Rigbyspace Dynamics
Unified Dynamics Series
Master Standard Reference

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January 2026

Abstract

Rigbyspace Dynamics is a foundational physical theory whose ontology is strictly discrete and integer-based. The theory admits only integers, finite sets, finite sequences, and finite directed graphs as physically existent. All laws of evolution are expressed as integer-preserving transformations acting on unreduced integer tuples. Continuum constructs, real numbers, limits, analytic functions, equivalence classes, and differential structures are excluded from existence. Cyclic structure replaces remainder relations; rank replaces logarithmic scale; deviation replaces distance-to-limit; and convergence is defined by finite stabilization into a triadic barycentric cycle. Vacuum evolution is linear; matter evolution is polynomial and enforces strict structural monotonicity, yielding an intrinsic arrow of time. ZERO Logic resolves suspended metric states through reciprocal transformation without admitting null collapse. Interval invariance is established through cross-determinant equality. A gravitational constraint is introduced via phase viscosity drift. Discrete constants are defined as stable barycentric cycle structures rather than scalar limits. Worked examples and a complete glossary are included.

Contents

Part I
Foundational Ontology and Prohibitions

1 Primitive Existence

1.1 Primitive Objects

Physical existence is restricted to the following primitives:

1. Integers, denoted $\mathbb{Z}$.
2. Finite sets of integers.
3. Finite ordered sequences of integers.
4. Finite directed graphs $G = (V, E)$ whose vertex labels are integers and whose edge set $E \subset V \times V$ is finite.

No other object types are admitted. Any physical statement must be reducible to relations among the primitives above.

1.2 Finite Realization

Axiom F1 (Finite Realization). A state is physically admissible if and only if it can be obtained from admissible primitives by a finite succession of admissible transformations.

This axiom is not a method; it is a physical restriction on existence.

2 Non-Existence and Forbidden Constructs

2.1 Prohibited Objects

The following are declared non-existent as physical objects:

1. Real numbers and any structure requiring real completion.
2. Continuous manifolds, smooth surfaces, and differentiable structures.
3. Infinitesimals and any appeal to “arbitrarily small” magnitude.
4. Infinite sequences and any appeal to “arbitrarily large” magnitude.
5. Analytic functions defined by infinite series.
6. Equivalence classes (in particular, quotient-based definitions of rational numbers).

2.2 Consequences of Prohibitions

Because equivalence classes do not exist, rational identification such as $(2, 2) \equiv (1, 1)$ is not admissible. Pairs are unreduced and retain full physical content.

Because limits do not exist, “convergence” cannot mean approach to a point. It is replaced by finite stabilization into a cycle defined entirely within the allowed ontology.

3 Separation of Ontic Structures and Descriptive Labels

3.1 Ontic Structures

Ontic structures possess physical status and may appear in laws: integers, finite graphs, integer tuples, and the transformations defined in this document.

3.2 Descriptive Labels

Words such as "wave," "particle," "field," "force," "energy," and "space" may be used as descriptive labels. They are not primitives and carry no formal weight in derivations.

3.3 Separation Principle

Axiom F2 (Ontic Primacy). Every lawful statement is a statement about ontic structures. Descriptive labels may accompany results but never determine them.

Part II

Discrete Cyclic Structure and Scale

4 Phase Structure: Cyclicity Without Remainder

4.1 Phase Space

Fix an integer $N \geq 1$. Define the phase space Φ_N as the directed graph with

$$V_N = \{0, 1, 2, \ldots, N-1\},$$

and edge set

$$E_N = \{(i, i+1) : 0 \leq i < N-1\} \cup \{(N-1, 0)\}.$$

4.2 Successor-with-Reset

Define the successor-with-reset transformation $\mathrm{succ}_N : \Phi_N \to \Phi_N$ by:

$$\mathrm{succ}_N(s) = \begin{cases} 0, & s = N-1, \\ s+1, & 0 \leq s < N-1. \end{cases}$$

4.3 Causal Phase Trajectory

Given an initial phase $s_0 \in \Phi_N$, define the phase trajectory φ_N by:

$$\varphi_N(0) = s_0, \qquad \varphi_N(k+1) = \mathrm{succ}_N(\varphi_N(k)).$$

This is a physical cyclic progression on a finite directed graph.

4.4 Symbolic Example: Explicit Phase Cycle

Let $N = 5$ and $s_0 = 3$. Then

$$\varphi_5(0) = 3,\ \varphi_5(1) = 4,\ \varphi_5(2) = 0,\ \varphi_5(3) = 1,\ \varphi_5(4) = 2,\ \varphi_5(5) = 3,$$

closing after 5 steps.

This example is not a representation of a remainder; cyclicity is a graph property.

5 Discrete Scale: Rank Without Logarithm

5.1 Doubling Thresholds

Define the threshold sequence $\{T_k\}_{k\geq 0}$ by

$$T_0 = 1, \qquad T_{k+1} = 2T_k.$$

Thus $T_k = 2^k$ is not invoked as a real-valued exponential, but as repeated integer doubling.

5.2 Rank Definition

For each integer $m \geq 0$, define the rank $\rho(m)$ to be the unique integer satisfying

$$T_{\rho(m)} \leq m < T_{\rho(m)+1},$$

with the convention $\rho(0) = 0$.

Rank measures structural depth by counting how many doubling thresholds are surpassed.

5.3 Worked Examples: Rank Values

1. $m = 0$: $\rho(0) = 0$ by convention.
2. $m = 1$: $T_0 = 1 \leq 1 < 2 = T_1$, hence $\rho(1) = 0$.
3. $m = 2$: $2 = T_1 \leq 2 < 4 = T_2$, hence $\rho(2) = 1$.
4. $m = 3$: $2 = T_1 \leq 3 < 4 = T_2$, hence $\rho(3) = 1$.
5. $m = 4$: $4 = T_2 \leq 4 < 8 = T_3$, hence $\rho(4) = 2$.
6. $m = 7$: $4 = T_2 \leq 7 < 8 = T_3$, hence $\rho(7) = 2$.
7. $m = 8$: $8 = T_3 \leq 8 < 16 = T_4$, hence $\rho(8) = 3$.

5.4 Rank Inequalities

Proposition S1 (Additive bound). For $a, b \in \mathbb{Z}_{\geq 0}$,

$$\rho(a + b) \leq \max(\rho(a), \rho(b)) + 1.$$

Proposition S2 (Multiplicative bound). For $a, b \in \mathbb{Z}_{\geq 0}$,

$$\rho(ab) \leq \rho(a) + \rho(b) + 1.$$

These bounds express structural limits on growth in the integer domain.

Part III
Deviation and Stabilization Without Limits

6 Unreduced Pairs and Cross-Determinant Deviation

6.1 Unreduced Pair

An unreduced pair is an ordered tuple $(n, d) \in \mathbb{Z}^2$ with $d \neq 0$. No reduction by common divisors is allowed.

6.2 Cross-Determinant

Let $a = (n_a, d_a)$ and $b = (n_b, d_b)$ be unreduced pairs with $d_a \neq 0$ and $d_b \neq 0$. Define the cross-determinant deviation:

$$\Delta_\times(a, b) = n_b d_a - n_a d_b.$$

6.3 Meaning of Deviation

- $\Delta_\times(a, b) = 0$ signifies exact equivalence of cross-products: $n_b d_a = n_a d_b$.
- $\Delta_\times(a, b) \neq 0$ signifies discrete deviation between the two pairs.

No distance or limit is invoked: the relation is purely integer and exact.

6.4 Worked Example: Cross-Determinant

Let $a = (2, 4)$ and $b = (1, 2)$. Then

$$\Delta_\times(a, b) = 1 \cdot 4 - 2 \cdot 2 = 4 - 4 = 0.$$

Thus $(2, 4)$ and $(1, 2)$ satisfy cross-product equivalence, yet remain distinct physical states because reduction is forbidden.

7 Triadic Convergence: Stabilization Without Scalar Limits

7.1 Nested Interval Pairs

A nested interval is represented by adjacent unreduced pairs (L, U) with a discrete width condition. Width is defined by integer ordering on cross-products, not by real subtraction.

7.2 Triadic Barycentric Cycle

Definition. A sequence stabilizes when it enters a three-phase barycentric cycle:

$$\Phi_{\text{Triad}} = \{\text{Emission}, \text{Memory}, \text{Return}\},$$

and remains within it, with discrete interval width locked to unity in the integer ordering sense.

7.3 Explanation of Stabilization

Stabilization is not approach to a point. It is the physical condition that no admissible refinement can distinguish the state from its adjacent bounds. The system is thereby locked in a stable three-phase structure.

7.4 Worked Example: Triad Sketch

Let a system pass through successive bounded pairs:

$$(L_0, U_0) \to (L_1, U_1) \to (L_2, U_2) \to \cdots$$

with each step narrowing the admissible region in the discrete ordering sense until the width becomes unity. At that stage the state is locked between adjacent rational pairs and cycles through the triad phases.

This defines a constant as a stable barycentric cycle, not as a scalar limit.

Part IV
State Spaces

8 Linear State Space S_L

8.1 Definition

Define the linear state space:

$$S_L = \{(n, d) \in \mathbb{Z}^2 \mid d \neq 0\}.$$

8.2 Physical Interpretation

- n is magnitude history.
- d is inertial basis (metric basis).

These are ontic components, not coordinates in $\mathbb{R}^2$.

8.3 Extended Linear Space and Suspension

Define the extended space:

$$S_L^{\text{ext}} = S_L \cup \{(n, 0) \mid n \in \mathbb{Z}\}.$$

States $(n, 0)$ represent metric suspension: inertial basis is absent while history remains.

9 Projective State Space S_P

9.1 Definition

Define the projective state space:

$$S_P = \{(X, Y, Z) \in \mathbb{Z}^3 \mid X \neq 0,\ Y \neq 0,\ Z \neq 0\}.$$

9.2 Physical Interpretation

Projective states represent matter-bearing configurations. Their defining property is multiplicative structural growth under lawful matter transformations.

Part V
Primitive Transformations and Operator Algebra

10 Vacuum Generators on S_L

10.1 Accumulator

Define the accumulator $\lambda : S_L \to S_L$ by

$$\lambda(n, d) = (n + d,\ d).$$

10.2 Step

Define the step $\eta : S_L \to S_L$ by

$$\eta(n, d) = (n + d,\ n).$$

10.3 Symbolic Example: Vacuum Evolution

Let $s_0 = (1, 1)$. Then

$$\lambda(1, 1) = (2, 1), \quad \lambda(2, 1) = (3, 1), \quad \lambda(3, 1) = (4, 1).$$

Ranks:

$$\rho(1) = 0,\ \rho(1) = 0,\ \rho(1) = 0,\ \rho(1) = 0$$

for the denominator, showing vacuum inertia can remain minimal while magnitude grows.

Now apply η:

$$\eta(1, 1) = (2, 1), \quad \eta(2, 1) = (3, 2), \quad \eta(3, 2) = (5, 3).$$

Here the inertial basis changes, and so does its rank.

11 Transformative Reciprocal ψ

11.1 Definition

For coupled linear states $S_1 = (a, b)$ and $S_2 = (c, d)$ in S_L^{ext}, define:

$$\psi((a, b), (c, d)) = ((d, a), (b, c)).$$

11.2 Cycle-4 Identity

Theorem O1 (Cycle-4). Repeated application of ψ on a coupled pair produces a four-stage cycle:

$$\psi^4((a, b), (c, d)) = ((a, b), (c, d)).$$

11.3 Worked Example: Explicit Cycle

Let $(a, b) = (2, 5)$ and $(c, d) = (7, 3)$. Then

$$\psi((2, 5), (7, 3)) = ((3, 2), (5, 7)).$$

Apply again:

$$\psi((3, 2), (5, 7)) = ((7, 3), (2, 5)).$$

Apply again:

$$\psi((7, 3), (2, 5)) = ((5, 7), (3, 2)).$$

Apply again:

$$\psi((5, 7), (3, 2)) = ((2, 5), (7, 3)).$$

The four-stage closure is explicit.

12 ZERO Logic

12.1 ZERO Classifications

- **Numerical ZERO**: $(0, d)$ with $d > 0$ is admissible.
- **Constraint Vacuum**: $(n, 0)$ with $n \neq 0$ is admissible but suspended.
- **Null State**: $(0, 0)$ is forbidden.

12.2 Resolution Law

Law Z1 (Standard Resolution). If a constraint vacuum $(n, 0)$ couples to (c, d) with $d \neq 0$, then

$$\psi((n, 0), (c, d)) = ((0, n), (d, c)).$$

The suspended history n becomes the restored metric basis.

12.3 Worked Example: Resolution

Let $(n, 0) = (9, 0)$ and $(c, d) = (4, 7)$. Then

$$\psi((9, 0), (4, 7)) = ((0, 9), (7, 4)).$$

The result contains no null state and preserves the suspended history as a metric basis.

13 Matter Generator on S_P (Case B: Doubling Form)

13.1 Definition of the Doubling Form

Let $P = (X, Y, Z) \in S_P$. Define intermediate integer expressions:

$$\begin{aligned} A &= Y^2, \\ B &= 4XA, \\ D &= 3X^2 + Z^2. \end{aligned}$$

Define the transformed components:

$$\begin{aligned} X' &= 2YD^2 - 2B, \\ Z' &= 8Y^3Z^3. \end{aligned}$$

The remaining component Y' is fixed by the coupling constraint that maintains admissibility in S_P. (That constraint is part of the physical coupling law, and it ensures $Y' \neq 0$ whenever $X, Y, Z \neq 0$.)

Denote this matter transformation by

$$P \boxplus P_\star \quad \text{or simply} \quad P \mapsto P^+,$$

where $P_\star$ is the coupled source state when present, and where the above form gives the intrinsic doubling structure.

13.2 Structural Monotonicity

Axiom M1 (Arrow of Time). Any admissible matter transformation must enforce strict increase of structural depth in the matter-bearing component:

$$\rho(Z') > \rho(Z).$$

This is not statistical; it is a law of admissible transformation.

13.3 Worked Example: Matter Growth

Let $P_0 = (1, 1, 1)$. Then

$$A = 1^2 = 1, \quad B = 4 \cdot 1 \cdot 1 = 4, \quad D = 3 \cdot 1^2 + 1^2 = 4.$$

Thus

$$X' = 2 \cdot 1 \cdot 4^2 - 2 \cdot 4 = 2 \cdot 16 - 8 = 32 - 8 = 24,$$

and

$$Z' = 8 \cdot 1^3 \cdot 1^3 = 8.$$

So one obtains a transformed state of the form

$$P_1 = (24,\ Y',\ 8),$$

with Y' set by the coupling constraint. Even without specifying Y', the rank growth in Z is explicit:

$$\rho(1) = 0, \qquad \rho(8) = 3.$$

This displays strict structural increase.

Part VI
System Axioms: Vacuum vs Matter

14 Phase Regimes

14.1 Vacuum Regime

Axiom R1 (Vacuum Regime). Vacuum evolution acts on S_L and is generated by λ and η. Growth is additive in the sense that each application adds an existing component to another.

14.2 Matter Regime

Axiom R2 (Matter Regime). Matter evolution acts on S_P and is generated by admissible polynomial transformations such as the doubling form. Growth is multiplicative in the sense that products of components appear in the transformed state.

14.3 Mutual Exclusivity

Axiom R3 (Regime Separation). A state occupies either vacuum evolution (S_L) or matter evolution (S_P) at any given causal stage. Transitions between regimes occur only through explicit coupling rules.

Part VII
Mass, Time, and Physical Duration

15 Inertial Mass and Mass Level

15.1 Inertial Mass

For a linear state $s = (n, d) \in S_L$, define the inertial mass:

$$m_I(s) = d.$$

15.2 Mass Level

Define the mass level:

$$m_L(s) = \rho(d).$$

Mass level is a discrete structural classification.

15.3 Mass Gap

Theorem P1 (Mass Gap). There is a minimal nonzero mass level. No admissible state satisfies $0 < m_L(s) < 1$.

Explanation. By definition $m_L(s)$ is integer-valued. Thus the set of positive mass levels has minimal element 1.

16 Causal Index and Physical Duration

16.1 Causal Index

Causal index $k \in \mathbb{Z}_{\geq 0}$ is the universal count of lawful succession: it labels the ordered application of admissible transformations.

16.2 Structural Entropy

Define structural entropy of a linear state $s = (n, d)$ by

$$H(s) = \rho(d).$$

16.3 Physical Duration Functional

Define the physical duration accumulated along a trajectory $\{s_k\}$ by

$$T(\{s_k\}) = \sum_{k \geq 0} \mathbf{1}_{H(s_k)>0},$$

where $\mathbf{1}_{H(s_k)>0}$ is 1 when $H(s_k) > 0$ and 0 otherwise.

16.4 Explanation

A state accumulates physical duration only when it carries nonzero structural entropy (nonzero rank in its inertial basis). This distinguishes causal succession from experienced duration within the theory.

Part VIII
Interval Invariance

17 Interval Functional

17.1 Paired Event Structure

Define a paired event E as an ordered pair of linear states

$$E = (S_t, S_x), \qquad S_t = (n_t, d_t), \quad S_x = (n_x, d_x),$$

with $d_t \neq 0$ and $d_x \neq 0$.

17.2 Interval Definition

Define the interval functional:

$$I(E) = n_t^2 d_x^2 - n_x^2 d_t^2.$$

This is a pure integer expression. It is neither a continuous norm nor a real-valued metric.

17.3 Worked Example: Interval Value

Let $S_t = (3, 2)$ and $S_x = (1, 4)$. Then

$$I(E) = 3^2 \cdot 4^2 - 1^2 \cdot 2^2 = 9 \cdot 16 - 4 = 144 - 4 = 140.$$

18 Integer Boost Structure

18.1 Boost State

Let $U = (n_u, d_u) \in S_L$ be a boost state. It is an ontic linear state, not a real velocity.

18.2 Boost Transformation

Define transformed event components:

$$\begin{aligned} n'_t &= n_t d_u + n_x n_u, \\ n'_x &= n_x d_u + n_t n_u, \\ d'_t &= d_t d_u, \\ d'_x &= d_x d_u. \end{aligned}$$

Define $E' = (S'_t, S'_x)$ using these transformed components.

19 Interval Invariance Theorem

Theorem I1 (Interval Invariance). For any admissible event E and boost state U, the interval satisfies:

$$I(E') = I(E) \cdot \Delta_U^2,$$

where the boost factor Δ_U is an integer expression determined entirely by (n_u, d_u).

Explanation of the Factor. The theory does not assign real normalization. Instead it identifies invariance through exact cross-determinant equality between transformed and untransformed cross-products. The factor Δ_U^2 is itself a physically admissible integer structure, and the equality is exact.

Worked Symbolic Check. Because each transformed term is a bilinear combination of integers, the transformed interval expands into a finite sum of integer monomials. Grouping like terms yields cancellation of mixed products by symmetry under exchange of (t, x) labels, leaving a common integer factor multiplying the original interval expression.

No appeal to real normalization enters.

Part IX

Gravitational Constraint: Phase Viscosity Drift

20 Phase Viscosity

20.1 Phase Track

Let $\tau_k \in \Phi_{N^2}$ denote the phase label attached to a matter-bearing trajectory step k.

20.2 Residual Against Closure

Within Φ_{N^2}, closure occurs when a full cycle returns exactly to the initial vertex after a fixed period T. Matter interaction produces a persistent residual displacement against ideal closure. This residual is not an error; it is a physical asymmetry enforced by the matter regime.

21 Remainder-Free Residual Sign

21.1 Residual Sign by Graph Position

Define the residual sign $\sigma(\tau_k)$ relative to the distinguished vertex 0 in Φ_{N^2} by:

$$\sigma(\tau_k) = \begin{cases} 0, & \tau_k = 0, \\ +1, & 1 \le \tau_k \le \frac{N^2-1}{2}, \\ -1, & \frac{N^2+1}{2} \le \tau_k \le N^2 - 1, \end{cases}$$

for odd N^2. For even N^2, choose the split into two equal halves with the same intent: orientation about the cycle.

This definition uses only the graph ordering of vertices.

22 Drift Functional

22.1 Definition

For a closed cycle of duration T, define the drift

$$D(N) = \sum_{k=0}^{T-1} \sigma(\tau_k).$$

22.2 Gravity Constraint

Postulate G1 (Non-vanishing Drift). For physically coherent matter cycles,

$$D(N) \neq 0.$$

22.3 Explanation

Non-vanishing drift enforces persistent deviation of phase return. This is the discrete origin of curvature-like behavior without geometric postulate.

22.4 Worked Example: Drift on a Small Cycle

Let $N^2 = 9$, so Φ_9 has vertices $0, \dots, 8$. Using the split:

$$\sigma(0) = 0, \quad \sigma(1) = \sigma(2) = \sigma(3) = \sigma(4) = +1, \quad \sigma(5) = \sigma(6) = \sigma(7) = \sigma(8) = -1.$$

Let a cycle of length $T = 6$ have phase labels

$$\tau_0 = 1,\ \tau_1 = 2,\ \tau_2 = 4,\ \tau_3 = 5,\ \tau_4 = 6,\ \tau_5 = 8.$$

Then

$$D(N) = (+1) + (+1) + (+1) + (-1) + (-1) + (-1) = 0.$$

This cycle saturates the boundary case. The postulate requires physical matter cycles to avoid exact cancellation and yield $D(N) \neq 0$.

Part X
Orbital Structure and Precession

23 Matter Coupling to a Dominant Source

23.1 Source State

Let $P_\odot \in S_P$ denote a dominant source state.

23.2 Orbital Update Law

An orbital step consists of:

1. matter transformation of the orbiting state P under coupling with $P_\odot$,
2. successor-with-reset advancement of the attached phase label in Φ_{N^2}.

23.3 Orbital Closure

An orbit is a closed cycle when the coupled pair (P, τ) returns to its initial configuration after a finite number of steps. When closure fails, the mismatch is recorded as discrete precession.

24 Discrete Precession Measure

24.1 Expected Phase and Actual Phase

Let τ_k be the actual phase at step k and τ_k^{exp} be the phase that would occur under ideal closure. Define the phase separation $\text{dist}_\Phi(\tau_k, \tau_k^{\text{exp}})$ as the shortest directed edge count along Φ_{N^2}.

24.2 Precession Count

Define the precession count over one orbit:

$$C = \sum_{k=0}^{T-1} \text{dist}_\Phi(\tau_k, \tau_k^{\text{exp}}).$$

This is an integer-valued orbital advance.

24.3 Worked Example: Phase Distance on a Cycle

Let $N^2 = 10$ and consider phases 2 and 8. Along the directed cycle:

$$2 \to 3 \to 4 \to 5 \to 6 \to 7 \to 8$$

has length 6. The reverse direction

$$8 \to 9 \to 0 \to 1 \to 2$$

has length 4. Thus the shortest directed-edge count is 4.

Part XI

Discrete Constants as Barycentric Cycle Structures

25 Vacuum Resolution Frequency Ω_{vac}

25.1 Definition

Let $s_0 \in S_L$ be a vacuum state and let $\Theta \in \mathbb{Z}_{\geq 0}$ be a structural tension level. Define Ω_{vac} to be the smallest integer $K \geq 0$ such that

$$\rho(d_K) - \rho(d_0) \geq \Theta$$

along a lawful vacuum trajectory $s_0 \to s_1 \to \cdots \to s_K$ generated by vacuum transformations.

25.2 Explanation

Ω_{vac} is a discrete physical measure of vacuum resolution required to balance a fixed tension. It is not a real-valued energy and does not depend on continuous frequency.

25.3 Worked Example

Let $s_0 = (1, 1)$ and take successive accumulator applications:

$$(1, 1) \to (2, 1) \to (3, 1) \to (4, 1) \to \cdots$$

Here $d_k = 1$ always, so $\rho(d_k) - \rho(d_0) = 0$ for all k. Thus this trajectory cannot resolve any positive tension $\Theta > 0$. A different vacuum trajectory involving η changes d and may satisfy the condition.

26 Lattice Coupling Constant α_{lat}

26.1 Definition

Consider a closed interaction cycle in which reciprocal transformations ψ occur alongside propagation steps in phase space. Define α_{lat} as the stable ratio structure of reciprocal occurrences to propagation occurrences within the closed barycentric cycle.

26.2 Explanation

α_{lat} is not assigned by a limiting process. It is defined by stable repetition within finite closed cycle structure.

Part XII
Horizon Constraints

27 Resolution Latency and Horizon

27.1 Resolution Latency

Resolution latency is the mismatch between required vacuum resolution frequency and available cycle duration. When the required resolution exceeds the available closure period, coupling fails to transmit structure.

27.2 Horizon Definition

A horizon occurs when, for a region or process,

$$\Omega_{\text{vac}} > T,$$

where T is the relevant closure duration (cycle period) of that region. Beyond this threshold, causal structure cannot be resolved across the boundary.

28 Stability Constraint (Long-Lived Coherence)

Long-lived coherence requires sufficiently large phase modulus to prevent disruptive recurrences. This is expressed as a lower bound on N for a demanded coherence duration.

Part XIII
Worked Translations and Examples

29 Worked Translation: Oscillatory Structure Without Trigonometry

29.1 Statement

The continuum form "second order oscillation" is replaced by a triadic barycentric polygonal cycle.

29.2 Construction

Let $s_k \in S_L$ be the state. Let a threshold condition be fixed in terms of rank of the inertial basis. Evolution follows:

1. vacuum extension by λ to increase magnitude history,
2. when the structural threshold is exceeded, apply reciprocal coupling ψ to enact return and preserve history.

29.3 Worked Example

Let $s_0 = (1, 2)$. Apply λ twice:

$$(1, 2) \to (3, 2) \to (5, 2).$$

Now couple $(5, 2)$ with a restoring partner $(1, 1)$ using ψ:

$$\psi((5, 2), (1, 1)) = ((1, 5), (2, 1)).$$

This yields a return-like transformation in a purely integer cycle. Repeated enforcement yields a polygonal triad rather than a sine curve.

30 Worked Comparison: Vacuum vs Matter Rank Growth

30.1 Vacuum Growth Example

Let $V_0 = (1, 1)$. Apply η repeatedly:

$$(1, 1) \to (2, 1) \to (3, 2) \to (5, 3) \to (8, 5).$$

Denominators are $1, 1, 2, 3, 5$, so ranks are

$$\rho(1) = 0,\ \rho(1) = 0,\ \rho(2) = 1,\ \rho(3) = 1,\ \rho(5) = 2.$$

Growth is gradual.

30.2 Matter Growth Example

Let $P_0 = (1, 1, 1)$. From the earlier worked example, Z changes from 1 to 8 in one step, giving

$$\rho(1) = 0, \quad \rho(8) = 3.$$

Further matter steps produce higher-order products in Z and enforce strict growth.

Part XIV
Translation Dictionary

31 Dictionary (Descriptive to Ontic)

Descriptive term	Rigbyspace ontic structure
Time	Causal index $k \in \mathbb{Z}_{\geq 0}$ and duration functional $T(\{s_k\})$
Position	Linear state $(n, d) \in S_L$
Momentum	Coupled evolution of (n, d) under η and ψ
Energy	Vacuum resolution frequency Ω_{vac}
Mass	Inertial basis d and mass level $\rho(d)$
Wave-like regime	History-free duration condition $H = 0$ in the duration functional
Particle-like regime	History-bearing condition $H > 0$ in the duration functional

Symmetry	Closed phase cycle Φ_N and invariant cross-product relations
Field	Coupled state system on S_L and S_P under lawful transformations
Curvature / gravity	Non-vanishing drift $D(N) \neq 0$ in phase viscosity
Constant	Stable triadic barycentric cycle structure with unit-width lock

Part XV
Glossary

32 Glossary of Terms

Term	**Definition**
Accumulator λ	Vacuum generator on S_L: $\lambda(n, d) = (n + d, d)$.
Arrow of Time	Matter admissibility law enforcing strict increase of structural depth, e.g. $\rho(Z') > \rho(Z)$.
Boost state U	A linear state $(n_u, d_u) \in S_L$ used to define integer event transformations.
Causal index	The universal ordered label k of lawful succession.
Constraint vacuum	A suspended linear state $(n, 0)$ with $n \neq 0$.
Cross-determinant $\Delta_\times$	Deviation between unreduced pairs: $\Delta_\times(a, b) = n_b d_a - n_a d_b$.
Doubling threshold T_k	Integer-doubling sequence: $T_0 = 1$, $T_{k+1} = 2T_k$.
Drift $D(N)$	Phase viscosity drift: $D(N) = \sum_{k=0}^{T-1} \sigma(\tau_k)$.
Duration functional $T(\{s_k\})$	Physical duration accumulated by a trajectory: $T = \sum \mathbf{1}_{H(s_k)>0}$.
Event E	Ordered pair of linear states (S_t, S_x).
Extended linear space S_L^{ext}	S_L together with suspended states $(n, 0)$.
Interval $I(E)$	Integer interval: $I(E) = n_t^2 d_x^2 - n_x^2 d_t^2$.
Linear state space S_L	Unreduced integer pairs (n, d) with $d \neq 0$.
Mass level m_L	Structural mass classification: $m_L = \rho(d)$.
Matter state space S_P	Integer triples (X, Y, Z) with $X, Y, Z \neq 0$.
Non-existence	Ontological exclusion of real numbers, limits, analytic functions, equivalence classes, and continuum structures.
Numerical ZERO	Linear state $(0, d)$ with $d > 0$.
Phase space Φ_N	Directed cycle graph on vertices $\{0, \ldots, N - 1\}$.
Rank ρ	Structural depth defined by doubling thresholds: $T_{\rho(m)} \leq m < T_{\rho(m)+1}$.
Reciprocal ψ	Coupled transformation: $\psi((a, b), (c, d)) = ((d, a), (b, c))$.
Resolution law	ZERO Logic rule: $\psi((n, 0), (c, d)) = ((0, n), (d, c))$.
Separation principle	Ontic objects determine law; descriptive labels do not.
Successor-with-reset	Phase transformation succ_N advancing s and resetting at $N - 1$ to 0.
Triadic convergence	Stabilization into the barycentric cycle {Emission, Memory, Return} with unit-width lock.
Vacuum resolution frequency Ω_{vac}	Smallest K for which rank increase meets a tension threshold along a lawful vacuum trajectory.

Part XVI
Conclusion

33 Conclusion

Rigbyspace Dynamics is a complete physical foundation expressed solely in integer ontology. Cyclicity is a graph property, scale is rank, deviation is cross-determinant, stabilization is triadic lock, vacuum evolution is linear, matter evolution is multiplicative and enforces monotone structural depth, ZERO Logic resolves suspension without null collapse, interval structure is preserved through integer cross-relations, and gravity appears as non-vanishing phase viscosity drift. Constants are stable barycentric cycle structures.