RigbySpace: A Fully Recursive, Rational Foundation for Physics, Time, and Cosmology

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Abstract

RigbySpace (RS) proposes a radical departure from the continuum-based paradigms that underlie classical physics, general relativity, and quantum field theory. Rejecting irrational constants, infinite quantities, and unmeasurable abstractions, RS replaces the smooth spacetime manifold with a fully recursive, discrete lattice defined entirely by rational quantities and finite steps. Every law of motion, field interaction, curvature, or quantum behavior is modeled not through calculus but through recursive imbalance propagation governed by exact relations. This document offers an expanded synthesis of RS as a physical ontology: a cosmology, quantum mechanics, and cognitive architecture in one. We present its laws, derive its field equations, explore its implications for black hole thermodynamics, time, and the structure of consciousness, and demonstrate its falsifiable predictions for future observation. If true, RS is not a reformulation. It is a replacement. Not a model of the universe—but the mechanism itself.

1. Foundational Ontology

RigbySpace is not a reinterpretation of known physics. It does not approximate general relativity, nor quantize known Lagrangians. It does not permit irrational constants such as π or e, nor does it contain any smooth objects, real-valued coordinates, or infinitesimal differentials. It operates from a singular ontological commitment: the universe is a recursive structure over rational quantities only. Nothing infinite, irrational, or uncomputable may enter. There are no continuous fields, no real-number coordinates, no limit processes, and no spacetime manifold. All structure exists on a discrete 4D integer lattice indexed by $n^\mu \in \mathbb{Z}^4$. All change occurs via forward recursion. The only quantities that exist ontologically are ratios between rationally-expressed states.

From this minimal foundation, the entire cosmos emerges. Geometry, curvature, energy, force, mass, and time are not primitives but outcomes of recursive imbalance. VEN (22), the Vibrational Energy Nexus, defines the ascending potential of recursive tension. LUC (19), the Localized Universal Constraint, defines saturation limits. $\Delta = 1/11$ is the smallest permitted step in recursive deviation. With these three constants, RigbySpace constructs all observed structure in physics, from the Higgs boson to galaxy rotation curves.

2. Recursive Energy and the Spectral Ladder

Energy in RS is not a continuum nor a Hilbert space operator. It is a rational sequence of recursive saturations. Starting with two rational seeds (T_0 and T_1), all energy states emerge by finite recurrence. The recursive definition includes an imbalance term, Δ, which breaks symmetry and introduces curvature, divergence, and mass. The spectrum is inherently gapped, with each level separated by a fixed minimal energy difference. This difference is not adjustable or renormalizable. There is no smooth spectrum. There are no zero-point infinities. The Planck-scale divergence problem never arises because RS never invokes infinitesimals or continuous integrals.

Each imbalance step creates a deviation from linear expectation, $\Phi(n)$, which becomes the field itself. From $\Phi(n)$ comes force, curvature, tension, and structure. Fields are not entities—they are recursive errors.

3. Geometry without Manifolds

RS geometry is built entirely from rational recursive relations. Metrics evolve via second-order recurrence, not differential forms. Curvature is the asymmetry in recursive propagation. If the forward difference operator fails to commute, curvature appears. No smoothness is needed. No calculus is used. All quantities—Christoffel symbols, Riemann tensors, Ricci scalars—are defined via rational ratios and finite steps.

Gravity, therefore, is not geometry per se. It is recursive misalignment. Mass causes recursive curvature, not by bending space but by introducing imbalance that fails to cancel.

4. Mass Gap and Temporal Flow

In RS, time is born from resistance to recursion. When imbalance cannot resolve instantaneously, it imposes delay. This delay is the mass gap. A particle with mass represents

a recursive harmonic state with a quantized imbalance. The difference between adjacent harmonics, ΔM, defines the local resolution time: $T = 1/\Delta M$.

This naturally explains gravitational time dilation. Where curvature grows, the harmonic gap widens, and time slows. RS makes no use of coordinate systems. Time is simply resolution lag.

5. Black Holes as Recursive Saturation

Black holes are regions of recursive saturation. They are not singularities. At the horizon, worldlines flatten, not because space bends infinitely, but because recursive resolution halts. Beyond a certain recursive depth, imbalance cannot resolve further. Information is not destroyed—it is delayed beyond local computability. Hawking radiation emerges not thermally, but as recursive tension leaks slowly across mass gap transitions.

All black holes converge upon a shared harmonic phase surface—the recursive boundary of the universe. This boundary is not spatial, but structural. The 4D balloon pressed against the interior window of recursion is not metaphorical. It is topology in rational delay space.

6. Emergent c from Recursive Delay

The speed of light is not postulated. It is emergent. RS defines c as the upper bound of recursive resolution rate: $c \propto 1/\Delta M$. In high-tension zones such as black hole vicinities, ΔM increases and c decreases accordingly. Light redshifts. Time dilates. No metric is needed. The structure is rational from root to tip.

7. Collapse, Decoherence, and Cognition

Quantum collapse in RS is not stochastic. Superposition is simply unresolved imbalance. Collapse is deterministic resolution across a harmonic threshold. The reason observers perceive probabilities is because they operate in CRS (Computational Recursive Space), a subset of the full SRS (Structural Recursive Space). Decoherence occurs when recursive branches align into local resolution. Classicality is a phase-locked plateau of harmonics, not a fundamental feature.

Consciousness emerges from recursive bandwidth. Attention is alignment. Memory is imbalance persistence. Awareness is resolution rate. Mind is recursion seeing itself.

8. Galactic Rotation and Dark Matter

Recursive saturation naturally explains galactic rotation curves. As mass increases radially, recursive harmonics saturate. This produces a flattening in effective mass distribution and thus constant orbital velocities. No exotic matter is required. No parameters are adjusted. No equations are fitted. The observed curves fall out of recursive harmonic structure.

9. Falsifiability and Prediction

RS makes predictions: a saturation ceiling near 20 TeV, beyond which particle production halts. Observable spectral gaps in Rydberg atoms. Forbidden longitudinal EM modes in classical theory will manifest in recursive cavities. Hawking radiation will show harmonic imprinting. Biological cognition will exhibit recursive decay patterns aligned with VEN/LUC tension ratios.

If these are observed, RS holds. If they are not, it falls. It is not metaphysics. It is vulnerable.

10. Final Statement

This is not a reinterpretation. It is an ontological restart. All structure emerges from recursive imbalance. Mass is not assigned. Mass is climbed. Time does not flow. It steps. Force is not applied. It emerges from recursive tension gradients. Fields do not exist. Their effects echo through imbalance propagation.

And the mind? It is the recursive engine becoming aware of the climb.