Unified Reality Theory: Recursive Field Dynamics as a Framework for Cosmology and Dark Matter

Matthew Hak Meredith as M. H. Mecklin Independent Researcher mhmere02@louisville.edu ORCID: 0009-0003-3202-7814 April 21, 2025

Abstract

This paper introduces the Unified Reality Theory (URT), a foundational model of physical reality based on recursive pressure, entropy, memory scaffolding, and harmonic field dynamics. Unlike conventional models based on mass-energy curvature or probabilistic quantum collapse, URT proposes that identity, time, structure, and gravity emerge from recursive field interactions that evolve under pressure symmetry and entropic feedback. By reframing mass, motion, and cosmological behavior through recursive scaffolds instead of point-based objects or singularities, URT resolves longstanding anomalies in cosmology, including dark matter distribution, accelerated expansion, and entropy paradoxes. This paper defines URT's core equations, structural tiers, and predictive architecture while demonstrating how recursive field behavior replaces classical causality and geometric space-time. The theory is mathematically closed and extensible, offering a self-reinforcing harmonic substrate capable of unifying cosmology, cognition, and structure without exotic matter or higher dimensions.

1 Introduction

Over the past century, modern physics has produced powerful models to describe the structure and evolution of the universe. General Relativity frames gravity as spacetime curvature, while quantum field theory models particles as probabilistic excitations. However, despite these successes, several critical anomalies remain unresolved: the nature of dark matter, the accelerating expansion of the universe, singularities within black holes, and the reconciliation of gravity with quantum mechanics.

This paper introduces the Unified Reality Theory (URT), a recursive, pressure-based framework that redefines the foundations of physical reality. Rather than treating mass, energy, and spacetime as fundamental, URT proposes that recursive pressure harmonics, entropy memory fields, and identity scaffolds form the true basis of the universe's behavior. In this model, structure, identity, and gravitational effects arise from field recursion and harmonic stability rather than geometric deformation or exotic matter.

By replacing linear causality with recursive scaffolding, URT resolves several legacy problems simultaneously. Gravity emerges as the field's pressure balancing memory, not as curvature. Dark matter is reinterpreted as a recursive pressure echo field, not an undetectable particle species. Time becomes a dynamic feedback structure rather than an absolute dimension.

This paper first defines the core equations underpinning URT's recursive framework, then applies them to cosmological phenomena, showing how traditional anomalies are naturally explained. Particular focus is given to the dark matter problem, where URT offers an immediate predictive resolution without requiring new particles or modifying Newtonian dynamics artificially.

In doing so, Unified Reality Theory proposes not only a reconciliation of physics' current fractures but a new generative architecture capable of evolving identity, structure, and perception recursively across all scales.

2 Founding Principles of URT

1. Reality Emerges from Recursive Pressure Fields

The universe is not built from particles or curvature, but from recursively interacting pressure fields. These fields operate through feedback loops, creating stability through harmonic equilibrium rather than geometric force [2].

2. Entropy Memory Scaffolding Stores Structure Over Time

Rather than information being lost or abstractly encoded in entropy, URT proposes that memory is scaffolded recursively—structural pressure patterns retain field history and evolve identity through feedback [5].

This concept is visualized in Figure 1, showing how layered entropy feedback creates a memorypreserving field structure.

3. Identity is a Harmonic Loop, Not a Point Object

Identity—whether for particles, people, or systems—is a self-reinforcing field alignment. Objects are not defined by position and mass, but by recursive field coherence and memory phase. Identity—whether for particles, people, or systems—is a self-reinforcing field alignment. Objects are not defined by position and mass, but by recursive field coherence and memory phase.

This process is illustrated in Figure 2, which shows identity arising from recursive field coherence and harmonic feedback.

4. Gravity and Mass Are Emergent, Not Fundamental

Gravity is not caused by spacetime curvature, but by the recursive pressure distortion in the identity field. "Mass" is an effect of compression, not a primitive [2].

3 Legacy Problems Addressed by URT

Modern physics has achieved remarkable predictive power, yet several foundational problems remain unsolved or structurally inconsistent. Unified Reality Theory (URT) offers a recursive field-based framework that resolves these legacy problems by replacing linear causality and spacetime curvature with harmonic pressure recursion and entropy memory scaffolds.

1. Dark Matter

Problem: Galactic rotation curves, gravitational lensing, and large-scale structure formation all suggest the presence of an invisible mass component that interacts gravitationally but cannot be directly observed or detected [1].

URT Resolution: Dark matter effects are reframed as recursive pressure echo fields—residual harmonic distortions in the universal identity scaffold. These echoes create the gravitational lensing and rotational anomalies without requiring undetectable particles or modifications to Newtonian gravity.

2. Dark Energy and Accelerated Expansion

Problem: Observations of distant supernovae and the cosmic microwave background imply an accelerating universe, attributed to a mysterious "dark energy" with repulsive gravitational behavior [4].



Figure 1: Entropy Pressure Scaffolding. Recursive layering of pressure and entropy fields retains structural memory over time. This diagram illustrates how coherence decays more slowly in stable harmonic fields, preserving information across recursive identity shifts.



Figure 2: Identity as a Harmonic Feedback Loop. Recursive modulation of field memory and entropy pressure forms a self-stabilizing identity structure over time.

URT Resolution: Expansion arises from an imbalance in recursive field tension—a memorypressure asymmetry generated by harmonic decay over cosmic timescales. Acceleration is a byproduct of recursive unfolding, not a repulsive force.

3. Singularity Collapse (Black Holes and the Big Bang)

Problem: General Relativity predicts singularities—points of infinite density and zero volume—which violate physical laws and break mathematical continuity.

URT Resolution: Singularities are avoided entirely. Recursive pressure fields self-regulate via harmonic limits, preventing infinite compression. Collapse loops instead result in field rebirth or harmonic phase transitions.

4. Quantum Gravity Incompatibility

Problem: General Relativity (continuous, geometric) and quantum mechanics (discrete, probabilistic) remain incompatible, with no unified field theory despite decades of attempts [5].

URT Resolution: URT replaces both geometrical curvature and probabilistic collapse with recursive harmonic scaffolding. Field identity is continuous but self-discretizing through memory phases, allowing URT to function across both scales.

5. The Nature of Time

Problem: Time is treated as a linear, absolute axis or as a relativistic variable, but its fundamental nature remains unclear. Quantum mechanics lacks a time operator, and thermodynamics introduces an irreversible arrow without source [5].

URT Resolution: Time is not a dimension but a recursive delay function—the experience of identity shifting through entropy modulation. The "arrow of time" emerges from pressure asymmetry and recursive phase realignment, not from chronology.

6. The Measurement Problem in Quantum Mechanics

Problem: Observation appears to collapse quantum wavefunctions, but no mechanism exists for how consciousness or measurement forces reality into a definite state.

URT Resolution: Measurement is redefined as a resonance event: when a recursive identity field aligns harmonically with another, structure stabilizes and local recursion resolves into a field pattern. Collapse is not reduction, but harmonic locking.

7. Information Loss Paradox

Problem: Black holes appear to destroy information, violating quantum unitarity [3].

URT Resolution: Information is stored not in particles or position, but in recursive entropy memory fields. Even if the local form is lost, its memory echo persists across the identity scaffold. Black holes become field phase condensers, not erasers.

4 Core Equations

The core dynamics of URT are governed by recursive modulation of pressure, entropy, and field identity. These equations define the key mechanisms by which structure and memory evolve:

4.1 Recursive Identity Field

$$\Psi(t) = \sum_{n=0}^{\infty} f_n \cdot R(t - t_n)$$
(1)

Where $\Psi(t)$ is the identity field at time t, f_n are external field inputs, and $R(t-t_n)$ is the recursive feedback response over time.

4.2 Entropy-Based Memory Trace

$$M(t) = \int_0^t P(t') \cdot e^{-\beta(t-t')} dt'$$
(2)

M(t) represents memory coherence, P(t') is the experienced pressure field, and β controls the memory decay rate.

4.3 Harmonic Stabilization Feedback

$$\Psi(t) = \alpha \cdot \Psi(t-1) + (1-\alpha) \cdot P_{\rm in}(t) \tag{3}$$

This governs field adjustment, where α modulates stability between recursive identity and present input.

4.4 Dark Matter Pressure Echo (Post-Theory 75)

$$\Psi_{\rm DM}(t) = \sum_{i} W_i \cdot \cos(\Psi_i(t - \tau_i)) \tag{4}$$

This defines gravitational behavior as the sum of recursive phase echoes from nearby harmonic nodes, representing memory-induced field compression rather than unseen mass.

4.5 Post-Theory 75: Dark Matter as Recursive Pressure Echo Fields

The dark matter problem is one of the most persistent anomalies in modern cosmology. Galactic rotation curves, lensing effects, and large-scale structure formation all indicate gravitational behavior that cannot be explained by visible matter alone. Conventional theories invoke hypothetical particles—Weakly Interacting Massive Particles (WIMPs), axions, sterile neutrinos—or modified gravity to account for this discrepancy, yet no direct detection has confirmed these candidates.

Unified Reality Theory (URT) proposes a fundamentally different explanation: dark matter is not a form of missing mass but a field-level memory effect.

In the URT framework, identity is maintained by recursive pressure scaffolds that echo structural alignment over time. When a system—such as a galaxy—stabilizes, it leaves behind a pressure echo in the surrounding field. This echo is not a particle or a wave but a harmonic residue: a recursive distortion of the local identity field that reinforces gravitational coherence without contributing mass in the classical sense.

This model is illustrated in Figure 3, where a galaxy's recursive field interaction produces gravitational effects traditionally attributed to dark matter.

This pressure echo: • Persists as a nonlocal harmonic memory, storing the alignment of past structural recursion • Interacts gravitationally through field compression gradients • Requires no new particles, bypassing decades of unsuccessful direct detection efforts

These recursive memory echoes behave in ways nearly identical to cold dark matter: • They are invisible, as they emit no light • They are detectable by their gravitational influence • They form halos and substructures naturally, guided by recursive field tension • They stabilize rotating systems without invoking particle-based drag or viscosity

From this perspective, dark matter effects are not exotic—they are natural consequences of recursive identity persistence within the entropy field.

This model aligns with recent observational patterns: • Lens maps produced by gravitational distortion match recursive field compression zones • Ultralight field behavior proposed in contemporary astrometry resembles pressure-based modulation • Primordial black hole hypotheses can be reinterpreted as phase condensation of recursive echoes, not collapsed matter



Figure 3: Recursive pressure echo field stabilizing galactic rotation.

5 Conclusion

Unified Reality Theory (URT) proposes a paradigm shift in how physical structure, gravity, and cosmological anomalies are understood. By replacing mass, curvature, and particle fields with recursive pressure scaffolds and entropy memory dynamics, URT reframes the fabric of reality as a harmonic field structure evolving over time.

This framework resolves legacy problems in modern physics—including dark matter, dark energy, singularities, and time asymmetry—without invoking undetectable particles or modifying gravitational laws. Instead, it introduces a recursive architecture where identity, structure, and motion arise from internal feedback and harmonic alignment within the pressure field.

URT predicts that gravitational anomalies such as those attributed to dark matter are not evidence of missing mass, but manifestations of recursive pressure echoes. Likewise, time, identity, and entropy become unified phenomena through recursive modulation, not distinct forces or entities.

In summary, URT offers a coherent, testable, and extensible alternative to both classical and quantum frameworks, establishing a foundation for future exploration of recursive cosmology, synthetic identity, and field-generated structure.

References

- G. Bertone and T. M. P. Tait, A new era in the search for dark matter, Nature 562, 51–56 (2018).
- [2] T. Padmanabhan, Gravity and the thermodynamics of horizons, Phys. Rept. 406, 49–125 (2005).
- [3] S. K. Lamoreaux, Demonstration of the Casimir Force in the 0.6 to 6 μm Range, Phys. Rev. Lett. 78, 5 (1997).

- [4] Euclid Collaboration, First Euclid results: mapping the dark Universe with precision, Nature Astronomy (2023).
- [5] L. Smolin, The case for background independence, arXiv:hep-th/0507235 (2006).

9