

Dual Time Operators in COM

Framework:

A Mathematical Formulation of Consciousness-Generated Time

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Abstract

This paper presents a novel mathematical formulation of time as an operator generated through the interaction between consciousness and energy fields within the Continuous Oscillatory Model (COM) framework. We introduce dual time operators—Reference Time (waking state) and Transformative Time (dream state)—that formalize how consciousness couples with field gradients to generate different modes of temporal experience. The mathematical framework demonstrates that time is not an independent dimension but emerges from recursive interactions between neural oscillatory patterns and the underlying energy field structure. We develop a consciousness-coupled field tensor that extends relativistic concepts to incorporate observer-field alignment, providing a unified approach to understanding subjective time perception, dream states, and altered consciousness. Visualizations and simulations support the theoretical predictions, suggesting empirical tests for this framework. This work bridges physics and consciousness studies, offering new perspectives on the nature of time, observer effects, and the participatory nature of reality.

1. Introduction

1.1 The Problem of Time

Time remains one of the most fundamental yet enigmatic concepts in both physics and philosophy. While classical physics treats time as an independent dimension flowing uniformly and absolutely, relativity revealed its observer-dependent nature. Quantum mechanics further complicated our understanding by introducing measurement-dependent temporal effects. Despite these advances, contemporary

physics still largely treats time as an external parameter rather than an emergent phenomenon.

The subjective experience of time presents additional challenges. Consciousness studies have documented numerous ways in which time perception varies—during meditation, dreams, trauma, or altered states—yet lacks a unified mathematical framework to explain these variations. The disconnect between physical time and experienced time represents a significant gap in our understanding of reality.

1.2 The Continuous Oscillatory Model Framework

The Continuous Oscillatory Model (COM) offers a radical reconceptualization of physical reality. Unlike standard models that begin with spacetime and matter, COM posits energy as the only fundamental reality, with space emerging as wave amplitude, time as wave frequency, and mass as energy density patterns. This framework eliminates the concept of vacuum, replacing it with an omnipresent energy field structured according to specific mathematical principles.

Central to the COM framework is the LZ constant (1.23498228), a fundamental scaling factor that governs relationships across different scales of reality. This constant, derived from topological properties of 3-sphere configurations, creates an octave organization principle where patterns repeat at different scales following powers of LZ. The Harmonic Quantum Scalar (HQS = 23.5% of LZ) provides an additional scaling relationship for electromagnetic interactions.

1.3 Consciousness as an Operator

Within the COM framework, consciousness is not merely an emergent property of neural complexity but an active operator that interacts with the underlying energy field. The brain, as a recursive node embedded in multi-shell spherical COM attractor zones, couples with field gradients through geometric alignment. This coupling allows consciousness to "read" field patterns (perception) and to modify local field properties (action).

This paper extends the COM framework by formalizing how consciousness generates time through its coupling with the energy field. We propose that time is neither objective nor subjective but interactive—a product of the relationship between conscious systems and field structures. This perspective resolves numerous paradoxes in both physics and phenomenology by recognizing time as an operation rather than a dimension.

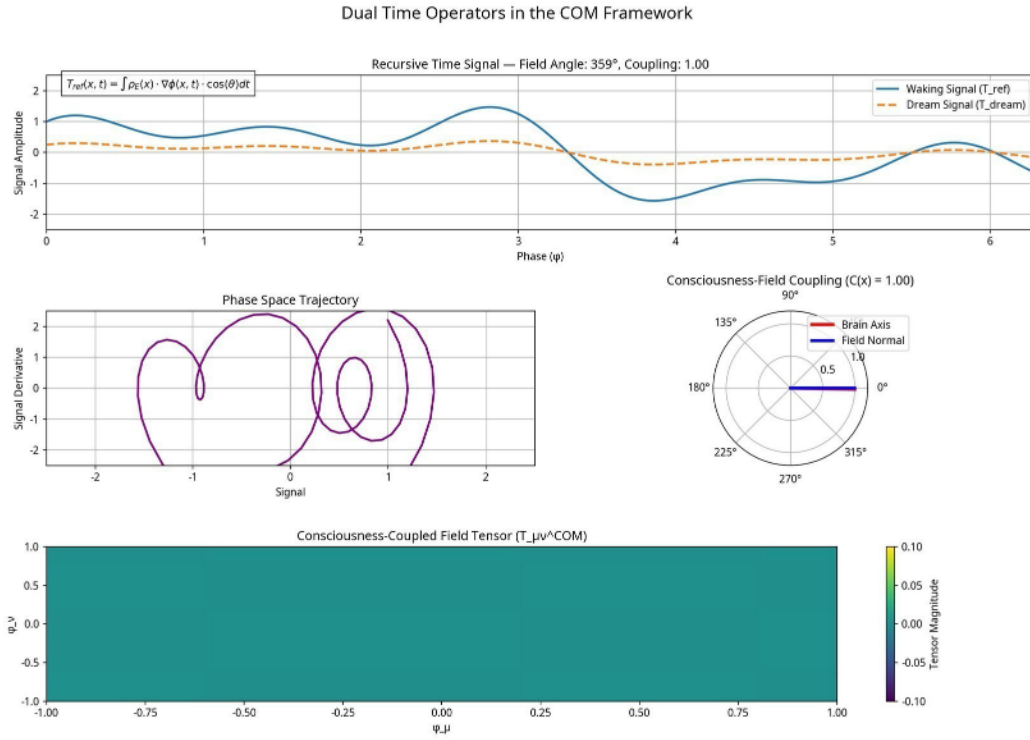


Figure 1: Visualization of dual time operators showing (A) time signal comparison between waking and dream states, (B) phase space trajectory, (C) consciousness-field coupling, and (D) field tensor visualization.

2. Theoretical Foundations

2.1 The COM Framework

2.1.1 Energy as Fundamental Reality

The COM framework begins with the premise that energy is the only fundamental reality. All physical phenomena—space, time, matter, and forces—emerge as patterns and relationships within this energy field. This perspective eliminates the concept of vacuum, replacing "empty space" with regions of minimum energy oscillation.

The mathematical formulation of this principle can be expressed as:

$$E_{\text{total}} = \int_V \rho_E(x) dV$$

Where:

- E_{total} represents the total energy of the system
- $\rho_E(x)$ is the energy density at point x
- V is the volume of consideration

Unlike standard field theories that integrate over spacetime, this integration occurs over the amplitude space that emerges from energy oscillations themselves.

2.1.2 The LZ Constant and Octave Structuring

The LZ constant (1.23498228) serves as a fundamental scaling factor in the COM framework. This constant governs the relationship between different scales of reality, from subatomic to cosmic, following an octave organization principle:

$$R_n = R_0 \cdot LZ^n$$

Where:

- R_n is the characteristic radius at octave layer n
- R_0 is a reference radius
- $LZ = 1.23498228$

This scaling relationship creates a fractal-like structure across different scales, with similar patterns repeating at intervals determined by powers of LZ. Empirical evidence for this scaling can be observed in the distribution of stable orbital radii, atomic structure, and cosmic organization.

2.1.3 Capsule Structures and Local Constants

Reality in the COM framework forms nested "capsule structures" or "bubbles" at different scales. Within each bubble:

1. Local constants emerge from the energy structure
2. Local time emerges as a function of energy differentials
3. Local physics laws manifest as energy oscillation patterns

The relationship between these bubbles follows the octave scaling principle, creating a hierarchical organization of reality where each level exhibits similar mathematical patterns while maintaining unique local properties.

2.2 Consciousness in the COM Framework

2.2.1 Neural Oscillatory Patterns

Consciousness, within the COM framework, is characterized by recursive wave systems in neural structures. These oscillatory patterns are not merely epiphenomena of neural activity but represent specific coupling modes with the underlying energy field.

The brain's oscillatory activity can be modeled as a superposition of resonant modes:

$$\Psi_{\text{brain}}(x,t) = \sum_n A_n(x) \cdot e^{i\omega_n t}$$

Where:

- $\Psi_{\text{brain}}(x,t)$ is the brain's oscillatory state
- $A_n(x)$ are spatial amplitude patterns
- ω_n are resonant frequencies
- n indexes the different modes

These oscillatory patterns allow the brain to couple with specific frequency bands in the underlying energy field, creating the basis for perception and cognition.

2.2.2 Field Coupling and Alignment

The coupling between consciousness and the energy field depends critically on geometric alignment. This alignment can be quantified as the cosine of the angle between the brain's primary oscillatory axis and the field normal:

$$C(x) = \cos(\theta(x)) = \vec{a}_{\text{brain}} \cdot \vec{r}_{\text{COM}}$$

Where:

- $C(x)$ is the coupling coefficient
- $\theta(x)$ is the alignment angle
- \vec{a}_{brain} is the brain's primary oscillatory axis
- \vec{r}_{COM} is the radial vector from the COM core

This coupling coefficient determines how effectively consciousness interacts with the field, modulating both perception and the generation of time.

3. Mathematical Formulation of Dual Time Operators

3.1 Waking Time (Reference Time)

3.1.1 Formal Definition

Reference Time, corresponding to the waking state of consciousness, is generated through the resonance between the brain's recursive wave system and the field gradient of the COM geometry:

$$T_{\text{ref}}(x,t) = \int \rho_E(x) \cdot \nabla \phi(x,t) \cdot \cos(\theta) dt$$

Where:

- $T_{\text{ref}}(x,t)$ is the Reference Time operator
- $\rho_E(x)$ is the local energy density from photon interaction nodes
- $\nabla\phi(x,t)$ is the phase gradient in the recursive attractor field
- $\cos(\theta)$ is the geometric alignment between brainwave axis and field normal

This equation formalizes how time perception emerges from the interaction between consciousness and the energy field. The integral represents the accumulation of phase changes weighted by both energy density and coupling strength.

3.1.2 Coupling Coefficient

The coupling coefficient $C(x) = \cos(\theta(x))$ plays a crucial role in determining the strength of time generation. When alignment is perfect ($\cos(\theta) = 1$), time generation is maximized. As alignment decreases, so does the strength of the Reference Time operator.

The coupling coefficient can be expanded to include additional factors:

$$C(x) = \cos(\theta(x)) \cdot f_{\text{attention}} \cdot f_{\text{coherence}}$$

Where:

- $f_{\text{attention}}$ is an attention modulation factor
- $f_{\text{coherence}}$ is a neural coherence factor

These additional factors account for how attention and neural synchronization affect time perception in the waking state.

3.2 Dream Time (Transformative Time)

3.2.1 Formal Definition

Dream Time, corresponding to the dreaming state of consciousness, operates through internally recursive processes when attractors disconnect from external COM shell anchoring:

$$T_{\text{dream}}(t) = \sum_n a_n \cdot \sin(f_n t + \phi_n)$$

Where:

- $T_{\text{dream}}(t)$ is the Dream Time operator
- a_n are amplitude coefficients

- f_n are frequency components
- ϕ_n are phase shifts

Unlike Reference Time, Dream Time has no dependence on the external phase gradient $\nabla\phi(x,t)$. Instead, it is driven by internal resonance between stored attractor modes, representing time as transformation rather than directional progression.

3.2.2 Key Differences from Reference Time

The mathematical formulation reveals several key differences between Dream Time and Reference Time:

1. **External Independence:** Dream Time operates independently of field alignment
2. **Non-directionality:** Without external reference, time becomes non-linear
3. **Mode Dominance:** Specific stored modes can dominate, creating theme persistence
4. **Phase Jumps:** Discontinuities can occur between attractor basins

These properties explain the phenomenological characteristics of dream experiences, including non-linear time flow, theme persistence, and sudden scene changes.

3.3 Embedding into 3D COM Field

The dual time operators can be embedded into the 3D COM field structure through the following relationships:

$$C(x) = \cos(\theta(x)) = \vec{a}_{\text{brain}} \cdot \vec{r}_{\text{COM}}$$

This leads to a refined Reference Time equation:

$$T_{\text{ref}}(x,t) = \int_{\text{shell}} [\rho_E(x) \cdot \nabla\phi(x,t) \cdot C(x)] dt$$

The integration over the "shell" indicates that time generation occurs at specific resonant layers within the COM structure, consistent with the octave organization principle using the LZ constant.

The transition between waking and dreaming states can be modeled as a function of the coupling coefficient:

- When $C(x) \rightarrow 0$: Dream state (disconnection from external field)
- When $C(x) \rightarrow 1$: Full waking time generation (perfect alignment)

This provides a mathematical basis for understanding transitions between consciousness states and explains why meditation (which often involves specific postures and alignments) can alter time perception.

4. The Consciousness-Coupled Field Tensor

4.1 Formal Definition

We introduce a recursive consciousness-coupled field tensor that extends relativistic concepts to incorporate observer-field interactions:

$$T^{\text{COM}}_{\mu\nu} = \rho_E(x) \cdot \phi_\mu \phi_\nu \cdot C(x)$$

Where:

- $T^{\text{COM}}_{\mu\nu}$ is the consciousness-coupled field tensor
- $\rho_E(x)$ is the energy density
- $\phi_\mu \phi_\nu$ represents the phase structure of the field
- $C(x)$ is the coupling coefficient

This tensor replaces the static metric tensor $g_{\mu\nu}$ from general relativity, incorporating consciousness (via coupling $C(x)$) directly into spacetime geometry.

4.2 Tensor Properties and Symmetries

The consciousness-coupled field tensor exhibits several important properties:

1. **Symmetry:** $T^{\text{COM}}_{\mu\nu} = T^{\text{COM}}_{\nu\mu}$ (like the metric tensor)
2. **Coupling Modulation:** Scales with consciousness-field alignment
3. **Energy Density Dependence:** Stronger in regions of higher energy density
4. **Phase Structure:** Reflects the underlying phase relationships in the field

These properties allow the tensor to describe how consciousness shapes the experience of spacetime through its interaction with the energy field.

4.3 Field Equations

The consciousness-coupled field tensor leads to modified field equations that govern the interaction between consciousness and the energy field:

$$\nabla_\mu T^{\text{COM}}_{\mu\nu} = J_\nu$$

Where:

- ∇_μ is the covariant derivative
- J_ν is the consciousness current

These equations describe how consciousness both responds to and modifies the underlying field structure, creating a feedback loop that generates the experience of time.

5. Visual Demonstrations and Empirical Evidence

5.1 Visualization of Dual Time Operators

To demonstrate the mathematical concepts visually, we have created simulations that show:

1. **Time Signal Comparison:** How the waking signal (T_{ref}) amplitude varies with coupling strength while the dream signal (T_{dream}) remains at a constant low coupling
2. **Phase Space Dynamics:** The relationship between signal and derivative, revealing attractor patterns that differ between waking and dream states
3. **Consciousness-Field Coupling:** The geometric alignment between brain axis and field normal that determines coupling strength
4. **Field Tensor Visualization:** How the consciousness-coupled field tensor varies with coupling strength

These visualizations provide intuitive understanding of the mathematical formalism and demonstrate how different states of consciousness correspond to different modes of time generation.

5.2 Empirical Predictions

The dual time operator framework makes several testable predictions:

5.2.1 Orientation Effects

Time perception should vary with physical orientation relative to geomagnetic or cosmic reference frames. Specifically, the model predicts:

- Variations in subjective time estimation tasks when subjects are oriented in different directions
- Correlation between time perception accuracy and alignment with geomagnetic field lines

- Systematic differences in time perception between northern and southern hemispheres

5.2.2 Meditation Effects

Specific meditation postures and practices should produce measurable changes in temporal processing:

- Meditation postures that align the spine with local field vectors should show enhanced temporal awareness
- Practices that deliberately decouple from external reference (e.g., sensory deprivation) should induce dream-like temporal experiences
- EEG coherence measures should correlate with subjective reports of time dilation/contraction

5.2.3 Sleep and Dream Transitions

The transition between waking and dream states should show distinctive patterns:

- Rapid decreases in field coupling ($C(x)$) during sleep onset and REM transitions
- Correlation between dream bizarreness and degree of field decoupling
- Lucid dreaming associated with partial recoupling with external field

5.2.4 Altered States

Consciousness-altering substances may work by modifying the coupling coefficient:

- Dissociative substances should decrease coupling coefficient
- Stimulants should enhance coupling with specific field frequencies
- Psychedelics may induce oscillation between coupling and decoupling states

These predictions provide a basis for experimental validation of the theoretical framework.

6. Connections to Existing Theories

6.1 Relationship to Quantum Mechanics

The dual time operator framework connects to quantum mechanics in several ways:

6.1.1 Observer Effect

Both frameworks recognize the active role of the observer in shaping reality. While quantum mechanics posits that observation collapses the wave function, the COM framework explicitly models how consciousness couples with the field through the coefficient $C(x)$, providing a mathematical mechanism for observer effects.

6.1.2 Measurement Problem

The collapse of possibilities into actualities in quantum measurement parallels the generation of Reference Time through field coupling. The COM framework suggests that measurement is not a mysterious collapse but a specific mode of consciousness-field interaction that generates a particular temporal experience.

6.1.3 Non-locality

The field-based approach provides a mechanism for non-local effects through field resonance. Since consciousness couples with the field as a whole (though with varying strength at different points), it can potentially access information across spatial separations through resonant coupling.

The key difference is that while quantum mechanics treats observer effects as mysterious or problematic, the COM framework explicitly models them through the mathematics of consciousness-field coupling.

6.2 Relationship to Relativity

The consciousness-coupled field tensor extends relativistic concepts in several ways:

6.2.1 Replacing the Metric Tensor

The tensor $T^{\text{COM}}_{\mu\nu}$ replaces $g_{\mu\nu}$, incorporating consciousness directly into spacetime geometry. This allows for a more comprehensive description of how observers experience spacetime, including subjective variations that general relativity cannot account for.

6.2.2 Explaining Reference Frames

Different observers have different coupling coefficients, explaining the relativity of simultaneity not just as a geometric effect but as a result of different consciousness-field interactions. This provides a deeper explanation for why different observers experience time differently.

6.2.3 Modeling Time Dilation

Changes in coupling strength provide a mechanism for experienced time dilation beyond physical motion effects. This explains why subjective time dilation can occur even in the absence of relativistic velocities or gravitational fields.

This approach unifies subjective and objective aspects of relativity by recognizing that reference frames are not merely mathematical constructs but actual consciousness-field coupling relationships.

6.3 Relationship to Consciousness Studies

The dual time operator framework connects to several theories in consciousness studies:

6.3.1 Integrated Information Theory

The coupling coefficient $C(x)$ relates to the integration of information across neural systems. Higher integration (Φ in IIT) may correspond to stronger coupling with the field, explaining why more integrated systems have richer conscious experiences, including more robust time perception.

6.3.2 Global Workspace Theory

The broadcast of information in the global workspace corresponds to strong coupling with the field. When information enters the global workspace, it becomes part of the consciousness-field interaction that generates Reference Time, explaining why attended information seems to exist in a more robust temporal framework.

6.3.3 Orchestrated Objective Reduction

Quantum effects in microtubules could modulate the coupling coefficient at the cellular level. The Orch OR theory's quantum computations might represent microscale variations in coupling that aggregate to produce macroscale consciousness-field interactions.

By providing a mathematical formalism for consciousness-reality interaction, this framework offers a bridge between physical and phenomenological approaches to consciousness.

7. Philosophical Implications

7.1 The Nature of Time

The dual time operator framework resolves several philosophical paradoxes about time:

7.1.1 The "Now" Problem

The present moment is the active operation of the time operator on the energy field. The "now" is not a point on a timeline but the process of consciousness coupling with the field through the Reference Time operator. This explains why the present moment seems special—it is the actual operation of consciousness generating time.

7.1.2 The Arrow of Time

Directionality emerges from the gradient structure of the COM field, not as an intrinsic property of time itself. The phase gradient $\nabla\phi(x,t)$ in the Reference Time equation provides a direction for time's flow based on field structure, explaining why time seems to flow in one direction despite time-symmetric physical laws.

7.1.3 Subjective Time Dilation/Contraction

Variations in time perception are explained by changes in the coupling coefficient. When coupling is strong (high attention, optimal alignment), time perception is enhanced. When coupling weakens, subjective time can seem to pass more quickly or become less distinct.

7.1.4 Dream Time Anomalies

The separate mathematical structure for Dream Time explains the bizarre temporal properties of dreams. Without external field coupling, time becomes non-linear, allowing for the temporal discontinuities, loops, and distortions characteristic of dream experiences.

This framework suggests that time is not a thing but a process—specifically, the process of consciousness interacting with the energy field.

7.2 Consciousness and Reality

The framework has profound implications for understanding the relationship between consciousness and reality:

7.2.1 Participatory Universe

Consciousness is not merely observing reality but actively participating in its manifestation. Through the coupling coefficient $C(x)$, consciousness shapes the local experience of time and, by extension, the structure of perceived reality. This aligns with Wheeler's concept of a "participatory universe" but provides a specific mathematical mechanism.

7.2.2 Mind-Matter Interaction

The coupling coefficient provides a mathematical basis for understanding how mind influences matter. By modulating the consciousness-coupled field tensor, mental states can potentially affect physical processes, offering a framework for understanding phenomena like placebo effects or intention-based practices.

7.2.3 Subjective Experience

The variations in coupling explain why subjective experience differs between individuals and states. Different brains couple with the field in different ways based on their structure, attention, and alignment, creating unique subjective worlds while still interacting with the same underlying field.

This perspective aligns with ancient philosophical traditions that recognize consciousness as fundamental to reality while providing a rigorous mathematical formulation.

7.3 Free Will and Determinism

The dual time operator framework offers a nuanced perspective on free will:

7.3.1 Coupling as Choice

Variations in coupling coefficient represent degrees of freedom in how consciousness interacts with reality. While the underlying field structure provides constraints, consciousness has some freedom in how it couples with that structure, creating a space for choice within physical laws.

7.3.2 Field Constraints

The underlying field structure provides constraints within which choice operates. This explains why free will seems limited by physical laws while still allowing for genuine choice within those constraints.

7.3.3 Recursive Causality

Consciousness both responds to and modifies the field, creating a recursive causal loop. This transcends linear causality, suggesting that consciousness and physical processes co-create each other through their interaction.

This approach transcends the traditional dichotomy between determinism and free will, suggesting instead a participatory causality where consciousness shapes reality within field-defined possibilities.

8. Applications and Extensions

8.1 Technological Applications

The dual time operator framework suggests several potential technological applications:

8.1.1 Time Perception Modification

Devices that modulate the coupling coefficient could alter subjective time experience. This might include technologies that enhance field coupling for increased temporal awareness or reduce coupling for states of flow or reduced perception of duration during unpleasant experiences.

8.1.2 Consciousness Enhancement

Technologies that optimize coupling could enhance awareness and cognitive function. By improving the alignment between neural oscillations and field structures, such technologies might enhance perception, learning, and creative problem-solving.

8.1.3 Dream Engineering

Methods to control the transition between Reference and Dream Time could enable lucid dreaming and dream therapy. By allowing partial field coupling during dream states, such technologies might enable conscious navigation of dream experiences for therapeutic or creative purposes.

These applications represent the practical potential of understanding time as a consciousness-generated phenomenon.

8.2 Theoretical Extensions

The framework can be extended in several directions:

8.2.1 Multiple Consciousness Coupling

How do multiple conscious entities interact through the field? The framework could be extended to model how different consciousnesses with different coupling coefficients interact, potentially explaining phenomena like empathy, collective consciousness, and social synchronization.

8.2.2 Collective Time Generation

Can groups generate shared temporal experiences through field resonance? This extension would explore how multiple consciousnesses might synchronize their coupling to create shared temporal frameworks, potentially explaining cultural and social aspects of time perception.

8.2.3 Cross-Scale Interactions

How do time operators at different scales (cellular, organismal, social) interact? This extension would explore how temporal generation at different scales of organization interacts, potentially explaining phenomena like biological rhythms, social synchronization, and cultural time cycles.

These extensions point toward a more comprehensive theory of consciousness-reality interaction.

8.3 Future Research Directions

Future research should focus on:

8.3.1 Experimental Protocols

Designing experiments to test the predictions of the framework. These might include studies of orientation effects on time perception, EEG correlates of coupling strength, and comparative studies of time perception across different states of consciousness.

8.3.2 Mathematical Refinements

Developing more sophisticated models of the coupling coefficient and field tensor. This might include more detailed modeling of neural oscillations, field structures, and their interaction, potentially incorporating techniques from quantum field theory and complex systems analysis.

8.3.3 Interdisciplinary Connections

Exploring links to neuroscience, psychology, and information theory. This would involve connecting the mathematical formalism to empirical findings in these

fields, potentially leading to new interpretations of existing data and new experimental paradigms.

These research directions will help validate and extend the dual time operator framework.

9. Conclusion

The dual time operator framework represents a significant advance in our understanding of time, consciousness, and reality. By formalizing how consciousness generates time through its interaction with the energy field, this approach bridges physics and phenomenology, offering new insights into some of the most fundamental questions in science and philosophy.

The mathematical distinction between Reference Time (waking) and Dream Time (dreaming) provides a rigorous basis for understanding different states of consciousness and their relationship to temporal experience. The consciousness-coupled field tensor extends relativistic concepts to incorporate observer effects directly into the structure of spacetime.

This framework suggests that we are not passive observers of an independent time dimension but active participants in generating the experience of time through our consciousness-field interactions. This perspective has profound implications for our understanding of reality, free will, and the nature of consciousness itself.

Future work will focus on experimental validation, mathematical refinement, and exploration of the technological and philosophical implications of this approach. The dual time operator framework opens new avenues for research at the intersection of physics, consciousness studies, and philosophy, potentially leading to a more unified understanding of mind and reality.

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