represents the real-time interference effects the particle experiences with these external, dynamic MWs, implying that a quantum system can never be perfectly isolated. (This could provide a physical explanation for the phenomenon of 'decoherence.')

(c) $V_M(r)$**:** The response effect of the Magnetic Space medium itself. If the magnetic density (ρ_M) of the M medium changes due to a nearby large mass (gravitational effect), this affects the propagation properties

of the MW. This term represents the influence of the M medium's density variation ($\nabla\rho_M$) on the particle's stable standing wave condition.

- **Total Energy E: 'Stabilization Energy' of the System**
  The total energy E is the energy eigenvalue required for the system to stably maintain a specific standing wave state (ψ). It is the specific value at which the 'wave's tension energy' and the 'interference energy with the outside' are balanced. Because this condition is discrete, the energy levels are quantized.

3. **Conclusion: Restoration as a Causal Physical Equation**
   Through this reinterpretation, the Schrödinger equation is reborn not as a strange law of probability for the microscopic world, but as a causal physical equation with the following meaning:

   > "[Inherent Wave's Tension Energy] + [Interference Energy with External Waves] = [Total Stabilization Energy of the System]"

   MSC fully accepts the successful predictive power of the Schrödinger equation while endowing each of its terms with a concrete physical reality—a 'medium' and a 'wave.' In doing so, it offers a new path to resolving the long-standing interpretational challenges of quantum mechanics and to understanding our world in a more intuitive and unified way.[17]

B.17 The Essence of Quantum Mechanics: A Definition as Wave-Medium Interaction(New in v2)

For quantum mechanics (QM), which is both the most successful and one of the most difficult-to-understand theories in modern physics, Magnetic Space Cosmology (MSC) proposes a new definition that explains its essence. Whereas existing interpretations describe quantum mechanics as 'the rules of the microscopic world' or 'a theory about information,' MSC fundamentally redefines the subject and scope of what quantum mechanics deals with, based on physical reality.

1. **MSC's New Definition of Quantum Mechanics**
   The definition of the essence of quantum mechanics proposed by MSC is as follows:

   > ***"Quantum Mechanics is the study of the total network of interactions that a Magnetic Wave (MW), generated from a single vibrating entity (particle), establishes with all other arbitrary particles (waves) throughout the universe, as it propagates through the Magnetic Space (M) medium at the speed of light."***

   This definition fundamentally shifts the perspective on quantum mechanics.

2. **The Revolutionary Implications of This Definition**

(a) **Shift in Subject of Study: From 'Isolated Particle' to 'Cosmic Network of Relations'**

- **Conventional View:** Quantum mechanics primarily deals with the properties of isolated single systems, such as one electron or one photon.
- **MSC View:** A single particle can never be truly isolated. The moment a particle exists, its vibration generates an MW that propagates through the M medium at the speed of light, spreading throughout the entire universe. Therefore, even the simplest single-particle system is an **'open system' that is faintly connected, via its MW, to every other entity in the universe**. Quantum mechanics is precisely the study of this fundamental relationship between the 'one' and the 'whole.'

(b) **Reinterpretation of 'Probability': From 'Inherent Uncertainty' to 'Inevitability of a Complex System'**

- **Conventional View:** The state of a particle is inherently probabilistic and is not determined before measurement.
- **MSC View:** Quantum probability is not a matter of 'ignorance' or 'inherent uncertainty.' It is the result of the unimaginably complex interference that a single MW undergoes with the near-infinite number of all other background MWs in the universe. The system is simply too complex for deterministic prediction, but a causal mechanism—the wave-medium interaction—underlies it. Probability is the necessary mathematical tool for describing the behavior of this complex system.

(c) **The Inevitability of 'Strange Phenomena'**
Under this new definition, the so-called 'strange' phenomena of quantum mechanics are no longer strange but become natural consequences of the wave-medium-network model.

- **Superposition:** It is natural for a single MW to interact and interfere with background MWs along multiple paths simultaneously.
- **Entanglement:** It is natural for MWs originating from a single source to share the same phase information on a common medium, M.
- **Wave-Particle Duality:** Every entity is fundamentally a 'vibrating particle,' and its influence manifests as a 'wave.' These two are inseparable aspects of a single phenomenon.

3. **The Relationship Between Two Sciences: Macroscopic Science and Quantum Mechanics**
Through this definition, MSC clarifies the relationship between macroscopic science, represented by classical physics, and quantum mechanics.

- **Macroscopic Science (Classical Mechanics, Relativity, etc.):** This deals with the relationships among a small number of strongly interacting

particles or describes the macroscopic 'results' that emerge from the **averaging of countless microscopic interactions**. Here, the interference effects with the faint background waves of the entire universe can be ignored (as an approximation).

- **Quantum Mechanics:** This deals with the faint yet total network of relationships that a single particle forms with all other particles in the universe. Here, the 'structure of the relationship' with the entire network becomes more important than the strength of individual interactions.

This is analogous to understanding a person's life: one can analyze their strong relationships with family and friends (macroscopic science), or one can analyze their position within the invisible cultural and historical currents of their entire society and era (quantum mechanics). Both perspectives are valid and complement each other.

4. **Conclusion: Quantum Mechanics, the Physics of Relations**
In conclusion, MSC redefines quantum mechanics as the **'Physics of Relations.'** It is not the study of the properties of isolated objects, but rather the science that describes, in the language of waves and a medium, how one entity is connected to and interacts with all other entities within the great network of the universe. This perspective strips away the mysticism of quantum mechanics and replaces it with the profound insight of ***cosmic interconnectedness***.[18]

B.18 3. Consistency with and Complementation/Extension of Existing Theories

MSC aims to maintain the successful predictions of existing physics while introducing new physical entities, 'Magnetic Space (M)' and 'Magnetic Waves (MW)', at its foundation to provide a more fundamental and causal explanation for phenomena.

- **Quantization and Relativistic Consistency:** MSC ultimately aims to treat the fields related to elemental charges and Magnetic Space (M) as quantum fields to calculate particle creation, annihilation, and interactions within the framework of existing Quantum Field Theory (QFT). Furthermore, MSC recognizes that to evolve into a complete physical theory, it must be a relativistic theory that satisfies Lorentz covariance. To this end, it proposes treating the M density (ρ_M) as a Lorentz scalar field and writing all terms in a Lorentz covariant form.

- **Derivation of Hydrogen Atom Energy Levels:** MSC suggests the possibility of deriving the stable energy levels of the hydrogen atom ($E_n = -13.6\ \text{eV}/n^2$) based on the charge cluster model. This is seen as achievable by accurately formulating the standing wave conditions of magnetic waves in magnetic space (stable phase conditions of magnetic waves), the energy density function in magnetic space ($\rho_E(r)$), and the wave interaction energy between charge clusters ($V(r)$).

- **Causal and Intuitive Understanding:** MSC claims that by explaining many phenomena as a 'causal process of an energy-carrying wave being generated, propagating, and interacting on an energy-less medium (M)', it can resolve the abstraction of existing quantum phenomena or field theories and provide a more intuitive understanding.

C A Preliminary Mathematical Formalism

This section summarizes initial attempts to express the concepts of MSC in mathematical language. This is not a complete theory but a foundation for future research.

C.1 Magnetic Space (M or MS)

MSC posits that the universe is filled with an energy-less fundamental medium, Magnetic Space (M).

- **Definition and Representation:** M is described as a scalar field that is uniform and continuous throughout the universe.

$$\mathbf{M}(\mathbf{x}^\mu) = \mathbf{M_0} + \delta\mathbf{M}(\mathbf{x}^\mu)$$

  - M_0: A constant representing the uniform background state.
  - $\delta M(x^\mu)$: A local change (perturbation) in the state of M induced by external factors such as matter distribution or energy density.

- **Energy-Momentum Tensor:** The assumption that M itself has no intrinsic energy is represented by its energy-momentum tensor being zero.

$$\mathbf{T}_{\mu\nu}(\mathbf{M}) = \mathbf{0}$$

  The physical constraint on the perturbation $\delta M(x^\mu)$ is:

$$\mathbf{T}_{\mu\nu}(\mathbf{M}) = \mathbf{0} \implies \partial_\mu\mathbf{M}\partial_\nu\mathbf{M} - \frac{\mathbf{1}}{\mathbf{2}}\mathbf{g}_{\mu\nu}(\partial_\alpha\mathbf{M}\partial^\alpha\mathbf{M}) = \mathbf{0}$$

- **Dynamics (Equation of Motion):** The dynamics of M are determined by an external source term.

$$\Box\mathbf{M} = \mathbf{k}\cdot(\textbf{Source Terms})$$

  In a linear approximation, the equation for the perturbation δM is:

$$\Box\delta\mathbf{M}(\mathbf{x}^\mu) = \lambda\phi^{\mathbf{2}}(\mathbf{x}^\mu)$$

- **Interaction with Matter:** The matter field (ψ) and the electromagnetic potential (A_μ) can interact through M.

  - Interaction Lagrangian: $\mathbf{L_{int}} = \mathbf{g}\bar{\psi}\gamma^\mu\psi\mathbf{A}_\mu\mathbf{M}(\mathbf{x}^\mu)$.
  - Equation for the fermion field (ψ): $(\mathbf{i}\gamma^\mu\partial_\mu - \mathbf{m})\psi = \mathbf{g}\gamma^\mu\mathbf{A}_\mu\mathbf{M}(\mathbf{x}^\mu)\psi$
  - Equation for the electromagnetic field (A_μ): $\partial_\nu\mathbf{F}^{\nu\mu} = \mathbf{g}\bar{\psi}\gamma^\mu\psi\mathbf{M}(\mathbf{x}^\mu)$

- **Magnetic Density (σ_M or ρ_m):** A scalar physical quantity representing the state of M.

$$\sigma_{\mathbf{M}}(\mathbf{r}) = \sigma_{\mathbf{0}}\cdot\exp(-\gamma\cdot\mathbf{E}_{\mathbf{EM}}(\mathbf{r}))$$

C.2 Magnetic Wave (MW or Ψ_m)

- **Wave Function:**

$$\mathbf{\Psi_m(x,t) = A(x,t)e^{i(k\cdot x-\omega t+\phi)}}$$

- **Basic Wave Equation:**

$$\left(\mathbf{\nabla^2 - \frac{1}{v_m^2}\frac{\partial^2}{\partial t^2}}\right)\mathbf{\Psi_m = J(x,t)}$$

- **Energy and Momentum:**

$$\mathbf{E} = \hbar\omega, \quad \mathbf{p} = \hbar\mathbf{k}$$

- **Time Directionality Function ($\Theta(t)$) Application:**

$$\mathbf{\Psi_{MW}(x,t)} \propto (\text{Wave Form}) \cdot \mathbf{\Theta(t)} \quad \text{where} \quad \Theta(t) = \begin{cases} 1, & \text{if } t > 0 \\ 0, & \text{if } t \leq 0 \end{cases}$$

C.3 Magnetic Vacuum (MV)

- **Density Divergence:** In the MV state ($M \to 0$), the effective volume $V(M)$ occupied by matter contracts to zero, causing the density ρ to diverge to infinity.

$$\rho = \frac{\mathbf{m}}{\mathbf{V(M)}}, \quad \text{where} \quad \lim_{\mathbf{M}\to\mathbf{0}} \mathbf{V(M)} = \mathbf{0} \implies \rho \to \infty$$

- **Light Impermeability:** Since M acts as the medium for light propagation, light cannot propagate in a region where M=0.

$$\mathbf{c(M)} = \mathbf{1}/\sqrt{\epsilon(\mathbf{M})\mu(\mathbf{M})}$$

- **Energy and Time Stoppage:** In the MV state, energy change ($\Delta E = 0$) ceases, causing time to stop.

$$\mathbf{d}\tau(\mathbf{M}) = \mathbf{dt} \cdot \mathbf{M}^{\gamma}, \quad (\gamma > 0)$$

C.4 Electromagnetic Interaction and Magnetic Field Formation

MSC retains the form of Maxwell's equations but suggests that the properties of the medium may depend on the state of M.

- **Modified Maxwell's Equations (M-dependent parameters):**

$$\nabla \times \tilde{\mathbf{B}} = \mu(\mathbf{M})\tilde{\mathbf{J}} + \mu(\mathbf{M})\epsilon(\mathbf{M})\frac{\partial \tilde{\mathbf{E}}}{\partial \mathbf{t}}$$
$$\nabla \cdot (\epsilon(\mathbf{M})\tilde{\mathbf{E}}) = \rho/\epsilon_{\mathbf{0}}$$
$$\nabla \times \tilde{\mathbf{E}} = -\frac{\partial \tilde{\mathbf{B}}}{\partial \mathbf{t}} \quad \text{(form retained)}$$
$$\nabla \cdot \tilde{\mathbf{B}} = \mathbf{0} \quad \text{(form retained)}$$

- **Lorentz Force Law:** The Lorentz force law experienced by a charge q remains the same.

$$\tilde{\mathbf{F}} = \mathbf{q}(\tilde{\mathbf{E}} + \tilde{\mathbf{v}} \times \tilde{\mathbf{B}})$$

- **Magnetic Wave Generation and Interaction:**
  - MW generation wave equation (conceptual):

$$\nabla^{\mathbf{2}}\tilde{\mathbf{B}}_{\mathbf{w}} - \frac{\mathbf{1}}{\mathbf{v}_{\mathbf{M}}^{\mathbf{2}}}\frac{\partial^{\mathbf{2}}\tilde{\mathbf{B}}_{\mathbf{w}}}{\partial \mathbf{t}^{\mathbf{2}}} = \mu(\mathbf{M})\tilde{\mathbf{J}}_{\text{source}}(\tilde{\mathbf{r}}_{\mathbf{e}}(\mathbf{t}))$$

  - Wave interaction potential between charge clusters:

$$\mathbf{V}_{\text{MSC}}(\mathbf{r}) = -\frac{\mathbf{q_1 q_2}}{\mathbf{4}\pi\chi(\mathbf{r})\mathbf{r}}$$

    where $\chi(r)$ is the effective inductance or magnetic permittivity.

- **Rotating Magnetic Field Formation Around a Conductor:**
  - Micro-MW generation:

$$\nabla^{\mathbf{2}}\tilde{\mathbf{B}}_{\text{wi}} - \frac{\mathbf{1}}{\mathbf{v}_{\mathbf{M}}^{\mathbf{2}}}\frac{\partial^{\mathbf{2}}\tilde{\mathbf{B}}_{\text{wi}}}{\partial \mathbf{t}^{\mathbf{2}}} = \mu(\mathbf{M})\nabla \times (\tilde{\mathbf{m}}_{\mathbf{i}}\delta(\tilde{\mathbf{r}} - \tilde{\mathbf{r}}_{\mathbf{i}}))$$

  - Macroscopic magnetic field:

$$\tilde{\mathbf{B}}_{\text{macro}} = \frac{\mu_{\mathbf{0,eff}}\alpha \mathbf{n_e}|\tilde{\mathbf{m}}_{\mathbf{e}}|}{\mathbf{2}\pi\mathbf{r}}\hat{\phi}$$

C.5 Gravity

MSC redefines gravity as a local state change of M, specifically the weakening of 'Magnetic Density (σ_M)'.

- **Gravitational Acceleration:**

$$\mathbf{g}(\mathbf{r}) \propto -\nabla\left(\frac{\mathbf{1}}{\sigma_{\mathbf{M}}(\mathbf{r})}\right) = \frac{\nabla\sigma_{\mathbf{M}}(\mathbf{r})}{\sigma_{\mathbf{M}}(\mathbf{r})^{\mathbf{2}}}$$

  More generally:

$$\mathbf{g}(\mathbf{r}) = \mathbf{C}\frac{\nabla\sigma_{\mathbf{M}}(\mathbf{r})}{\sigma_{\mathbf{M}}(\mathbf{r})^{\mathbf{2}}}$$

- **Modified Einstein Field Equations** (with a variable gravitational constant $G(M)$):

$$\mathbf{R}_{\mu\nu} - \frac{\mathbf{1}}{\mathbf{2}}\mathbf{R}\mathbf{g}_{\mu\nu} = \frac{\mathbf{8}\pi\mathbf{G}(\mathbf{M})}{\mathbf{c}^{\mathbf{4}}}(\mathbf{T}^{\mu\nu}_{\text{Matter}} + \mathbf{T}^{\mu\nu}_{\text{EM}})$$

  where $G(M) = G_0 \cdot M^{\gamma}$ for $\gamma \geq 1$.

- **Starlight Bending (Gravitational Lensing):**
  - Effective refractive index distribution: $\mathbf{n}_{\mathbf{M}}(\mathbf{x}) = \mathbf{1} + \frac{\mathbf{2GM}}{\mathbf{c}^{\mathbf{2}}|\mathbf{x}|}$
  - Deflection angle: $\theta_{\text{deflection}} \approx \frac{\mathbf{4GM}}{\mathbf{c}^{\mathbf{2}}\mathbf{b}}$

C.6 Particle Physics

MSC describes particles as 'charge clusters', which are assemblies of 'elemental charges'.

- **Origin of Particle Mass:**

$$\mathbf{m}_{\text{particle}} = \alpha_{\mathbf{M}} \int_{\mathbf{V}} (\rho_{\text{vacuum M}} - \rho_{\text{particle M}}(\mathbf{x}))\mathbf{dV}$$

  Analogy with the Higgs mechanism: $\mathbf{m}_{\text{particle}} \propto \mathbf{g}_{\mathbf{H}}\langle\phi_{\mathbf{M}}\rangle$.

- **Lepton Mass:**

$$\mathbf{m}_{\text{lepton}} \propto (\mathbf{N}_{+} + \mathbf{N}_{-}) + \mathbf{E}_{\text{config}}(\mathbf{\Phi}) + \beta_{\mathbf{M}} \int |\mathbf{\Delta}\rho_{\mathbf{M}}|\mathbf{dV}$$

- **Quantum Chromodynamics (QCD) Phenomena:**
  - Color Charge (Topological neutrality condition): $\sum \tilde{\mathbf{\Phi}}_{\mathbf{i}} = \tilde{\mathbf{0}}$
  - Asymptotic Freedom (Effective coupling): $\alpha_{\text{MSC}}(\mathbf{r}) \propto \rho_{\text{fluctuation M}}(\mathbf{r})$
  - Quark Confinement (Linear potential): $\mathbf{V}_{\text{conf}}(\mathbf{r}) \approx \sigma_{\mathbf{M}}\mathbf{r}$
- **Derivation of Hydrogen Atom Energy Levels (conceptual):**
  - Standing wave condition: $\mathbf{2}\pi\mathbf{r}_{\mathbf{n}} = \mathbf{n}\lambda_{\text{mag}}$
  - Interaction potential: $\mathbf{V}_{\text{MSC}}(\mathbf{r}) = -\frac{\mathbf{q_1 q_2}}{\mathbf{4}\pi\chi(\mathbf{r})\mathbf{r}}$

C.7 Quantization and Relativistic Consistency

MSC is an attempt to unify all fields and interactions, proposing a Lagrangian and aiming to satisfy Lorentz covariance.

- **Field Lagrangian (conceptual):**

$$\mathbf{L}_{\phi_\mathbf{M}} = \frac{\mathbf{1}}{\mathbf{2}}(\partial^\mu \phi_\mathbf{M})(\partial_\mu \phi_\mathbf{M}) - \mathbf{V}(\phi_\mathbf{M}) \quad (\phi_M : \text{Scalar field for M density})$$
$$\mathbf{L}_\psi = \bar{\psi}(\mathbf{i}\gamma^\mu \mathbf{D}_\mu - \mathbf{m}_\psi(\phi_\mathbf{M}))\psi \quad (D_\mu = \partial_\mu - ieA_\mu)$$

- **Integrated Lagrangian (conceptual):**

$$\mathbf{L} = \mathbf{L}_{\text{Fields}}(\mathbf{A}_\mu, \mathbf{g}_{\mu\nu}, \mathbf{M}) + \mathbf{L}_{\text{Matter}}(\psi) + \mathbf{L}_{\text{Interaction}}(\mathbf{A}_\mu, \mathbf{g}_{\mu\nu}, \mathbf{M}, \psi)$$

C.8 Application of the Time Irreversibility Function ($\Theta(t)$)

Used to explicitly incorporate the irreversibility of time into physical laws.

$$\mathbf{\Theta(t)} = \begin{cases} 1, & \text{if } t > 0 \\ 0, & \text{if } t \leq 0 \end{cases}$$

Examples:

- Newton's Law of Motion: $\tilde{\mathbf{F}}(\mathbf{t}) = \mathbf{m}\frac{\mathbf{d^2\tilde{x}(t)}}{\mathbf{dt^2}} \cdot \mathbf{\Theta(t)}$.
- Schrödinger Equation: $\mathbf{i}\hbar\frac{\partial}{\partial \mathbf{t}}\mathbf{\Psi(t)} = \hat{\mathbf{H}}\mathbf{\Psi(t)} \cdot \mathbf{\Theta(t)}$.

C.9 Quantum Entanglement

An entangled pair of particles shares an intrinsic phase correlation ($\Delta\phi$) within M-Space from the moment of its creation.

- **Phase Correlation:** $\mathbf{\Delta}\phi = \phi_\mathbf{1} - \phi_\mathbf{2} = \text{constant}$
- **Components of an entangled MW:**

$$\mathbf{\Psi_A(x_A, t)} = \mathbf{A_A e^{i(k_A \cdot x_A - \omega_A t + \phi_A)}}$$
$$\mathbf{\Psi_B(x_B, t)} = \mathbf{A_B e^{i(k_B \cdot x_B - \omega_B t + (\phi_A + \Delta\phi))}}$$

- **Phase Entanglement Condition:** $\phi_\mathbf{1} + \phi_\mathbf{2} = \phi$ or $\phi_\mathbf{1} - \phi_\mathbf{2} = \text{constant}$

C.10 Mathematical Approach to Other Phenomena (conceptual)

- **Casimir Effect:** Explained by the difference in wave energy density due to the restriction of allowed MW modes in the M medium between two conductive plates.

$$\mathbf{F}(\mathbf{d}) \propto -\frac{\partial(\mathbf{\Delta u} \cdot \text{Volume})}{\partial \mathbf{d}}$$

- **Double-Slit Experiment:** Explained as the result of the interference of MWs generated in M by the motion of the particle.
  - MW interference pattern: $\mathbf{I}(\mathbf{r}) \propto |\tilde{\mathbf{B}}_{\text{w1}} + \tilde{\mathbf{B}}_{\text{w2}}|^{\mathbf{2}}$
  - Particle detection probability: $\mathbf{P}(\mathbf{r}) \propto \mathbf{I}(\mathbf{r})$

D A Supplement to the Preliminary Mathematical Formalism

D.1 Refinements to the Dynamical Equation of Magnetic Density (ρ_m)

In existing MSC literature, ρ_M is defined as a scalar field representing the "structural stability of Magnetic Space (M)," but its dynamics are incomplete. To supplement this, we introduce the variational principle and conservation laws.

(1) Field Equation for ρ_M

We assume that the variation of ρ_M is induced by the distribution of external energy-momentum (e.g., mass, electromagnetic fields). We propose the following modified Klein-Gordon equation:

$$\Box\rho_M + \lambda(\rho_M)^3 = \kappa g^{\mu\nu} T^{(\text{ext})}_{\mu\nu}$$

where:

- $\Box$: The D'Alembertian operator ($\partial_t^2 - \nabla^2$).
- λ, κ: Coupling constants (to be determined experimentally).
- $T^{(\mathbf{ext})}_{\mu\nu}$: The external energy-momentum tensor. The right side represents its trace.

Physical Meaning:

- **Left-hand side**: Describes the free oscillation (wave) of ρ_M and its non-linear self-interaction (the $\lambda(\rho_M)^3$ term).
- **Right-hand side**: Represents how external energy deforms ρ_M (e.g., near a mass, ρ_M decreases, leading to gravity).

(2) Gravity-ρ_M Connection Condition

We modify the Einstein field equations to include ρ_M:

$$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = \frac{8\pi G}{c^4}\,(+)$$

where is the energy-momentum tensor of ρ_M, formally defined as:

$$= \partial_\mu \rho_M \partial_\nu \rho_M - g_{\mu\nu}\left[\frac{1}{2}\partial^\alpha \rho_M \partial_\alpha \rho_M + V(\rho_M)\right]$$

Here, $V(\rho_M)$ is the self-potential of ρ_M (e.g., $V(\rho_M) = \frac{\lambda}{4}(\rho_M)^4$).

(3) Interpretation of the Black Hole Singularity

The equation explains how the Magnetic Vacuum (MV) state is reached when $\rho_M \to 0$:

$$\lim_{\rho_M \to 0} [] \to \infty \quad \text{(energy divergence)}$$

This is analogous to the singularity problem in General Relativity (GR), but it mitigates the mathematical issue by introducing a physical interpretation: the collapse of the medium.

D.2 Quantitative Connection between Magnetic Waves (MW) and Standard Model Particles

To connect MWs with Standard Model particles (electrons, quarks, etc.), we propose the **Phase Cluster Model**.

(1) Quantization of Elemental Charges (ψ^+/ψ^-)

We treat ψ^+/ψ^- as spin-1/2 Dirac fermions to ensure compatibility with quantum field theory.

The Lagrangian for a free MW is:

$$= \bar{(}i\gamma^\mu \partial_\mu - m_M) - \bar{g}\gamma^\mu A_\mu$$

- : The spinner field of the MW.
- A_μ: The electromagnetic field (representing interaction with the MW).

(2) Reinterpretation of Particle-Wave Duality

Standard Model particles are interpreted as stable clusters of MWs:

- **Electron (e^-):**

$$e^- \equiv {}^{+\ -+} \quad \text{(A phase-locked combination of three MWs)}$$

  The charge $Q = -e$ is determined by the total sum of the MW phases (e.g., $\sum \phi_k = \pi$).

- **Quarks:** More complex topological arrangements (e.g., ${}^{++-}$).

(3) Mass Generation Mechanism

Instead of the Higgs mechanism, we introduce a -dependent mass term:

$$m_e(\rho_M) = m_0 \exp(-\gamma \rho_M)$$

The lower the (e.g., near a strong gravitational field), the greater the mass, which is consistent with the effects of spacetime curvature.

D.3 Predictions for Experimental Verification

(1) Hydrogen Atomic Spectrum

The energy levels of the hydrogen atom in the MW model are given by:

$$E_n = -\frac{m_e e^4}{2(4\pi\epsilon_0 \chi(\rho_M))^2 n^2 \hbar^2}$$

- $\chi(\rho_M)$: A ρ_M-dependent permittivity factor that modifies the vacuum permittivity ϵ_0.
- The model is calibrated so that $\chi(\rho_M) \to 1$ in regions of high ρ_M (far from gravitational sources, i.e., in a vacuum), recovering the standard formula.

(2) Gravitational Waves and ρ_M Fluctuations

It is predicted that signals from gravitational wave detectors (like LIGO) would contain an additional component from ρ_M fluctuations. The metric perturbation would be:

$$h_{\mu\nu} = h_{\mu\nu}^{(\mathrm{GR})} + \kappa' \delta\rho_M g_{\mu\nu}$$

This suggests that gravitational waves are not just ripples in spacetime but are also accompanied by oscillations in the underlying magnetic density of space.

E Philosophical Implications

Beyond reinterpreting fundamental physical phenomena, Magnetic Space Cosmology (MSC) presents profound philosophical implications for ontology, epistemology, and the debate between determinism and free will.

E.1 Ontology

MSC proposes a new perspective on the fundamental substance of the universe, constructing an ontology distinct from the traditional materialist view.

- **The Fundamentality of Magnetic Space (M):** MSC starts from the core hypothesis that the universe is not empty space but is filled with an energy-less fundamental medium, 'Magnetic Space (M)'. This M is the background and an active participant that mediates all physical phenomena and interactions. Although M does not directly possess energy or mass, it is a physical entity in itself—the intrinsic 'magnetic' property of space.
- **All Existence as Magnetic Waves (MW):** MSC asserts that all elementary particles, interactions, and indeed all matter and phenomena, are understood as various forms or interference patterns of 'Magnetic Waves (MW)' occurring within M. Material particles like protons, neutrons, and electrons are considered localized energy clusters formed by the extreme condensation or stable interference and superposition of magnetic waves in specific patterns. This presents the radical view that matter is not a fixed substance but a momentary interference structure of a wave.
- **The Nature of Reality:** The reality or world we experience is ultimately defined as a picture constructed by consciousness capturing the 'wavefront' of a continuously advancing magnetic wave. Since past wavefronts have already passed and vanished (existing only in memory), and future wavefronts have not yet arrived, what truly exists is only the 'present wave state' experienced by consciousness.
- **Radical Ontological Implication:** Pushing this perspective further, MSC presents the philosophical conclusion:

  > *"The world does not exist; only the consciousness perceiving the wavefront of the magnetic wave exists."*

  This suggests that since consciousness itself is understood as a phenomenon that manifests under specific conditions of the magnetic wave, the ultimate reality can be reduced to the interaction between the magnetic wave and the conscious perception that arises from it.

E.2 Epistemology

MSC also offers a new interpretation of how we perceive the world and acquire knowledge.

- **Consciousness and Perception of the Wavefront:** Consciousness is defined as a phenomenon intimately linked to the dynamic progression of magnetic waves within M. All material existence and phenomena are formed instantaneously at the wavefront of the continuously advancing magnetic wave, and consciousness is the very act of perceiving the wave interference pattern at this present wavefront. In other words, consciousness is a kind of 'self-awareness' or 'state-awareness' process, like a mirror reflecting the wavefront, and it can only directly experience the wave state of the 'here-and-now'.

- **The Physical Mechanism of Memory:** If consciousness is the perception of the present wavefront, then memory is the mechanism for storing and retrieving information from past wave states. MSC links this to the phenomenon of 'local time stagnation' inside charge clusters (protons, neutrons, etc.). It is proposed that in certain high-density magnetic environments (e.g., the MV state), when microscopic charge elements are extremely close, the magnetic wave activity in that local region can almost stop or become extremely slow, leading to a state of fixed energy and time. This state becomes the physical substance of 'memory,' which imprints past wave patterns (external stimulus information) like a photograph.

- **The Process of Thought:** Thought is understood as the process where the current consciousness (perception of the present wavefront) activates past memories (stored wave traces) and explores new connections between them, simulating various scenarios. This can be modeled as a complex interference and resonance phenomenon between stored magnetic wave patterns and currently incoming magnetic wave patterns.

E.3 Determinism and Free Will

MSC attempts to uniquely resolve the tension between the deterministic view that arises when the universe is understood as one giant magnetic wave system and the concept of human free will.

- **The Irreversible Wave Flow of the Universe:** MSC views M as single and continuous, and all magnetic waves within it as interconnected. The processes of interference, diffusion, and dissipation of magnetic waves are intrinsically irreversible, and this irreversible progression of waves determines the direction of time (the arrow of time). Therefore, it is explained to be practically impossible to reverse the wave state of the entire universe back to the past simultaneously. This carries a strong deterministic implication, in that all beings are pushed forward by the vast flow of the wave, and this flow (time) cannot be reversed.

- **Interpretation of Free Will:** Nevertheless, MSC suggests the possibility of a limited form of free will emerging in complex wave systems, especially in living organisms.
  - **Tendency Towards System Stability:** All physical systems have a tendency to prefer more stable, lower-energy states (e.g., the principle of least action). Complex magnetic wave systems like living organisms also have an intrinsic tendency to maintain their structure and function and achieve stability against external disturbances.
  - **Choice Among Multiple Interference Paths:** In response to external stimuli or internal state changes, a group of charge clusters (a living organism) faces several possible reaction paths (future wave interference patterns). The process of selecting a particular path at this juncture, based on past memory, the current situation, and the inherent stabilizing tendency, can be understood as the manifestation of free will. This choice is not purely random unpredictability but could be a probabilistic yet patterned decision emerging from complex wave interference. That is, the unfolding of the wave involves numerous possible paths, and consciousness can be seen as participating in the process of actualizing a specific path (the one most advantageous or stable for the group of charge clusters).
- **Conditioned Freedom:** Consequently, MSC suggests the possibility not of complete determinism or complete free will, but of **"conditioned freedom"** or **"emergent freedom."** That is, while the grand flow is determined, subtle changes of path within it are possible. The instincts of living beings or collective consciousness could also be explained as this 'stabilizing tendency of a collective wave'.

Thus, through the single fundamental concept of M, MSC attempts to provide an integrated and causal answer to a wide range of philosophical questions, from the nature of matter to the irreversibility of time, the workings of consciousness, and the problem of free will.