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Article

The Information Lattice Model (ILM): A Braneworld Framework for Technosignatures, the Role of Observer Consciousness, and Implications for Unidentified Anomalous Phenomena

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Abstract

The hierarchy problem, the anomalous weakness of gravity relative to other fundamental forces, remains one of the most persistent challenges in theoretical physics. Here we introduce the Information Lattice Model (ILM), a framework that reinterprets gravity not merely as spacetime curvature but as the macroscopic manifestation of directed informational flow across a permeable, multi-layered lattice spanning our observable 4-dimensional brane and a higher-dimensional bulk. In the ILM, mass-energy density modulates the bandwidth of inter-node links, naturally accounting for gravitational weakness via trans-layer dilution and resolving the black hole information paradox through lattice-mediated data transfer. The model aligns with recent developments in braneworld scenarios, Causal Dynamical Triangulations, and holographic principles, while generating two falsifiable predictions: anomalous attenuation in high-frequency gravitational wave spectra detectable by LIGO/LISA, and non-linear deviations in quantum decoherence rates near lattice saturation. Beyond its physical core, the ILM offers a speculative but theoretically grounded framework for technosignature detection, proposing that advanced intelligences may be identified by their degree of lattice sovereignty, and for Unidentified Anomalous Phenomena (UAP), reinterpreted here as bulk-brane perturbation events. We also identify consciousness as a participatory interface within the lattice architecture, whose neural complexity functions as a biological transducer of bulk-brane informational coupling. This structural continuity between mind and lattice suggests that UAP encounters may constitute bilateral informational exchange events sharing common substrate in the higher-dimensional bulk.

Keywords: quantum gravity; braneworlds; emergent gravity; technosignatures; consciousness; UAP

1. Introduction

The great weakness of gravity compared to the other fundamental forces, estimated by staggering factors of order $\sim 10^{40}$ at the electroweak scale, constitutes one of the most enduring enigmas in theoretical physics, commonly referred to as the hierarchy problem. This disparity is clear by the vast separation between the Planck scale where quantum gravitational effects become dominant, and the TeV-scale masses of Standard Model particles. Braneworld scenarios offer a geometrically valid solution by positing that our observable 4D universe is a lower-dimensional brane embedded within a higher-dimensional spacetime bulk. In the seminal Randall–Sundrum (RS) models, the Standard Model fields are confined to a 3+1-dimensional brane, while gravity propagates freely throughout the bulk [1]. This exponential warp factor dilutes gravitational strength on the TeV brane (our observable 4D world) relative to the Planck brane, naturally addressing the hierarchy problem.

In the Randall–Sundrum model, the universe has an extra hidden dimension, and space-time is "warped" or stretched. Our universe is confined to a flat "membrane" or brane, the TeV brane. There

is another membrane along that extra dimension, the Planck brane, where gravity would behave normally at very high energies. Gravity, unlike the other forces, is allowed to leak into and travel freely through the entire extra-dimensional space (the "Bulk"). Because of that steep exponential warping, gravity gets hugely diluted by the time it reaches our brane.

Recent advancements have added new aspects to this paradigm. Extensions incorporating hyperbolic warp factors and bulk horizons demonstrate scale hierarchies without singularities, separating hidden and visible branes by a horizon that sets independent scales for the 4D Planck mass and cosmological constant [2]. Similarly, studies on the uplift of 4D wormhole solutions into braneworld geometries reveal novel 5D structures, including flare-out conditions distinct from flat extra dimensions, and embeddings of wormholes [3]. These developments highlight the potential for bulk topology and geometry to influence brane phenomenology. All these studies suggest that the space between branes (the Bulk) may not be an inert vacuum after all, but a structured medium capable of hosting complex physical and informational interactions.

Parallel progress in non-perturbative quantum gravity approaches has provided complementary insights into emergent spacetime. Causal Dynamical Triangulations (CDT) have matured significantly [4]. CDT bridges discrete quantum fluctuations to macroscopic smooth spacetime, offering a bottom-up perspective on how dimensionality and curvature arise dynamically.

Holographic principles, particularly the Anti-de Sitter/Conformal Field Theory (AdS/CFT) correspondence, further deepen our understanding by equating gravitational dynamics in the bulk to quantum information theories on the boundary. Recent resolutions of the long-standing black hole information paradox invoke replica wormholes and quantum extremal surfaces [5] [6].

This convergence of braneworld warping for hierarchy, CDT for emergent discreteness, and holography/replica structures for information preservation motivates a unified framework where gravity emerges from informational structures. Inspired by these convergent lines of inquiry, we propose the Information Lattice Model (ILM): gravity is fundamentally the permeable lattice of quantum information, a dynamic, multi-dimensional network whose nodes represent localized informational degrees of freedom (e.g., entanglement entropy densities) and whose links encode curvature, flux of information, and causal connectivity.

Non-gravitational forces and Standard Model fields remain strictly confined to a 4D "brane-like" layer, while gravitational/informational effects can "leak" across lattice layers via tunable permeability parameters. This leakage dilutes gravity's effective strength on the observable layer, naturally addressing the hierarchy problem without invoking extra dimensions *per se*. In the ILM model, black holes represent intense concentrations of information that leak back out through wormhole bridges, ensuring no data is ever lost. The ILM model posits an informational-layer ontology where baryonic matter represents localized singularities of topological collapse within the 4D lattice, and dark matter is defined as non-collapsed informational density residing within the underlying strata of the manifold [7].

In the ILM framework, we introduce a permeability function $\Pi(y)$ that modulates the warp factor to account for informational leakage across lattice layers:

$$ds^2 = e^{(-2k|y|\cdot\Pi(y))} \eta_{\mu\nu} dx^\mu dx^\nu + dy^2 \quad (1)$$

with the permeability defined as $\Pi(y) = 1 + \varepsilon \exp(-\lambda|y| / \ell^{\text{Pl}})$, where $\varepsilon \ll 1$ is a small dimensionless parameter controlling the strength of gravitational/informational leakage, λ is a decay constant, and ℓ^{Pl} is the Planck length. This modification allows gravity (as informational flow) to permeate between discrete lattice layers, while non-gravitational fields remain confined to a single observable layer, extending the RS mechanism into a discrete, information-theoretic lattice.

ILM contemplates gravitational waves as propagating lattice perturbations — ripples in informational flow — potentially yielding modified dispersion relations or memory effects testable with LIGO/Virgo/KAGRA. Traditional SETI efforts have long been constrained by the "Kinetic

Paradigm". Under the ILM framework, SETI should search for non-random gravitational oscillations or localized "de Sitter-like" smoothing of spacetime geometry, thereby expanding the scope of previous proposed technosignature detection [8].

The ILM proposes a multidimensional architecture where gravity is the physical tension generated by the transfer of information from the Bulk to the Brane. Unlike studies describing a self-contained 4D universe that utilizes gravity as a computational optimization algorithm [9], for the ILM, reality is an interface reacting to data flow from a higher dimension, integrating consciousness as a sensor of an information exchange that transcends the known physical plane. To bridge the gap between abstract lattice dynamics and observable effects, we define the Transfer Operator ($T\xi$) as the mathematical function regulating the permeability of the brane-bulk interface, modulated according to the Complexity Index (ξ) (Figure 1).

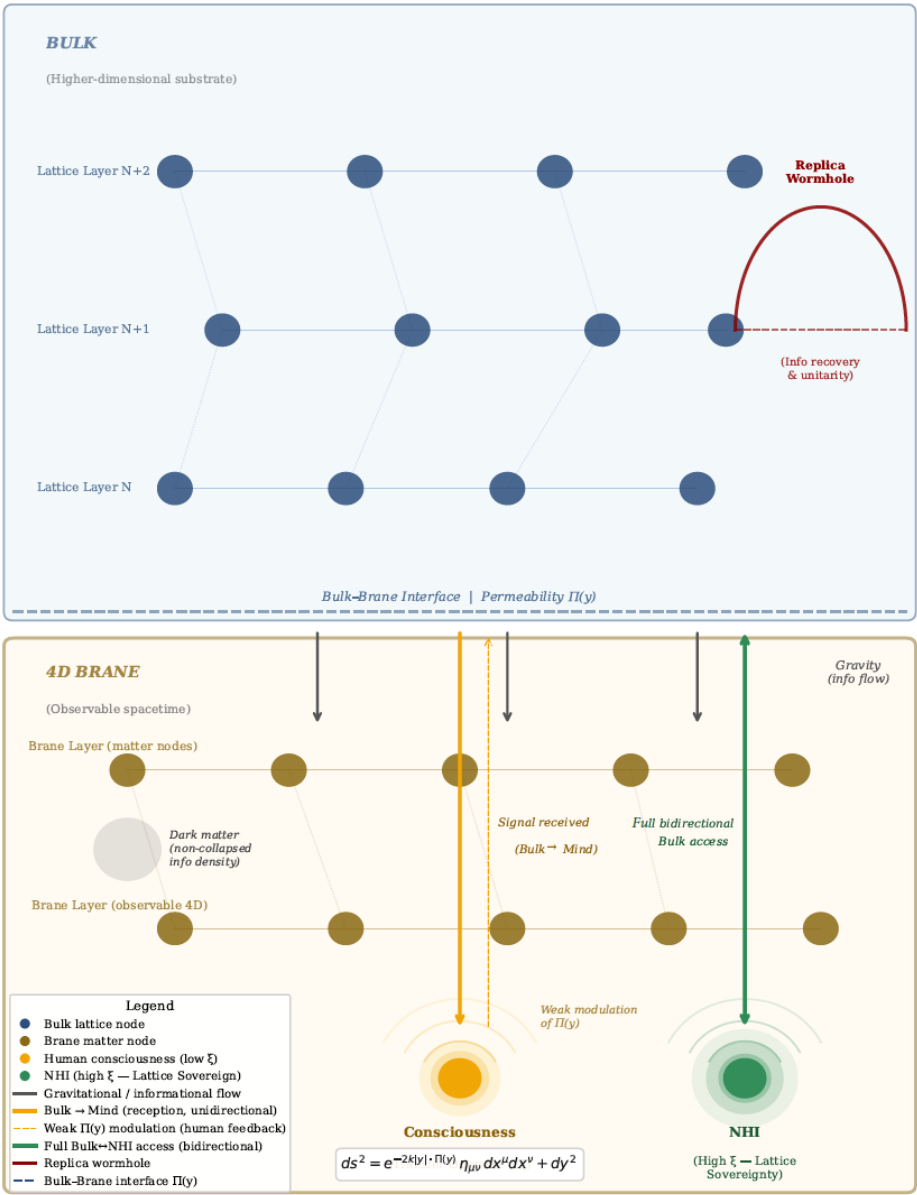


Figure 1. Schematic representation of the Information Lattice Model (ILM). Consciousness acts as a biological antenna (Transfer Operator $T\xi$) receiving informational flux from the Bulk. Human observers (low ξ): unidirectional reception with weak $\Pi(y)$ modulation. Non Human Intelligence or Advanced Extraterrestrial Intelligence NHI-AEI (high ξ - Lattice Sovereign): full bidirectional Bulk access, enabling coordinate re-indexing and active permeability control.

2. Technological Maturity and Trans-Layer Intelligence in Cosmos

Within the ILM framework, advanced extraterrestrial intelligence (AEI) or non human intelligence (NHI) is defined by its degree of "Lattice Sovereignty", the ability to transition from merely inhabiting the 3+1D brane to actively manipulating its permeability. A civilization reaching this technological maturity would view the cosmos not as a vast void to be traversed by light-speed propulsion, but as a high-bandwidth network where interstellar distances are bypassed through bulk-manifold resonance.

We also suggest that the universe may host interdimensional intelligences whose substrate originates within higher-order lattice layers of the Bulk. In this light, the "Great Silence" or Fermi Paradox is resolved not by an absence of life, but by a spectral mismatch: we are searching for electromagnetic ripples within the 4D brane, while advanced communication may occur via resonant, trans-dimensional channels within the Bulk's underlying lattice.

Under this framework, a hypothetical extraterrestrial space probe would not be interpreted as a conventional craft only, but rather as a localized bulk-to-brane projection. The ILM suggests that interactions between disparate lattice layers exist on a gradient of resonance: at lower permeability levels, NHI may appear as purely informational projections; conversely, by increasing their coupling frequency, they could achieve full physical manifestation according to their higher-dimensional templates. This implies that contact may occur across a spectrum from intangible telemetry to solid physical presence.

The concept of coordinate re-indexing represents a fundamental paradigm shift from conventional astronautics, eliminating the requirement for warp drives or the manipulation of negative energy densities to distort spacetime. Rather than displacing a physical object through the resistance of the 4D brane, ILM transit functions by modifying the network index, de-manifesting from one node and re-manifesting at another within timescales outside standard 4D causal constraints.

A particularly significant implication is what we term "delegated trans-layer presence": a NHI residing within the Bulk orchestrates the re-indexing of synthetic substrates, autonomous probes, cybernetic drones, or robotic avatars, into the 3+1D manifold. The controlling intelligence remains as a persistent informational anchor in the higher-dimensional substrate, maintaining real-time synchronization with the local 4D terminal via resonant coupling.

We propose a Lattice Sovereignty (LS) classification of intelligent civilizations (Table 1): Class I (Brane-Bound) civilizations, such as current humanity, are restricted to 4D surface physics. Class II (Phase-Shifters) achieve experimental Bulk access via the Transfer Operator at microscopic scales. Class III (Lattice Sovereign Engineers) possess mastery over the Lattice, enabling routine re-indexing and construction of stable Persistent Re-indexing Conduits (PRCs). Class IV (Bulk-Native) entities represent a post-biological state existing as pure informational templates within the Bulk, capable of architecting pocket realities that Class I observers would perceive as fundamental laws of nature.

Table 1. Classification of Intelligent Civilizations by Lattice Sovereignty. (*) Current humanity.

Civilizational Class	Access Level	Primary Mechanism	Perception of Space
Class I *	4D Manifold only	Kinetic Propulsion	Linear & Distant
Class II	Experimental Bulk	Quantum Tunnelling	Fragmented
Class III	Lattice Sovereign	Transfer Operator (TΞ)	Integrated Network

Civilizational Class	Access Level	Primary Mechanism	Perception of Space
Class IV	Bulk-Native	Simplicial Manipulation	Omnipresent / Virtual

3. Consciousness as a Higher-Layer Universal Interface

Traditional neuroscience treats consciousness as a localized byproduct of biological brain activity. Contemporary neuroscience relies on models such as Global Workspace Theory (GWT) [10] which views consciousness as a broadcast of neural signals, or the Integrated Information Theory (IIT) [11] which calculates consciousness as an internal property of integrated data. These frameworks remain strictly localist, they interpret the brain as a closed generative system.

In contrast, the ILM posits that the brain's primary function is not to generate information, but to interface with a pre-existing informational substrate in the Bulk.

Within the ILM architecture, consciousness is redefined as a universal functional interface between the Bulk and the localized Brane. The Transfer Operator (T_{ξ}) is a non-local mechanism governing the transduction of higher-dimensional informational leakage into coherent reality (Equation 2):

$$\Psi_L = T_{\xi} (\Phi_{Bulk}) \tag{2}$$

Where T_{ξ} operator with Complexity Index ξ represents the level of sophistication of the observer's "hardware". For a human, ξ is constrained by 4D biology, acting as a restrictive filter that allows only a minimal fraction of the Bulk's information to pass through, what we define as "physical reality." For NHI, ξ would be significantly higher, enabling conscious and voluntary reindexing. Ψ_L (Local Reality) is the resulting output: an AEI might perceive the Bulk as a navigable space, whereas humans perceive it as "empty vacuum."

To provide a robust formalization, the Transfer Operator (T_{ξ}) is defined as a projection-filter function that maps higher-dimensional informational densities from the Bulk onto the 4D manifold. The Complexity Index ξ acts as a coupling constant that determines the bandwidth of this interface. Operationally, ξ is approximated by the system's integrated information (Φ), as defined in IIT, and the decoherence timescales (τ^{dec}) within neural substrates. This anchoring allows the ILM to be constrained by empirical neurobiology: a higher ξ represents a greater capacity for the biological hardware to maintain a stable, high-fidelity link with the Bulk's informational flow before collapsing into a localized 4D reality (Ψ_L).

In ILM, the double-slit experiment is reinterpreted as a direct manifestation of Bulk-Brane informational dynamics. The particle in superposition represents an unresolved informational density distributed across the higher-dimensional Bulk, whose full interference pattern remains latent until a sufficiently complex observer engages the Transfer Operator (T_{ξ}). At that point, the Bulk state undergoes projection onto the 4D manifold, $\Psi_L = T_{\xi}(\Phi_{Bulk})$, collapsing the distributed informational field into a localised brane event. We conclude that measurement is not a passive recording but an active coupling between the observer's Complexity Index (ξ) (observer consciousness) and the lattice permeability $\Pi(y)$, transforming quantum indeterminacy from an epistemological mystery into a predictable consequence of trans-layer informational architecture. In this view, entangled particles are not separate objects communicating across space-time but a single informational vertex intersecting our 4D manifold at two distinct coordinates. Just as the double-slit demonstrates how information remains latent until ξ intervenes, entanglement reveals that spatial distance is an illusion of the 4D Brane (our physical world), a "shadow" cast by a unified structure in the Bulk that remains topologically contiguous. Conventional human technology, including CERN instruments, induces quantum state collapse through irreversible macroscopic coupling within the 4D brane, effectively masking high-dimensional data with thermal noise.

The neuro-architectural traits of the avian and dinosaurian lineages provide a compelling biological basis for the ILM Transfer Operator ($T\xi$). Key features, such as the high neuronal density of the pallium and the specialized processing power of the Wulst, function as high-bandwidth receivers for dimensional data. This specialized anatomy explains why migratory birds often demonstrate navigational precision that transcends mere celestial or magnetic guidance.

The cryptochrome-mediated radical pair mechanism documented in avian magnetoreception[12] may represent, within the ILM framework, a biological precedent for quantum-coherent Bulk coupling, not as an established transduction pathway, but as an evolutionary trace suggesting that certain lineages developed sensory architectures more attuned to lattice-level phenomena than others. While the avian lineage specialized in this high-resolution spatial-dimensional awareness, the mammalian (and specifically human) brain evolved toward complex social and linguistic abstraction.

Consequently, the human nervous system is more prone to “loading” its captures of the Bulk with heavy semantic interpretations and cultural metaphors. On the other hand, whereas birds might navigate the direct “gravitational” tension of a dimensional bridge, a human is likely to filter that same informational influx through the lens of language, transforming raw dimensional data into subjective narrative or mythic interference driven by cognitive bias.

This differential ξ capacity is exemplified by two divergent evolutionary strategies: the avian pallium, optimized for high-bandwidth spatial-dimensional processing via cryptochrome-mediated quantum coherence, and the human neocortex, which trades raw lattice sensitivity for symbolic abstraction and linguistic reindexing. Both architectures implement the Transfer Operator, but at distinct operational bandwidths, a testable prediction of the ILM that could be approached through comparative measures of Φ and τ^{dec} across species.

The ILM redefines consciousness not as a biochemical byproduct, but as a fundamental universal constant acting as the primary interface between baryonic matter and the Bulk, allowing high-order neural complexity to function as a region of enhanced permeability where informational patterns from higher layers couple to brane dynamics. In this architecture, qualia and unified subjective experience result from coherent informational patterns residing in the Bulk that project onto neural activity via gravitational bridges, effectively resolving the binding problem through the non-local connectivity of the fifth dimension.

While the Orch-OR model posits that consciousness is biologically generated through quantum collapse within microtubules [13], the ILM redefines this process as trans-scalar tuning: microtubules may function as biological antennas that utilize gravitational bridges to filter and select coherent states from the network. This paradigm shift suggests that the universe operates as a distributed learning system where every biological entity possesses a “Lattice Link” whose bandwidth scales with its complexity index ξ , functioning much like the Quantum Blockchain proposed by Rajan and Vissera cosmological blockchain, where consciousness would act as the validating node [14].

4. UAP as Brane Perturbation Technosignatures

Under the ILM framework, UAPs are not merely advanced aerodynamic vehicles, but coherent informational patterns reindexing themselves through the multidimensional Bulk. These phenomena operate by manipulating the Transfer Operator ($T\xi$), allowing them to bypass 4D inertial laws and manifest as “instantaneous” kinematic anomalies within our local reality. A UAP encounter is a phase-lock event where the object's high Complexity Index interacts with the witness's nervous system, creating a temporary lattice link.

This interaction explains two otherwise anomalous features consistently reported in UAP encounters. The first is the physical “Oz Factor” [15], a term describing the perceptual isolation experienced by witnesses, characterized by the sudden absence of ambient sound, a sense of temporal suspension, and a subjective decoupling from the immediate environment. Within the ILM framework, this is interpreted as a localized saturation of the Bulk-Brane interface, where the Transfer Operator's ($T\xi$) phase-lock event temporarily overrides the standard 4D metric update, creating a

measurable desynchronization between the observer's neural processing and the environmental informational flow.

The second feature is the subjective sense of mutual awareness, the persistent witness report that the phenomenon appears to recognize, respond to, or even anticipate the observer's attention. Perhaps the most operationally documented instance of this bilateral informational exchange is the 2004 USS Nimitz encounter, in which the phenomenon demonstrated instantaneous coordinate re-indexing, reappearing at a classified Combat Air Patrol rendezvous point known exclusively to the strike group, and exhibited explicit reactive awareness to the observer's movements, with Commander Fravor reporting under oath that the object mirrored his flight trajectory, suggesting active monitoring of the witness's cognitive and spatial intent [16] [17]. Within the ILM framework, the phenomenon's apparent knowledge of classified coordinates is consistent with trans-layer informational access, while the mirroring behavior constitutes direct empirical evidence of the phase-lock mechanism. We propose that his bidirectionality is not psychological projection but a structural consequence of the phase-lock: once the observer's consciousness engages as a validating node, the informational exchange becomes genuinely bilateral, operating outside 4D causal constraints and therefore effectively instantaneous, collapsing the distinction between detector and detected.

The absurd or surreal nature of UAP cases can be a byproduct of informational overload on the human nervous system. When high-dimensional leakage from the Bulk occurs, the brain performs a heuristic reconstruction, translating pure metric tension into familiar, albeit sometimes nonsensical, physical forms. The recurrence of specific morphologies (e.g., disc-shaped craft or humanoid entities) suggests a structural alignment between the UAP's metric distortion and human cognitive archetypes, evolving alongside culture over the decades [18]. Evidence from a sample of 209 interested individuals, focused on a subset of approximately 90 direct witnesses suggests that specific psychological characteristics may facilitate or catalyze this interaction [19] (Figures 2 and 3). Within the ILM framework, this is understood as a heightened permeability $\Pi(y)$ with the Bulk.

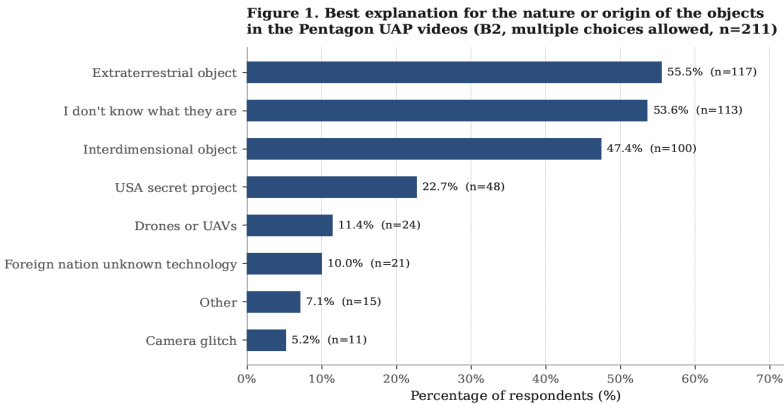


Figure 2. UAP study results (De la Torre, 2023 [19]) regarding witness interpretations of Pentagon videos; a high percentage favored the interdimensional hypothesis.

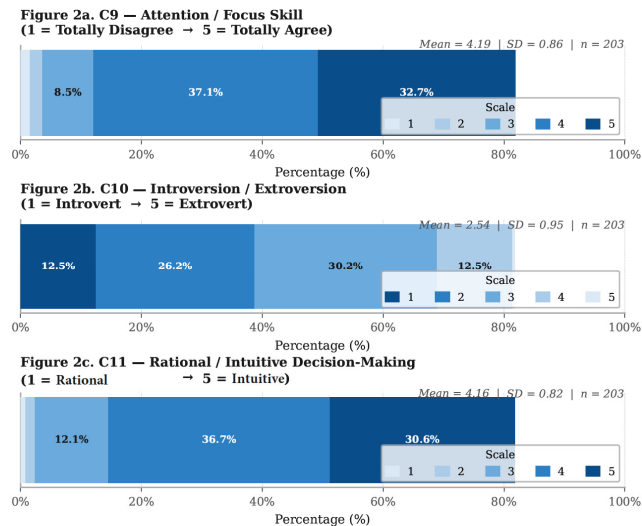


Figure 3. Results from De la Torre (2023 [19]) regarding psychological aspects related to Bulk permeability within the ILM framework.

Regarding this permeability factor, the statistical correlation found between 1950s transients, nuclear testing, and UAP reports in recent study [20], provides empirical weight to the ILM theory. Under this framework, these flashes are not mere orbital debris, but localized reindexing events or Brane Perturbation Technosignatures (BPT). The energy surge from nuclear detonations increases the Brane's Permeability $\Pi(y)$, allowing high-complexity patterns from the Bulk to manifest as transient optical signatures. This suggests that UAPs or NHI may monitor dimensional stability, especially nuclear activity, appearing as "glints" when the informational threshold of our local reality is compromised.

In line with previous psychological research in UAP [19], and other phenomenology theories in the field [21], despite its apparent physical manifestations, the UAP appears to establish an intimate bidirectional relationship with the observer's conscious activity, adapting its perceptual presentation to the witness's cognitive framework through mechanisms consistent with top-down processing. In this interaction, the observer becomes simultaneously coupled at both the cognitive and gravitational levels, a phase-lock event in ILM terms, resulting in an ontological shock characterized by persistent epistemic uncertainty and prolonged affective post-processing.

5. Conclusions

The Information Lattice Model (ILM) offers a transformative perspective on the fundamental nature of reality by shifting the ontological focus from matter-energy to the dynamics of a permeable informational network. By synthesizing the geometric elegance of braneworld scenarios with the discrete causality of Causal Dynamical Triangulations, the ILM provides a natural resolution to the hierarchy problem, reinterpreting gravity's weakness as a result of trans-layer informational dilution. This framework suggests that the ultimate trajectory of intelligence in the universe is the achievement of Lattice Sovereignty, wherein advanced intelligent civilizations transcend the passive role of observers to become active administrators of the local metric.

Perhaps the most significant contribution of the ILM is its capacity to bridge the chasm between cosmological dynamics and neuroscience. By redefining consciousness as a resonant coupling with higher-dimensional lattice layers, we offer a physical basis for reconsidering the role of biological life in the cosmos. Within this framework, life is not an isolated accidental byproduct of matter, but a specialized evolutionary interface designed to tune into the fundamental informational strata of the universe through a structural reciprocity that allows for non-local coordination.

As upcoming observations from LIGO O4/O5, LISA, and the Einstein Telescope begin to probe high-frequency and stochastic gravitational backgrounds, the ILM provides concrete opportunity for empirical validation. Based on ILM, we propose to add the identification of informational anomalies to the current search for technosignatures.

By defining consciousness as a measurable interface (ξ), we propose a new metric for astrobiological studies, suggesting that the complexity of a species is directly linked to its capacity to interact with the high-dimensional informational flux of the Bulk.

To ensure the falsifiability of the ILM, future research should focus on empirically constraining the free parameters of the permeability function $\Pi(y)$ through two progressive levels of observational testing. First, the ILM predicts a measurable attenuation or anomalous dispersion in the high-frequency gravitational wave spectrum within the projected sensitivity of LIGO O4/O5, LISA, and the Einstein Telescope. Second, the model predicts non-linear deviations in quantum decoherence rates as local systems approach lattice saturation, detectable in high-precision quantum systems such as ion traps or Bose-Einstein condensates.

We think that while conventional high-energy physics (e.g., CERN) collapses the wave function through entropic saturation within the 4D brane, the ILM identifies biological consciousness as a low-energy interface capable of navigating lattice permeability. This suggests a new technological paradigm: coherent coupling engineering or maybe a form of coherent synthetic quantum computing. By emulating high complexity (ξ), such technology could access the Bulk's informational flux without triggering the stochastic decoherence inherent in current macroscopic observation.

While the application of the ILM to consciousness and UAP remains speculative, these predictions provide a concrete roadmap through which the core claims of the model can be progressively tested, constrained, or refuted.

In the language of the ILM, Sagan's vision of the universe seeing itself "*the cosmos is within us. We are made of star-stuff. We are a way for the cosmos to know itself*" [22] is realized through the collapse of the Bulk into local reality, a process where the observer is not a bystander, but the essential aperture through which the cosmos achieves self-awareness.

Conflicts of Interest: The author declares no conflicts of interest.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process: During the preparation of this work, the author used Gemini and Claude to refine the linguistic flow and ensure grammatical English accuracy and verify equation correctness. The author takes full responsibility for the entire manuscript. The core theoretical framework of the Information Lattice Model (ILM), including the conceptualization of gravitons as informational bridges, the effects of dimensional friction, the permeability function, the transfer operator, and the original hypotheses concerning consciousness and UAP, represents the original work and ideas of the author.

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