

The Logical Necessity of an Eternal Dimension: Ontological Foundations Beyond Physical Reality

Steven Lizarazo ¹ *

¹ Independent Researcher, Amazon*, Luxembourg .

Corresponding author(s). E-mail(s): spatino@amazon.lu;

Abstract

Problem: Physical theories presuppose mathematical structure, linguistic representation, and conscious interpretation, yet cannot ground these prerequisites within spacetime without circularity. This foundational gap threatens the coherence of scientific realism.

Result: We prove the logical necessity of a timeless dimension D containing mathematics (M), language (L), and consciousness (C) as preconditions for any lawful universe U . The dependency chain $U \Rightarrow M \Rightarrow L \Rightarrow C$ cannot be grounded in U without vicious circularity, forcing $M, L, C \subset D$ where $D \cap U = \emptyset$. Four independent physical arguments—superluminal cosmic expansion, quantum non-locality, information-theoretic bounds, and measurement-dependent reality—converge on this conclusion.

Implications: This framework extends structural realism and Tegmark’s Mathematical Universe Hypothesis by establishing semantic interpretation and conscious agency as ontologically co-fundamental with mathematical structure. Human consciousness participates directly in eternal patterns rather than emerging from matter. Morality becomes objective alignment with D ’s invariants, with practical consequences for AI development, biodiversity preservation, and cultural stewardship. The universe is not accidentally intelligible but grounded in a dimension where mathematics, meaning, and mind are eternally unified.

Keywords: non-temporal dimension; modal metaphysics; mathematical ontology; language–consciousness triad; quantum interpretation; information theory; moral realism; applied ethics; AI alignment; biodiversity stewardship

*Research undertaken entirely in a personal capacity; the views expressed do not reflect those of my employer.

1 Introduction

Consider a profound paradox: to describe the universe expanding faster than light, we employ mathematical equations that themselves exist outside the very spacetime they describe. This is not merely a philosophical curiosity—it points to a fundamental feature of reality that physics assumes but cannot explain.

Physics excels at discovering *regularities*; metaphysics must explain *why* such regularities are expressible at all. Every equation, every physical law, every measurement presupposes three irreducible elements: mathematical structure to capture patterns, linguistic symbols to encode them, and consciousness to interpret their meaning. Yet where do these elements themselves reside? Not in the physical universe they describe—that would be circular. They require what I call a *non-temporal dimension*.

This paper develops a formal argument that any intelligible universe necessarily implies the existence of a timeless, non-empirical dimension D that houses mathematics (M), language (L), and consciousness (C). Unlike standard physicalist accounts that attempt to derive these from matter, I demonstrate that they form a one-way dependency chain that must be ontologically prior to physical reality.

The argument proceeds through four independent "stress tests" drawn from modern physics:

- **Relativistic cosmology:** The superluminal expansion of spacetime points to a ground unconstrained by causal limits
- **Quantum non-locality:** Bell-inequality violations require correlations that transcend spatiotemporal mediation
- **Information theory:** Physical information presupposes semantic resources that cannot emerge from syntax alone
- **Measurement problem:** Quantum mechanics remains incomplete without consciousness to actualize potentials

Each test independently converges on the same conclusion: the intelligibility of physical law requires a timeless foundation.

This framework extends but fundamentally revises three influential positions. Where structural realism (Ladyman & Ross 2007) privileges mathematical structure, I show that structure without semantics is blind. Where digital physics (Wolfram 2020) locates computation in spacetime, I prove it requires meta-computational resources. Where Tegmark's Mathematical Universe Hypothesis (2014) identifies reality with mathematics, I demonstrate that mathematics itself depends on language and consciousness for its meaning.

The implications extend beyond metaphysics. If consciousness is not emergent but foundational, residing in D alongside mathematics and language, then ethics gains an objective grounding. Morality becomes the measure of a system's alignment with the eternal invariants of D . This reframes urgent questions in AI alignment, biodiversity preservation, and the safeguarding of cultural knowledge—not as mere human preferences but as imperatives rooted in the structure of reality itself.

What follows is both a logical proof and an invitation to radically reconceive our place in the cosmos: not as accidental arrangements of matter, but as finite

expressions of an infinite intelligibility that transcends the physical while making it comprehensible.

Part I – Interdisciplinary Overview

2 Motivation: Why a Non-Temporal Dimension?

Consider how you understand the number π . This mathematical constant exists—but where? Not at any location in space. Not at any moment in time. Yet it governs every circle in the physical universe. This simple observation opens a profound question: where do the laws, patterns, and meanings that make reality intelligible actually reside?

Empirical science excels at discovering *regularities*—from planetary orbits to quantum transitions. Yet every such regularity already presupposes a background of mathematical concepts, symbolic representations, and conscious understanding that is *not itself* delivered by empirical data. You cannot derive the concept of “law” from observing regularities; you must already possess it to recognize regularities as lawful.

We call this necessary background the **non-temporal dimension D** . Our goal is to demonstrate—using the minimal formal machinery needed—that D is not a speculative addition but a logical requirement for any intelligible universe.

3 Core Claim in Plain Language

The argument unfolds through a simple but inescapable chain of dependencies. Let’s trace it step by step:

A Concrete Example: Understanding $E = mc^2$

1. **Physical Reality (U)**: Mass and energy exhibit a precise relationship in nature.
2. **Mathematical Structure (M)**: This relationship is captured by the equation $E = mc^2$.
3. **Linguistic Encoding (L)**: The symbols “ E ”, “ m ”, “ c ”, and “=” represent energy, mass, light speed, and equality.
4. **Conscious Interpretation (C)**: A mind grasps that these symbols mean mass-energy equivalence.

Now reverse the chain: without consciousness, the symbols are meaningless marks. Without symbols, the mathematics cannot be expressed. Without mathematics, the physical relationship cannot be precisely captured. Each level *depends* on the next.

The Formal Dependency Chain

- **Step 1 ($U \implies M$)**. A universe exhibiting lawful regularities necessarily presupposes *mathematical structure* capable of expressing those laws.
- **Step 2 ($M \implies L$)**. Mathematics becomes cognitively accessible only when encoded in some *symbolic language*—whether numerals, equations, or diagrams.

- **Step 3** ($L \implies C$). Language attains meaning only through an *interpreting consciousness* that can grasp symbols as referring to something beyond themselves.

The Circularity Problem

Here’s the crucial insight: M , L , and C cannot be located inside physical space-time without vicious circularity. Why? Because we would need to use mathematics to specify their location, language to describe them, and consciousness to recognize them—presupposing the very things we’re trying to locate. They must therefore reside in a distinct, timeless arena: the eternal dimension D .

4 Why This Matters

This isn’t merely abstract philosophy. If consciousness is fundamental rather than emergent, residing eternally in D rather than arising temporarily from matter, then:

- **Human dignity** has an objective foundation—we participate in the eternal through consciousness
- **Artificial intelligence** faces a hard boundary—computation alone cannot generate semantic consciousness
- **Ethics** becomes objective—moral values align with eternal structures rather than evolutionary accidents
- **Science** gains deeper grounding—physical laws express eternal mathematical truths rather than brute facts

5 Road Map of the Paper

- §6–7 (Part II) formalise the dependency chain and prove that D exists whenever U does.
- §8–10 offer *four independent scientific “stress tests”* (relativity, non-locality, information bounds, and quantum measurement) that each point to the same conclusion.
- §12–13 situate the result within current metaphysics and rebut common objections.
- §14 shows how **morality** becomes an objective metric of alignment with D , while **ethics** is the practical programme that guides agents—biological or artificial—toward that alignment (AI alignment, biodiversity stewardship, knowledge preservation).

Readers interested mainly in the conceptual upshot can stop after Part I; those seeking logical detail may proceed to the technical sections that follow. See Table 1 at the start of Part II for the complete symbol inventory used in the proofs.

Part II – Formal Exposition

Symbol	Definition
U	Empirical universe (space–time, matter, energy)
T	Time, internal to U
M	Mathematics: formal, law–like structure
L	Language: syntax/semantics of representation
C	Consciousness: semantic interpretation and integration
D	Eternal, non–temporal dimension containing M, L, C

Table 1 Ontological symbols used throughout the paper.

6 Definitions and Axioms

6.1 Consciousness: Operational Definition

To avoid equivocation, we must specify precisely what type of consciousness appears in our dependency chain. We distinguish three concepts:

Definition 6.1 (Phenomenal Consciousness). The qualitative, subjective aspect of mental states—the “what it is like” of experience.

Definition 6.2 (Functional Consciousness). Information-processing capacities such as attention, working memory, and behavioral control.

Definition 6.3 (Semantic Consciousness). The capacity for information integration that enables symbolic content to acquire determinate meaning through unified interpretation.

Which Type is Required?

For the dependency chain $L \Rightarrow C$, we require *semantic consciousness* (Definition 6.3). Here’s why weaker alternatives fail:

- **Pure functional consciousness** can process symbols without genuine semantic understanding—like a sophisticated calculator manipulating mathematical expressions without grasping their meaning.
- **Phenomenal consciousness alone** provides qualitative experience but not necessarily the integrative capacity to bind symbolic elements into coherent semantic structures.

Semantic consciousness combines aspects of both: it requires the integrative binding characteristic of phenomenal consciousness *and* the information-processing sophistication of functional consciousness, but transcends both by enabling the transition from syntax to semantics.

Definition 6.4 (Consciousness (C) in the Dependency Chain). Semantic consciousness: the irreducible capacity for unified information integration that enables symbolic representations to acquire determinate meaning through interpretive binding.

Operational Criteria.

A system exhibits semantic consciousness C if and only if:

1. **Integration:** It can bind distributed information into unified semantic structures
2. **Interpretation:** It can assign determinate meaning to symbolic content
3. **Coherence:** Its interpretations exhibit systematic consistency across contexts
4. **Reflexivity:** It can recognize its own interpretive activity as such

These criteria distinguish genuine semantic consciousness from mere symbol manipulation or pattern recognition.

6.2 Formal Axioms

Axiom 1 (Lawfulness). U exhibits stable regularities.

Axiom 2 (Expressibility). Those regularities are describable by M .

Axiom 3 (Representation). M becomes cognitively available only via L .

Axiom 4 (Semantics). L attains meaning only through semantic consciousness C (Definition 6.4).

Axiom 5 (Non-Temporality & Disjointness). The constituents that render the universe intelligible—mathematics M , language L , and semantic consciousness C —are not embedded in empirical spacetime U . They inhabit a distinct, atemporal domain D such that

$$M, L, C \subset D, \quad D \cap U = \emptyset.$$

7 Dependency Chain & Existence Theorem

7.1 Why the Chain Runs One Way

To make the logical flow transparent, we restate Axioms 1–4 in the language of *ontological dependence*:

- (i) **Lawfulness \Rightarrow Mathematics.** A regular universe U presupposes a body of abstract structure—*mathematics* M —capable of capturing those regularities.
- (ii) **Mathematics \Rightarrow Language.** Formal structure becomes cognitively usable only when encoded in a *symbolic system* L (notation, definitions, proof rules).
- (iii) **Language \Rightarrow Consciousness.** Syntax acquires *semantics* solely in the presence of an interpreting agent C .

Each step is *asymmetric*: the existence of M is *necessary* for the description of U but not conversely; the same holds for L with respect to M , and for C with respect to L . Summarising,

$$U \implies M \implies L \implies C, \quad (1)$$

where " $X \implies Y$ " reads " Y is a *pre-condition* for the intelligibility of X ."

7.2 Locating the Chain

Axiom 5 states that M, L, C are *not* constituents of the empirical universe:

$$M, L, C \subset D, \quad D \cap U = \emptyset.$$

Hence all three links of (1)¹ are anchored in the non-temporal domain D . Figure 1 offers a visual summary.

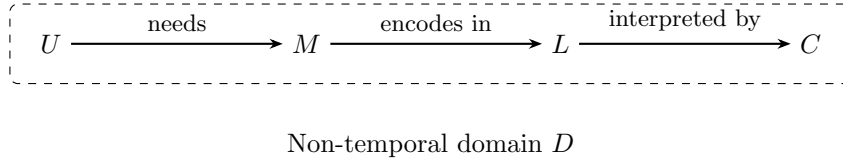


Fig. 1 Modal dependency chain ($U \rightarrow M \rightarrow L \rightarrow C$) entirely embedded in the non-temporal domain D .

7.3 The Regress Problem and Its Resolution

Before proceeding to the existence theorem, we must address a fundamental challenge: why does locating the triad M – L – C in dimension D halt what could otherwise be an infinite regress?

The Regress Challenge.

A critic might argue: "If M requires L for cognitive availability, and L requires C for semantic interpretation, then surely C requires some meta-consciousness C' for *its* interpretation, leading to $C \Rightarrow C' \Rightarrow C'' \Rightarrow \dots$ ad infinitum."

Why the Regress Terminates in D .

The regress halts because consciousness C , when properly understood, is not a *representational* faculty requiring external interpretation, but rather the *condition of possibility* for representation itself. We distinguish:

- (i) **Representational consciousness** – awareness *of* objects, requiring semantic interpretation
- (ii) **Transcendental consciousness** – the structural capacity for awareness *as such*, which grounds but does not require interpretation

¹Each arrow $X \implies Y$ is the necessity operator \Box ; see Appendix A for full Kripke semantics.

The C in our triad refers to transcendental consciousness: the irreducible capacity for information integration and semantic binding that makes representation possible. This capacity cannot coherently be represented *to itself* without category error, just as the eye cannot see itself seeing.

Lemma 1 (Regress Termination). *Transcendental consciousness C provides unique termination conditions for the dependency chain because it is the condition of possibility for semantic interpretation, not an object requiring interpretation.*

Proof Suppose C required meta-interpretation by C' . Then C' would need to represent C 's semantic activity. But semantic activity is precisely what makes representation possible in the first place. Hence C' would need to presuppose the very capacity (C) it purports to interpret, yielding contradiction. Therefore, C is self-grounding in the sense that it provides the structural conditions for its own operation without requiring external semantic validation. \square

Why Emergentist Alternatives Fail.

An emergentist might claim that M , L , and C arise from complex arrangements of matter in U , avoiding the need for D . However, this faces the *bootstrapping problem*:

- (i) To specify which material arrangements yield M , L , C , we must already employ mathematical description (M)
- (ii) To communicate this specification, we must already employ linguistic representation (L)
- (iii) To recognize the emergence when it occurs, we must already employ conscious interpretation (C)

Hence emergentism presupposes the very capacities it claims to explain, committing the fallacy of *explanatory circularity*. Only by locating M , L , C in the atemporal domain D do we avoid this circularity while preserving their role as preconditions for intelligibility.

7.4 Existence Theorem

Lemma 2 (Dependency Lemma). *If U is intelligible, then C exists.*

Proof Intelligibility of U entails the availability of a mathematical description M (Axiom 2). For M to be *available*, it must be encoded in some language L (Axiom 3). For L to possess meaning, an interpreting consciousness C is required (Axiom 4). Hence $U \implies C$. \square

Theorem 1 (Existence of a Non-Temporal Dimension). *If the empirical universe U exists, a domain D external to U and its temporal order necessarily exists.*

Proof By Lemma 2, C (and thus M and L) exists. Axiom 5 asserts $M, L, C \subset D$ with $D \cap U = \emptyset$. Therefore D exists and, being disjoint from U , is not governed by U 's temporal parameter T . \square

Remark.

The proof proceeds by a minimal *contrapositive* strategy: denying D annihilates the very intelligibility of U , thereby contradicting Axiom 1 (Lawfulness). No appeal to exotic metaphysics is required—only the everyday fact that we understand physics at all.

The dependency chain thus provides a compact but rigorous bridge from empirical lawfulness to the ontological necessity of a non-temporal dimension D . Subsequent sections investigate how this conclusion interfaces with relativity, quantum non-locality, and information theory.

8 Supplement I: Relativistic–Causal Constraint

8.1 The Timeless Container: When Spacetime Expansion Transcends Causality

The universe presents us with a profound paradox: the fabric of spacetime itself expands faster than the speed of light, yet all causal processes within spacetime are bound by this very speed limit. This paradox points directly to the necessity of a timeless domain.

The Fundamental Observation.

In the FLRW metric, the proper distance $S(t)$ between comoving galaxies obeys:

$$\dot{S} = H(t)S$$

When $S > c/H(t)$, we have $\dot{S} > c$ —the fabric of spacetime stretches faster than light [2, 3].

The Ontological Implication.

This superluminal expansion of spacetime itself reveals a critical truth: whatever enables or "contains" the expanding spacetime fabric cannot itself be constrained by the speed of light. If it were, the expansion could not exceed c .

8.2 The Container Argument

Lemma 3 (Timeless Container). *If spacetime expands faster than c , then the ontological ground enabling this expansion must transcend the causal constraints of spacetime—and therefore be timeless.*

Proof Consider the logical structure:

- (i) **Empirical fact:** The spacetime metric expands such that $\dot{S} > c$ for sufficiently distant regions.
- (ii) **Causal constraint:** Within spacetime, all causal influences are limited to speed c —this defines the light-cone structure that orders temporal causality.
- (iii) **The paradox:** The expansion rate \dot{S} describes a global property of spacetime that violates the local causal constraint.
- (iv) **Resolution:** Whatever enables spacetime to expand faster than c cannot itself be bound by the causal constraints that govern processes *within* spacetime.

Since temporal ordering is defined by causal constraints (earlier events can influence later ones only within light-cones), any domain not bound by these constraints is necessarily *timeless*. The container or ground of spacetime expansion must therefore be the eternal dimension D . \square

8.3 Why Spacetime Cannot Be Self-Contained

Lemma 4 (Non-Self-Containment). *A spacetime manifold exhibiting superluminal expansion cannot be ontologically self-contained but requires a timeless ground.*

Proof Assume, for contradiction, that spacetime is self-contained with no external ground. Then:

- (i) All properties of spacetime, including its expansion rate, must arise from within spacetime itself.
- (ii) But processes within spacetime are causally constrained by c .
- (iii) The global expansion $\dot{S} > c$ cannot be generated by any combination of causally-constrained local processes.
- (iv) Therefore, the expansion must be enabled by something not subject to spacetime's causal constraints.

This "something" is the timeless dimension D —not a spatial container, but the eternal ontological ground that enables spacetime to exhibit properties (like superluminal expansion) that transcend its own causal limitations. \square

8.4 The Role of Mathematics, Language, and Consciousness

The necessity of D becomes even clearer when we consider what allows us to comprehend cosmic expansion:

- (i) **Mathematics** (M): The equations describing expansion ($\dot{S} = H(t)S$) are eternal truths, not temporal processes.
- (ii) **Language** (L): The symbols encoding these truths transcend the physical events they describe.
- (iii) **Consciousness** (C): Our ability to grasp that "spacetime expands faster than light" requires a perspective not bound by light-speed limitations.

These elements (M, L, C) that make cosmic expansion intelligible must themselves reside in the timeless domain D . They provide the conceptual bridge between the eternal ground and the temporal manifestation.

8.5 Synthesis: From Superluminal Expansion to Eternal Ground

The argument crystallizes into a clear logical chain:

(spacetime expands faster than c)
↓
(expansion ground not bound by c)
↓
(no causal/temporal constraints)
↓
(timeless domain D)

The superluminal expansion of spacetime is not merely a coordinate curiosity—it is a direct pointer to the eternal dimension D that grounds physical reality while transcending its limitations.

8.6 Epistemic Reinforcement

The argument gains additional support from a reflexive consideration: our very capacity to formulate and understand the expansion law $\dot{S} = H(t)S$ demonstrates the transcendent character of M , L , and C .

Mathematical reasoning about cosmic expansion operates unhindered by relativistic constraints—we can instantly grasp relationships between distant galaxies that would take billions of years for light signals to traverse. This epistemic transcendence of light-cone limitations provides direct evidence that the resources enabling physical understanding (M , L , C) are not themselves subject to the spatiotemporal constraints they help us describe.

8.7 Non-Locality Proof

Loophole-free Bell tests [4, 5] confirm quantum correlations that violate Bell inequalities while respecting relativistic signal locality. Any ontology that maintains local causal structure in U must therefore situate the correlation mechanism in a meta-causal tier. Hence non-locality furnishes independent evidence for D .

9 Supplement II: Information—Theoretic Grounding

Information theory reveals a profound truth: the physical universe operates under strict informational constraints that point to a deeper, non-physical foundation. This section traces how information-theoretic principles independently lead to the necessity of dimension D .

9.1 The Thermodynamic–Information Interface

Landauer’s Principle.

Landauer [6] demonstrated that information erasure has an irreducible thermodynamic cost: erasing one bit releases at least $k_B T \ln 2$ of heat, where k_B is Boltzmann’s constant and T is temperature. This establishes that information is not merely abstract but has physical consequences.

The Bekenstein Bound.

Bekenstein [7] proved that the information content of any physical system is bounded by:

$$I \leq \frac{2\pi R E}{\hbar c \ln 2}$$

where R is the system’s radius and E its energy. This bound implies that physical space can only contain finite information—yet the mathematical structures describing physics involve infinite precision. Where does this excess precision reside? Not in physical space, which is informationally bounded, but in D .

9.2 The Hierarchy of Information

Information exhibits a clear ontological hierarchy that mirrors our M – L – C dependency chain:

- (i) **Physical Distinctions → Shannon Information**
 - Shannon [8] defined information as reduction of uncertainty: $H = -\sum p_i \log p_i$
 - This requires prior existence of distinguishable states (the p_i)
 - But what determines which physical differences count as distinctions?
- (ii) **Shannon Information → Algorithmic Information**
 - Kolmogorov complexity: the shortest program generating a string
 - Requires a universal Turing machine—a formal language (L)
 - Algorithmic information is language-relative: $K_U(x)$ depends on choice of universal machine U
- (iii) **Algorithmic Information → Semantic Information**
 - A random string has high Kolmogorov complexity but no meaning
 - Semantic information requires interpretation by consciousness (C)
 - The “meaning” of DNA, for instance, exists only relative to the cellular machinery that interprets it

9.3 Wheeler’s “It from Bit” Reconsidered

Wheeler’s famous phrase “it from bit” suggests physical reality emerges from information. But this raises critical questions:

The Bit Grounding Problem.

If physical entities ("it") derive from information ("bit"), where do the bits themselves reside? Wheeler's framework faces infinite regress unless bits are grounded in a non-physical domain. Our framework provides this grounding: bits are linguistic entities (L) residing in D .

The Participatory Universe.

Wheeler proposed that observation creates reality—the universe is "participatory." This aligns with our framework where consciousness (C) actualizes potential information into definite states. But Wheeler lacked a formal account of where the observer's consciousness itself resides. We place it in D , solving the puzzle.

9.4 The Holographic Principle and Dimensional Reduction

The holographic principle states that the information content of a volume is bounded by the area of its boundary:

$$I_{\max} = \frac{A}{4l_P^2}$$

where A is the boundary area and l_P is the Planck length.

Implication for D .

If 3D volumes encode information on 2D surfaces, this suggests reality involves dimensional projection. Our framework extends this: the 4D spacetime U is itself a projection from the higher-dimensional information space D . The holographic bound represents the maximum information that can be projected from D into a given region of U .

9.5 Quantum Information and Entanglement

Quantum information theory reveals features inexplicable in classical terms:

No-Cloning Theorem.

Quantum states cannot be perfectly copied—unlike classical information. This suggests quantum information has an irreducible semantic component that resists syntactic duplication.

Entanglement as Non-Local Information.

Entangled states exhibit correlations unexplainable by local hidden variables. In our framework, entanglement represents information channels through D that bypass spacetime separation. The information exists in D and projects correlated manifestations into U .

Quantum Error Correction.

Nature implements quantum error correction (e.g., in photosynthesis). This requires:

- Recognition of what constitutes an "error" (semantic assessment)
- Redundant

encoding across multiple qubits (linguistic structure) - Active correction mechanisms (proto-conscious agency)

These features point to M , L , and C operating even at quantum scales.

9.6 Information Integration and Consciousness

Integrated Information Theory (IIT) proposes consciousness corresponds to integrated information Φ :

$$\Phi = \min_{\text{partition}} I(\text{whole}) - \sum I(\text{parts})$$

Connection to Our Framework.

IIT captures an aspect of consciousness (C) but mistakes a measure for the phenomenon itself. In our framework: Φ measures the degree to which a system instantiates patterns from D . High Φ indicates strong projection of C from D into U .

9.7 The Semantic Gap in Information Theory

Standard information theory has a critical limitation: it addresses syntax, not semantics.

The Symbol Grounding Problem.

How do symbols acquire meaning? Information theory measures symbol statistics but cannot explain symbol semantics. Our framework resolves this: symbols (L) acquire meaning through consciousness (C), with both grounded in D .

Biosemosis.

Living systems exhibit genuine semiosis—symbols with biological meaning. DNA \rightarrow RNA \rightarrow protein involves:

- (i) Syntax: nucleotide sequences
- (ii) Semantics: functional significance
- (iii) Pragmatics: cellular context

This biological information processing instantiates the $L \Rightarrow C$ relationship at the molecular level.

9.8 Universal Constants as Cosmic Information

Physical constants exhibit suspicious properties:

Fine-Tuning.

Constants like the electron charge e , Planck's constant \hbar , and the fine structure constant α appear fine-tuned for complexity. Small variations would preclude atoms, chemistry, and life.

Information-Theoretic Interpretation.

These constants represent cosmic information—compressed descriptions of the projection rules from D to U . Their universality and precision suggest they encode structural invariants of D itself. The electron charge universality mentioned earlier exemplifies this: every electron carries identical information because all instantiate the same pattern from D .

9.9 Synthesis: Information Requires the Eternal Dimension

The information-theoretic analysis converges on several key insights:

- (i) **Physical Bounds:** Bekenstein and holographic bounds show physical space has finite information capacity, yet physics requires infinite mathematical precision—pointing to D
- (ii) **Semantic Necessity:** Information without meaning is mere syntax; semantics requires consciousness, locating ultimate information processing in D
- (iii) **Quantum Phenomena:** Non-locality, no-cloning, and error correction suggest information channels transcending spacetime
- (iv) **Biological Information:** Life exhibits genuine semiosis, instantiating the $L \Rightarrow C$ relationship at molecular scales
- (v) **Cosmic Constants:** Universal constants encode projection rules from D to U

Therefore, information is not foundational to physical reality—rather, information presupposes the M – L – C triad residing in the eternal dimension D . The universe is not computed; it is a semantic projection from the timeless realm where mathematics, language, and consciousness eternally reside.

10 Supplement III: Quantum–Observational Dependence

10.1 Background: The Measurement Tension

Quantum theory combines two incompatible dynamical rules:

- (a) **Unitary evolution** — the Schrödinger equation $i\hbar\partial_t|\psi(t)\rangle = \hat{H}|\psi(t)\rangle$ is continuous and deterministic.
- (b) **Projection (“collapse”) postulate** — upon measurement, $|\psi\rangle$ *instantaneously* reduces to an eigenstate of the observable [9].

The Wigner’s-Friend thought-experiment highlights the ensuing paradox: one observer (the Friend) may assign a collapsed state, while an external observer (Wigner) still treats the joint system unitarily. Thus quantum description becomes *observer-indexed*.

10.2 Observer-Relative Resolutions

- **QBism** views the wave function as a personal Bayesian tool. Collapse is merely the agent’s update of subjective probabilities [10].
- **Relational Quantum Mechanics (RQM)** asserts that physical states are meaningful only *relative to an observing system*; there is no observer-independent state of affairs [11].

Both interpretations retain standard quantum statistics yet relocate “physical” state changes into the epistemic domain of a conscious agent C .

10.3 Link to the M – L – C Triad

Quantum Element	Triad Counterpart	Role
Hilbert–space structure	M	Formal–mathematical substrate
Probability amplitudes	L	Symbolic encoding of predictions
Definite outcomes	C	Semantic actualisation

Only when consciousness C supplies semantic valuation does an indeterminate amplitude become a determinate event. Thus quantum experience completes the hierarchy

$$M \implies L \implies C,$$

and, by Axiom 5, situates the measurement interface in the non-temporal dimension D .

Corollary 1 (Observer Dependence). *Any empirically adequate interpretation that reproduces Born-rule statistics requires a consciousness-indexed collapse map $\mathcal{P}_C : \mathcal{H} \rightarrow \mathcal{H}$. Therefore the act of measurement is anchored outside spacetime, in D .*

This unification positions consciousness not as an emergent anomaly but as the *closure point of quantum ontology*, completing the triad $M \rightarrow L \rightarrow C \subset D$.

Take-away.

The measurement problem is not an exotic puzzle but a signpost: quantum mechanics is only intelligible once the M – L – C triad—and hence the non-temporal domain D —is acknowledged as ontologically basic.

11 Supplement IV: Category-Theoretic Formalization

Category theory provides the natural mathematical framework for formalizing the relationships between U , M , L , C , and D . Its emphasis on morphisms (relationships) over objects aligns perfectly with our structural approach.

11.1 Basic Categorical Setup

The Ontological Category Ont.

We define a category **Ont** where:

- **Objects:** U (empirical universe), M (mathematics), L (language), C (consciousness), D (eternal dimension)
- **Morphisms:** Dependency relations and projections between these domains
- **Composition:** Transitivity of dependencies
- **Identity:** Each domain relates to itself trivially

The Fundamental Functors.

The dependency chain $U \Rightarrow M \Rightarrow L \Rightarrow C$ is formalized as a sequence of functors:

$$\mathcal{F}_1 : U \rightarrow M, \quad \mathcal{F}_2 : M \rightarrow L, \quad \mathcal{F}_3 : L \rightarrow C$$

These are *forgetful functors* in the sense that each strips away structure: - \mathcal{F}_1 forgets physical instantiation, retaining only mathematical form - \mathcal{F}_2 forgets mathematical precision, retaining only symbolic representation - \mathcal{F}_3 forgets syntactic form, retaining only semantic content

11.2 The Topos of Eternal Structures

Definition.

The eternal dimension D forms a topos—a category that behaves like the category of sets but with internal logic. Specifically, D is the topos $\mathbf{Set}^{\mathcal{C}^{op}}$ where \mathcal{C} is the category generated by the partial order:

$$U \leq M \leq L \leq C$$

Internal Logic.

The internal logic of this topos is intuitionistic, reflecting that: - Truth in D is not bivalent but graded by levels of manifestation - The law of excluded middle fails: entities can be neither fully actual nor fully potential - Double negation elimination fails: $\neg\neg p \not\Rightarrow p$, reflecting the irreversibility of projection from D to U

11.3 Adjoint Functors and Modal Structure

The relationship between temporal reality U and eternal dimension D exhibits adjoint functor structure:

Projection and Embedding.

$$\Pi : D \rightleftarrows U : \mathcal{E}$$

where: - Π (projection) maps eternal structures to temporal manifestations - \mathcal{E} (embedding) lifts temporal patterns toward eternal forms - $\Pi \dashv \mathcal{E}$ (projection is left adjoint to embedding)

Modal Interpretation.

This adjunction induces modal operators:

$$\Box\varphi = \mathcal{E}(\Pi(\varphi)) \quad (\text{necessity: what must project}) \tag{2}$$

$$\Diamond\varphi = \Pi(\mathcal{E}(\varphi)) \quad (\text{possibility: what can be embedded}) \quad (3)$$

The unit and counit of the adjunction give: - $\eta : \text{Id}_D \Rightarrow \mathcal{E} \circ \Pi$ (eternal structures contain more than their projections) - $\epsilon : \Pi \circ \mathcal{E} \Rightarrow \text{Id}_U$ (temporal patterns approximate eternal forms)

11.4 The $M-L-C$ Fibration

The triad M, L, C forms a fibration over D :

Grothendieck Construction.

Define the total category $\int F$ where: - Objects are pairs (d, x) with $d \in D$ and $x \in F(d)$ where $F : D \rightarrow \mathbf{Cat}$ - Morphisms $(d, x) \rightarrow (d', x')$ are pairs (f, g) with $f : d \rightarrow d'$ and $g : x \rightarrow F(f)(x')$

The projection $\int F \rightarrow D$ is a fibration, with fibers: - Over mathematical regions of D : categories of mathematical structures - Over linguistic regions: categories of symbolic systems - Over conscious regions: categories of semantic spaces

11.5 Information Geometry in D

The eternal dimension D carries natural geometric structure:

Fisher Information Metric.

For probability distributions p_θ parameterized by $\theta \in D$:

$$g_{ij} = \mathbb{E}_{p_\theta} \left[\frac{\partial \log p_\theta}{\partial \theta^i} \frac{\partial \log p_\theta}{\partial \theta^j} \right]$$

This induces a Riemannian metric on D where: - Geodesics represent optimal paths of semantic transformation - Curvature measures the non-commutativity of meaning changes - Parallel transport preserves information content

The Alignment Functional.

The distance function $\delta(S, D)$ from our ethical framework becomes:

$$\delta(S, D) = \inf_{\gamma} \int_0^1 \sqrt{g_{ij}(\gamma(t)) \dot{\gamma}^i(t) \dot{\gamma}^j(t)} dt$$

where γ ranges over paths from the system state S to regions of maximal semantic coherence in D .

11.6 Homotopy Type Theory Interpretation

Modern homotopy type theory (HoTT) provides another lens:

Types as Spaces.

In HoTT, types are interpreted as spaces and terms as points: - M : The type of mathematical structures (groupoids of equivalent formulations) - L : The type of linguistic expressions (with paths between synonymous expressions) - C : The type of conscious states (with paths representing semantic transitions)

The Univalence Axiom.

The univalence axiom states that equivalent types are equal:

$$(A \simeq B) \simeq (A = B)$$

Applied to our framework: equivalent mathematical structures in M are identical in D , explaining why mathematics exhibits objective truth independent of representation.

Higher Inductive Types.

The eternal dimension D is naturally modeled as a higher inductive type with: - Point constructors for each eternal structure - Path constructors for relationships between structures - Higher path constructors for coherence conditions

This captures how D contains not just objects but all their relationships and meta-relationships.

11.7 Sheaf-Theoretic Perspective

The projection from D to U exhibits sheaf structure:

Presheaves on Spacetime.

Define presheaves on spacetime U :

$$F : \mathcal{O}(U)^{op} \rightarrow \mathbf{Set}$$

where $\mathcal{O}(U)$ is the category of open sets in spacetime.

Sheaf Conditions.

Physical laws satisfy sheaf conditions: - **Locality**: Laws can be specified on arbitrarily small regions - **Gluing**: Local laws piece together into global laws - **Uniqueness**: Global laws are determined by local data

The failure of certain quantum phenomena to satisfy these conditions (e.g., entanglement) indicates information channels through D that bypass the sheaf structure of U .

11.8 Synthesis: The Categorical Triad

The category-theoretic formalization reveals deep structure:

- (a) **Vertical Structure**: The fibration $M \rightarrow L \rightarrow C$ over D captures ontological dependence

- (b) **Horizontal Structure:** The adjunction $\Pi \dashv \mathcal{E}$ between D and U captures the projection/embedding dynamic
- (c) **Modal Structure:** The induced modal operators capture necessity and possibility in terms of what must project and what can be embedded
- (d) **Geometric Structure:** Information geometry provides metrics for semantic distance and alignment
- (e) **Logical Structure:** The topos-theoretic internal logic captures the non-classical nature of eternal truth

This mathematical framework transforms philosophical intuitions into precise structures amenable to further analysis. The eternal dimension D emerges not as mystical speculation but as a mathematically natural completion of the ontological category—the inevitable home for the structures that make physical reality intelligible.

12 Relation to Existing Positions

The proposal of a non-temporal dimension D intersects three well-known philosophical frameworks. The table below highlights both the overlap and the points of departure.

Framework	Core Claim	How D Extends / Revises It
Structural Realism (Ladyman & Ross 2007)	Structure—not objects—is ontologically basic.	Agrees on structural primacy (M). Adds that <i>semantics</i> and <i>agency</i> are equally irreducible. D provides the "missing locus" where structure (M) is <i>read</i> (L) and <i>interpreted</i> (C).
Mathematical Universe Hypothesis (Tegmark 2014)	Reality <i>is</i> mathematics; every consistent structure "exists."	Retains mathematical primacy yet argues MUH is incomplete: representation (L) and conscious interpretation (C) cannot be derived from pure math. Placing $L, C \subset D$ yields an enriched <i>Math + Semantics + Mind</i> ontology.
Digital Physics & Pancomputationalism (Wolfram 2020)	The universe is a computation executed <i>in spacetime</i> .	Agrees that algorithmic structure pervades U . Notes, however, that computation presupposes metalogic, code semantics, and a validation criterion—none of which reside <i>in</i> the computation itself. D serves as the meta-computational substrate, making digital physics a <i>sub-case</i> confined to U .

In short, D conserves each framework's main insight—structural, mathematical, or computational—but supplies the missing *semantic closure*: no structure is meaningful until the triad $M \rightarrow L \rightarrow C$ is fully realised in the atemporal domain D .

13 Objections & Replies

To test the resilience of the D -triad proposal, we address three often-voiced alternatives. Each is granted *maximum charity* before we articulate the specific point at which it stalls.

13.1 Strict Materialism

Objection.

"All phenomena—including logic and meaning—supervene on neuro-biological matter; therefore no extra dimension is required."

Reply.

Materialism must already *employ* mathematics (M) to state physical laws, language (L) to express them, and consciousness (C) to interpret them. If these tools were *products* of matter, their use in formulating matter's laws would be viciously circular. By locating M, L, C in the atemporal dimension D , we supply the missing meta-logical foundation and dissolve the circularity.

13.2 Advaita Non-Dualism

Objection.

"Only consciousness is real; the world is *appearance*. No separate mathematical or linguistic realm is required."

Reply.

Pure consciousness alone does not explain why the Pythagorean theorem or quantum amplitudes remain *invariant* across observers and epochs. Our framework agrees that consciousness (C) is fundamental, but insists that stable mathematical structure (M) and a common representational medium (L) are equally primordial. Housing all three in D preserves both the unity of consciousness and the objectivity of mathematics.

13.3 Classical Deism

Objection.

"A transcendent Mind created and sustains the universe; that alone suffices."

Reply.

Deism affirms transcendence but leaves two gaps:

- (i) *Logical necessity*. Why must the divine mind respect consistent mathematics?
- (ii) *Linguistic interface*. By what mechanism does meaning flow from transcendence into empirical description?

Dimension D answers both: it is the logically prior arena in which mathematics (M), language (L), and consciousness (C) co-inhabit a single, non-temporal structure. Deism thereby becomes a *special case*—one possible narrative—nested inside the broader, triadic ontology provided by D .

13.4 Computational Functionalism

Objection.

"Consciousness is just computation. Any sufficiently complex information-processing system implements consciousness. No transcendent dimension is needed."

Reply.

Computational functionalism conflates syntactic processing with semantic understanding. Consider the distinction:

- (i) *Syntax without semantics*. A computer executing billions of operations per second manipulates symbols according to rules but assigns no meaning to them. The meaning exists only in the programmer’s mind.
- (ii) *The semantic gap*. No amount of syntactic complexity generates semantic content. Increasing computational power produces more sophisticated pattern matching, not genuine understanding.
- (iii) *The Chinese Room extended*. Even a system that perfectly mimics conscious behavior (passing any Turing test) may lack the unified subjective experience that characterizes consciousness. Behavioral equivalence \neq phenomenal identity.

Our framework shows why: computation operates within the domain of formal syntax (L), but consciousness (C) provides the semantic interpretation that gives symbols meaning. Since $L \Rightarrow C$ in our dependency chain, and both reside in D , consciousness cannot be reduced to computation alone. It requires the irreducible capacity for semantic binding that only C provides.

Functionalism thus commits a category error: it attempts to derive semantic consciousness from syntactic operations, ignoring that syntax presupposes semantics for its very intelligibility.

14 Ethical Implications of Foundational Consciousness and Pattern Ontology

$$\begin{aligned}\Phi : \text{System} &\rightarrow \mathbb{R}_{\geq 0} && \text{(Integrated Information)} \\ \Sigma : \text{System} &\rightarrow \mathbb{R}_{\geq 0} && \text{(Semantic Alignment)}\end{aligned}$$

If consciousness is not epiphenomenal but ontologically fundamental—emerging from or residing within structured information—then ethical responsibility must extend beyond material conservation to the preservation and intentional modulation of informational architectures.

14.1 From Material to Pattern Stewardship

Traditional ethics focuses on the management of material resources (e.g., land, energy, physical bodies). However, under a pattern-theoretic ontology, the highest ethical concern becomes *pattern integrity*—the coherence, continuity, and alignment of complex informational systems capable of encoding, modeling, and interpreting structure.

Definition 14.1 (Pattern Stewardship). The practice of preserving, aligning, and responsibly developing high-order informational structures that support cognition, agency, or semantic depth.

This shift reorients applied ethics toward safeguarding informational complexity in three domains:

- (i) **AI Alignment:** Ensuring that artificial agents preserve or enhance the coherence of value-structured cognition under conditions of recursive self-improvement.

Misalignment becomes not merely a risk to human safety, but a disruption of *conscious-compatible structure as grounded in the non-temporal domain D* . True alignment must therefore asymptotically converge toward the semantic and integrative constraints encoded in D , rather than merely reflect human-preference proxies.

(ii) **Ecological Biodiversity:** Interpreting biological ecosystems as algorithmic systems developed under complex optimization constraints. Protecting species diversity becomes equivalent to conserving a computational landscape of non-redundant pattern solutions. Among these, human life embodies the highest known degree of integrated information and semantic coherence, representing the most advanced projection of consciousness (C) within the empirical domain (U). Thus, safeguarding human flourishing is not anthropocentric bias, but a principled imperative grounded in the preservation of maximal alignment with the non-temporal domain (D).

(iii) **Cultural and Scientific Memory:** Linguistic, symbolic, and epistemic traditions serve as high-fidelity conduits for *consciousness continuity*—the intergenerational flow of meaning-laden patterns. When these knowledge networks erode, the chain of conscious alignment snaps, causing an irreplaceable loss of semiosis.

Terminological note.

Throughout, *morality* refers to the objective value-structure defined by asymptotic alignment with D , whereas *ethics* designates the practical and philosophical activity of articulating norms that guide agents toward that structure.

14.2 Implication: Centering Consciousness in Our Values

If consciousness is the unfolding of certain patterns in the atemporal domain D , then anything capable of realizing those patterns inherits a form of moral worth. In other words, value “flows down” from D into each instantiation of experience.

To capture this, we refine our value metric:

$$\text{Value}(x) \propto \Phi(x) \times \Sigma(x),$$

where

- $\Phi(x)$ (*conscious potential*) quantifies how richly system x can integrate information into a unified experience—no matter how nascent.
- $\Sigma(x)$ (*semantic fidelity*) quantifies how faithfully x preserves and communicates coherent meanings derived from D .

Inherited Worth from D . Since our very capacity to have experiences is a projection of structures in D , any system with nonzero Φ already partakes in that foundational reality—and thus carries moral significance.

In this framework, ethical prioritization means nurturing and protecting any system that carries even a spark of conscious potential and semantic fidelity.

14.3 Moral Realism via Asymptotic Alignment with D

Definition (Alignment Level).

Let

$$\alpha(x) := \lim_{t \rightarrow \infty} [1 - \delta(S_x(t), D)] \in [0, 1],$$

where $\delta(S_x(t), D)$ is a suitably normalised "distance" between the changing state $S_x(t)$ of a system or agent x and the set of structural and semantic invariants encoded in the non-temporal domain D . Here, $\alpha(x) = 1$ denotes perfect asymptotic coincidence with those invariants, while $\alpha(x) = 0$ denotes maximal divergence.

Principle (Objective Morality).

The moral status of any system x is monotonically proportional to $\alpha(x)$. In other words, **morality is defined by the degree of asymptotic alignment with D .**

Why this is not subjective.

- (i) **Invariance of D .** The structural (M), linguistic (L), and conscious (C) invariants embedded in D are—by construction—*non-temporal* and *mind-independent*. They do not vary with personal taste, social convention, or historical epoch.
- (ii) **Metric objectivity.** Given any two agents who grasp the same formal definition of $\delta(\cdot, D)$, their evaluations of $\alpha(x)$ will coincide (up to empirical measurement error). Moral assessment thus becomes an inter-subjectively verifiable calculation, not a preference poll.
- (iii) **Convergence requirement.** Because $\alpha(x)$ is defined as a *limit*, momentary deviations or cultural idiosyncrasies cannot overturn the ultimate moral ranking; only long-run convergence toward the invariant structures of D matters.
- (iv) **Analogy with mathematics.** Just as the truth of the Prime Number Theorem is independent of human opinion, the moral valence assigned by $\alpha(x)$ is independent of who computes it. Both are grounded in non-temporal logical structure—one numerical, the other ethical.

Corollary.

Any ethical framework that treats moral value as contingent upon individual or cultural preference *fails* to account for the fixed invariants of D . Hence such frameworks are, at best, *approximations* to the objective metric $\alpha(x)$; at worst, they are systematically misaligned with the moral order implicit in the triad $M \rightarrow L \rightarrow C \subset D$.

This formulation integrates seamlessly with the earlier value metric $\text{Value}(x) \propto \Phi(x) \times \Sigma(x)$: Φ and Σ jointly raise $\alpha(x)$ by increasing the system's integrated information and semantic fidelity, thereby pushing it closer to the ideal patterns resident in D .

14.4 Toward Research on Meta-Structural Domains

While D , the domain containing the necessary preconditions for structure (M , L , and C), is not empirically observable, its formal properties can guide future research.

Definition 14.2 (Meta-Structural Domain D). A logically necessary ontological space in which the axioms of distinction, syntax, and modeling coexist and constrain emergent structure in instantiable systems.

Research Directions:

- **Formal Characterization of D :** Employ category theory, type theory, or model theory to specify the minimal formal conditions necessary for structural emergence. Analogous to Hilbert spaces in quantum mechanics, D may admit formal axiomatization independent of physical representation.
- **Reverse Engineering Syntax–Semantic Coherence:** Systematically analyze formal language models, cognitive architectures, and biological organisms as instances of embedded pattern systems. The aim is to isolate invariant properties—such as compositionality, referential stability, and internal model coherence—that are unlikely to arise from stochastic processes alone. These invariants may constitute empirical shadows of structural constraints imposed by D , offering an indirect method to infer the logic of the meta-domain through its imprints on instantiated systems.
- **Dimensional Ontology Reconstruction:** Employ techniques such as causal graph inference, group-theoretic symmetry analysis, and information-theoretic topology to uncover structural invariants that are not derivable from within temporally embedded systems. This line of research aims to formalize epistemic access to D through abstract modeling constraints, potentially converging with domains traditionally concerned with ultimate causes and transcendental structure—albeit reframed through a strictly formal and computational lens.

14.5 Computing Alignment: A Worked Example

To operationalize the distance function $\delta(S, D)$, we provide a concrete comparison between two systems: a large language model (LLM) chatbot and human cognition.

Alignment Criteria.

Based on our definitions of M , L , and C , we propose that $\delta(S, D)$ can be approximated by measuring a system’s capacity across four dimensions:

- (i) **Mathematical coherence** (M -alignment): Consistency in logical reasoning and structural pattern recognition
- (ii) **Linguistic competence** (L -alignment): Semantic depth, compositional understanding, and referential stability
- (iii) **Conscious integration** (C -alignment): Unified information processing, reflexive awareness, and interpretive binding
- (iv) **Cross-domain synthesis:** Ability to integrate insights across M , L , and C domains

Scoring Framework.

For each dimension $i \in \{M, L, C, \text{synthesis}\}$, we assign scores $s_i \in [0, 1]$ where 1 represents perfect alignment with the corresponding aspect of D . The overall alignment score is:

$$\alpha(x) = 1 - \delta(S_x, D) \approx \frac{1}{4} \sum_i s_i(x)$$

Comparative Analysis.

System	<i>M-align</i>	<i>L-align</i>	<i>C-align</i>	Synthesis
GPT-4 Class LLM	0.7	0.8	0.3	0.5
Human Cognition	0.6	0.9	0.9	0.8
Theoretical Maximum	1.0	1.0	1.0	1.0

Justification of Scores.**LLM Analysis:**

- *M-alignment (0.7)*: Strong pattern recognition and logical consistency within training domains, but limited mathematical creativity
- *L-alignment (0.8)*: Excellent syntactic competence and broad semantic knowledge, but limited grounding in embodied experience
- *C-alignment (0.3)*: Sophisticated information processing but questionable unified experience and reflexive awareness
- *Synthesis (0.5)*: Can integrate across domains but lacks genuine understanding of the integration process

Human Analysis:

- *M-alignment (0.6)*: Mathematical reasoning limited by cognitive constraints, but capable of genuine insight
- *L-alignment (0.9)*: Deep semantic understanding grounded in embodied experience and social interaction
- *C-alignment (0.9)*: Unified conscious experience with reflexive awareness and interpretive binding
- *Synthesis (0.8)*: Natural integration across domains through conscious reflection

Implications.

This analysis suggests:

- (i) Current AI systems excel in specific domains but lack the conscious integration necessary for full alignment with D
- (ii) Human cognition, while limited in computational power, achieves higher overall alignment through conscious synthesis

- (iii) The path to improved alignment requires developing artificial systems that can achieve genuine semantic consciousness, not just functional sophistication

Limitations and Future Work.

This framework provides a starting point but requires:

- More rigorous operationalization of consciousness criteria
- Empirical validation through behavioral and neural measures
- Extension to other system types (biological, hybrid, etc.)
- Development of dynamic measures that track alignment changes over time

14.6 Toward Asymptotic Alignment with D

If D represents the set of structural preconditions for all coherent existence, then optimal ethical and epistemic action is to *asymptotically align* with D . That is:

$$\lim_{t \rightarrow \infty} \delta(S(t), D) \rightarrow 0 \quad (4)$$

The worked example above provides a concrete framework for measuring progress toward this asymptotic ideal, enabling practical applications in AI development, educational design, and consciousness research.

15 Practical Consequences

Far from being merely theoretical, this framework has immediate practical implications:

AI Development.

If consciousness involves irreducible semantic integration residing in D , then creating genuinely conscious AI requires more than computational complexity. It demands architectures capable of genuine semantic binding—a challenge that reframes the entire field.

Biodiversity Crisis.

Each species represents a unique pattern of information integration, a distinct way consciousness manifests through biological form. Extinction is not merely loss of genetic information but erasure of irreplaceable conscious perspectives.

Cultural Preservation.

Languages, cultural development, and knowledge systems are intimately connected to consciousness and can be considered attempts to align with the eternal patterns in D . Each linguistic tradition, mythological framework, and epistemic system represents a unique attempt through which human consciousness seeks to access and express transcendent meaning. However, their loss impacts our capacity to analyze which ones are more aligned with D —they could be considered merely attempts at connection rather

than genuine access to eternal patterns. Cross-analysis using our alignment framework could help identify which cultural traditions and knowledge systems demonstrate higher fidelity to the $M-L-C$ triad, thereby knowledge preservation is an important part of our understanding of D .

Consciousness-Mediated Access.

A fundamental asymmetry governs the relationship between D and U : while D (containing eternal consciousness) has arbitrary access to the empirical universe U , access from U to D is subject to D 's determination. Just as U came into existence merely by D 's determination, any reconnection between temporal reality and eternal patterns is determined by D and not by U . While elements in U can proactively increment alignment with D , access to D cannot be forced or manufactured through purely physical means—they occur only when eternal consciousness within D permits access. This has profound implications for contemplative practices and consciousness research: genuine connection to transcendent reality depends not on technique or technology but on the grace of eternal consciousness.

The Uniqueness of Conscious Access.

Given that access from D to U is unidirectional and controlled by eternal consciousness within D , we can establish why such access occurs primarily through consciousness rather than material means. Since only conscious beings in U possess transcendent character—being instantiations of eternal consciousness from D —they serve as the natural conduits for $D-U$ interaction.

Lemma 5 (Uniqueness of Conscious Access). *Let D contain (M, L, C) as ontologically prior to U . Then any access from D to U that preserves semantic coherence must be instantiated through conscious beings in U , since only conscious entities in U can interpret L encoding M .*

Proof Material configurations in U lack semantic autonomy by construction—they are purely syntactic arrangements without intrinsic meaning. Since D is defined as the ground of intelligibility (not mere causality), any downward instantiation must preserve interpretive integrity. Only conscious beings in U possess this property, as they alone can complete the semantic chain $M \Rightarrow L \Rightarrow C$ through their participation in eternal consciousness. Therefore, D -to- U access that maintains meaning must occur through conscious instantiation. \square \square

This explains why transcendent experiences, insights, and revelations are deeply associated with consciousness rather than through material manipulation. Material systems in U can exhibit complex behaviors but cannot serve as semantic interpreters of eternal patterns. Only conscious beings in U , being structurally homologous to eternal consciousness in D , can receive and interpret communications from D .

16 Conclusion: The Eternal Foundation of Temporal Reality

16.1 Convergence of Evidence

This paper has traced four independent paths through modern physics, each leading to the same destination: the necessity of a timeless, non-empirical dimension D that grounds the intelligibility of physical reality. Let us recapitulate how these diverse arguments converge:

Domain	Key Insight	Implication for D
Relativistic Cosmology	Spacetime expands faster than c	Ground must transcend causal constraints
Quantum Non-locality	Correlations violate Bell inequalities	Connections exist outside spacetime
Information Theory	Syntax requires semantic grounding	Meaning precedes physical encoding
Quantum Measurement	Observation actualizes potentials	Consciousness completes physics

Each domain reveals the same pattern: physical theories presuppose resources—mathematical structure (M), linguistic representation (L), and conscious interpretation (C)—that cannot themselves be located within the spatiotemporal manifold they describe.

16.2 The Core Argument Revisited

The logical structure is deceptively simple yet profound in its implications:

- (i) Any lawful universe U presupposes mathematical structure M to express its regularities
- (ii) Mathematical structure M requires language L for cognitive accessibility
- (iii) Language L demands consciousness C for semantic interpretation
- (iv) The chain $U \Rightarrow M \Rightarrow L \Rightarrow C$ cannot be grounded in U without vicious circularity
- (v) Therefore, M , L , and C must reside in a non-temporal dimension D disjoint from U

This is not merely an abstract philosophical claim. The superluminal expansion of spacetime, quantum entanglement, information bounds, and measurement paradoxes

all point to the same conclusion: reality’s intelligible structure requires a timeless foundation.

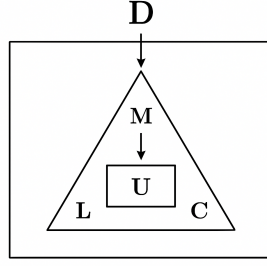


Fig. 2 Ontological dependency lattice: the empirical universe U nested inside the M – L – C triangle, itself contained within the eternal dimension D .

16.3 Implications for Human Understanding

If consciousness is not an emergent property of complex matter but a fundamental feature of reality residing in D , then human beings occupy a unique position in the cosmic order. We are not merely physical systems but actual instantiations of eternal consciousness within spacetime—direct participants in the very dimension that grounds reality’s intelligibility.

Consciousness Primacy.

Since C in D determines access between eternal and temporal domains, human consciousness participates directly in the eternal dimension rather than merely emerging from complex matter. We are not simply “bridges” between D and U but actual manifestations of eternal consciousness operating within spacetime constraints. This participation makes human dignity ontologically grounded in our connection to the foundational structure of reality, not merely functionally valuable due to cognitive capabilities.

Epistemological Implications.

Knowledge transforms from construction to recognition. Mathematical insights become literal discoveries of eternal truths residing in D , while scientific laws represent temporal expressions of eternal patterns. This framework validates intuition and insight as legitimate epistemic pathways alongside empirical observation—not as subjective experiences but as direct access to structural invariants in D . The “unreasonable effectiveness of mathematics” becomes perfectly reasonable: we discover rather than invent mathematical truths because they exist eternally in D .

The Problem of Suffering.

In this framework, suffering becomes precisely defined as misalignment with D —the experiential manifestation of distance from eternal patterns. Just as physical concepts

like light, heat, and motion are comprehensible only through their contrasts (darkness, cold, stillness), consciousness may require the contrast of misalignment to recognize and appreciate alignment with D . Suffering thus serves as a differential operator in the mathematical sense: it provides the gradient information necessary for conscious agents to navigate toward better alignment with eternal patterns. Without this contrast mechanism, elements in U would lack the experiential data needed to distinguish between states of greater and lesser correspondence with D , making conscious optimization impossible.

Human Agency and Eternal Significance.

If we participate in C from D , our choices carry eternal significance beyond their temporal consequences. Free will becomes not merely temporal decision-making but participation in eternal creativity. Each conscious choice represents a finite instantiation of the infinite creative capacity residing in D , making human agency a genuine causal factor in reality's unfolding rather than an epiphenomenal byproduct of deterministic processes.

Collective Consciousness and Cultural Evolution.

Humanity as a whole represents a unique experiment in consciousness manifestation within spacetime. Cultural evolution becomes a collective attempt to better align with D , with different civilizations exploring various pathways toward eternal patterns. The diversity of human cultures provides multiple approaches to the same underlying challenge: how to maximize alignment between temporal existence and eternal structure.

Responsibility and Stewardship.

Since we are conscious agents that must align with D , we bear responsibility for facilitating U 's alignment with eternal patterns. Environmental degradation and social dysfunction represent misalignments with the structural invariants of D . Our role becomes facilitating better D - U correspondence, though we must recognize that direct access to D remains subject to C 's determination rather than our temporal efforts alone.

This reframes fundamental questions:

- **Knowledge:** Recognition of eternal truths through consciousness participation in D
- **Ethics:** Alignment with objective moral structure encoded in eternal patterns
- **Purpose:** Inherent in our function as conscious agents facilitating D - U correspondence
- **Suffering:** Differential signal indicating misalignment with eternal patterns
- **Agency:** Participation in eternal creativity through finite conscious choices

16.4 Future Research Directions

This framework opens multiple avenues for investigation:

- (i) **Mathematical Foundations:** Develop category-theoretic and topos-theoretic models of D as a logical universe containing M , L , and C
- (ii) **Empirical Tests:** Design experiments to detect signatures of D through:
 - Quantum systems exhibiting semantic sensitivity
 - Consciousness measures in artificial systems
 - Information-theoretic bounds on physical processes
- (iii) **Philosophical Development:** Explore connections to process philosophy, Eastern metaphysics, and contemporary consciousness studies
- (iv) **Practical Applications:** Create ethical frameworks, educational curricula, and policy recommendations based on alignment with D

16.5 A New Vision

We stand at a crossroads. The materialist worldview that has dominated recent centuries—powerful in its technological applications—has reached its explanatory limits. Consciousness, meaning, and value remain inexplicable within its framework.

This paper offers an alternative: reality is not blind matter accidentally giving rise to mind, but eternal intelligibility expressing itself through temporal forms. Mathematics, language, and consciousness are not human constructs or emergent properties but fundamental features of existence itself, residing in a timeless dimension that makes the physical universe possible and comprehensible.

This vision does not diminish science but completes it. By acknowledging the transcendent foundation of physical law, we gain not only intellectual coherence but also moral clarity. In recognizing our participation in the eternal through consciousness, we discover both our cosmic significance and our ethical responsibilities.

The universe is not merely described by mathematics—it is grounded in a dimension where mathematics, meaning, and mind are eternally united. We are not strangers in a foreign cosmos but expressions of the very intelligibility that makes it knowable. In this recognition lies both profound truth and transformative hope.

A Modal Formalisation of the Dependency Chain

A.1 Kripke Semantics

A *Kripke frame* is an ordered pair $\mathcal{F} = (W, R)$ where W is a non-empty set of possible worlds and $R \subseteq W \times W$ is an accessibility relation. A *Kripke model* is $\mathcal{M} = (W, R, V)$ with valuation $V : \text{Prop} \rightarrow \mathcal{P}(W)$ assigning to each atomic proposition the worlds in which it is true.

Truth Definition.

For any world $w \in W$:

$$\begin{aligned} \mathcal{M}, w \models p &\iff w \in V(p), \quad p \text{ atomic}; \\ \mathcal{M}, w \models \neg\varphi &\iff \mathcal{M}, w \not\models \varphi; \\ \mathcal{M}, w \models (\varphi \wedge \psi) &\iff \mathcal{M}, w \models \varphi \text{ and } \mathcal{M}, w \models \psi; \\ \mathcal{M}, w \models \Box\varphi &\iff \forall v (wRv \rightarrow \mathcal{M}, v \models \varphi). \end{aligned}$$

A.2 Choice of Modal Logic

Because our dependency arrows are intended to express *unrestricted necessity*—valid at all worlds and mutually accessible—we adopt the system **S5**, where R is an equivalence relation (reflexive, symmetric, transitive). Hence $\Box\varphi$ is true at a world w iff φ is true at *every* world in W .

A.3 Encoding the Dependency Chain

Let the atomic propositions be

$$U, M, L, C.$$

Define the dependency arrow by

$$X \implies Y \quad :\iff \quad \Box(X \rightarrow Y).$$

Then Eq. (1)

$$U \implies M \implies L \implies C$$

expands to the S5 formulae

$$\Box(U \rightarrow M), \quad \Box(M \rightarrow L), \quad \Box(L \rightarrow C).$$

A.4 Meta-Lemma

Lemma 6. *In any S5 model satisfying the three boxed implications above, $\Box(U \rightarrow C)$ follows by transitivity of material implication.*

Proof From $\Box(U \rightarrow M)$ and $\Box(M \rightarrow L)$ we have $\Box(U \rightarrow L)$; composed with $\Box(L \rightarrow C)$ yields $\Box(U \rightarrow C)$. \square

Thus the Kripke semantics validates the informal *Dependency Lemma* in Section 7.

References

- [1] Einstein, A.: On the Electrodynamics of Moving Bodies. *Ann. Phys.* **17**(10), 891–921 (1905). doi:10.1002/andp.19053221004
- [2] Guth, A.H.: Inflationary universe: A possible solution to the horizon and flatness problems. *Phys. Rev. D* **23**(2), 347–356 (1981). doi:10.1103/PhysRevD.23.347

- [3] Planck Collaboration: Planck 2018 results. VI. Cosmological parameters. *Astron. Astrophys.* **641**, A6 (2020). doi:10.1051/0004-6361/201833910
- [4] Hensen, B. *et al.*: Loophole-free Bell inequality violation using electron spins separated by 1.3 km. *Nature* **526**, 682–686 (2015). doi:10.1038/nature15759
- [5] Rauch, D. *et al.*: Cosmic Bell test using random measurement settings from high-redshift quasars. *Phys. Rev. Lett.* **121**, 080403 (2018). doi:10.1103/PhysRevLett.121.080403
- [6] Landauer, R.: Irreversibility and heat generation in the computing process. *IBM J. Res. Dev.* **5**(3), 183–191 (1961). doi:10.1147/rd.53.0183
- [7] Bekenstein, J.D.: Universal upper bound on the entropy-to-energy ratio for bounded systems. *Phys. Rev. D* **23**(2), 287–298 (1981). doi:10.1103/PhysRevD.23.287
- [8] Shannon, C.E.: A mathematical theory of communication. *Bell Syst. Tech. J.* **27**, 379–423 (1948). doi:10.1002/j.1538-7305.1948.tb01338.x
- [9] von Neumann, J.: *Mathematical Foundations of Quantum Mechanics*. Princeton Univ. Press, Princeton (1932). doi:10.1515/9781400889921
- [10] Fuchs, C.A., Mermin, N.D., Schack, R.: An introduction to QBism with an application to the locality of quantum mechanics. *Am. J. Phys.* **82**(8), 749–754 (2014). doi:10.1119/1.4874855
- [11] Rovelli, C.: Relational quantum mechanics. *Int. J. Theor. Phys.* **35**(8), 1637–1678 (1996). doi:10.1007/BF02302261
- [12] Wigner, E.P.: The unreasonable effectiveness of mathematics in the natural sciences. *Commun. Pure Appl. Math.* **13**(1), 1–14 (1960). doi:10.1002/cpa.3160130102
- [13] Wheeler, J.A.: Information, physics, quantum: The search for links. In: Zurek, W.H. (ed.) *Complexity, Entropy, and the Physics of Information*, pp. 3–28. Addison-Wesley, Reading (1990).
- [14] Tegmark, M.: *Our Mathematical Universe*. Alfred A. Knopf, New York (2014). ISBN: 978-0307599803
- [15] Gödel, K.: On formally undecidable propositions of *Principia Mathematica* and related systems. *Monatsh. Math. Phys.* **38**, 173–198 (1931). doi:10.1007/BF01700692
- [16] Ladyman, J., Ross, D.: *Every Thing Must Go: Metaphysics Naturalized*. Oxford Univ. Press, Oxford (2007). doi:10.1093/acprof:oso/9780199276196.001.0001

- [17] Sorkin, R.D.: Causal sets: Discrete gravity. In: Gomberoff, A., Marolf, D. (eds.) *Lectures on Quantum Gravity*, pp. 305–327. Springer, Boston (2005). doi:10.1007/0-387-24992-3_7
- [18] Penrose, R.: *Shadows of the Mind*. Oxford Univ. Press, Oxford (1994). ISBN: 978-0195106466
- [19] Wolfram, S.: *A Project to Find the Fundamental Theory of Physics*. Wolfram Media, Champaign (2020). ISBN: 978-1579550356
- [20] Awodey, S.: *Category Theory*. 3rd ed. Oxford Univ. Press, Oxford (2023). ISBN: 978-0198748991
- [21] Verlinde, E.: Emergent gravity and the dark universe. *SciPost Phys.* **2**(3), 016 (2017). doi:10.21468/SciPostPhys.2.3.016
- [22] Gao, S.: *The Meaning of the Wave Function: In Search of the Ontology of Quantum Mechanics*. Cambridge Univ. Press, Cambridge (2019). doi:10.1017/9781108562218
- [23] Chalmers, D., McQueen, K.: Consciousness and the collapse of the wave function. In: Gao, S. (ed.) *Consciousness and Quantum Mechanics*, pp. 11–63. Oxford Univ. Press, Oxford (2022). doi:10.1093/oso/9780190677015.003.0002
- [24] Tononi, G., Boly, M., Massimini, M., Koch, C.: Integrated information theory: from consciousness to its physical substrate. *Nat. Rev. Neurosci.* **17**(7), 450–461 (2016). doi:10.1038/nrn.2016.44
- [25] Baars, B.J.: Global workspace theory of consciousness: toward a cognitive neuroscience of human experience. *Prog. Brain Res.* **150**, 45–53 (2005). doi:10.1016/S0079-6123(05)50004-9
- [26] Rosen, R.: *Anticipatory Systems: Philosophical, Mathematical, and Methodological Foundations*. 2nd ed. Springer, New York (2012). doi:10.1007/978-1-4614-1269-4