What If Space Is What Survives?

End Theory: Evans Node Dialect

A public feature, ontology-aligned mathematical specification, worked derivations, and falsification programme

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Independent research programme

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Scientific status. This document is a theory specification, mathematical repair, and public explanation. It is not a report of completed empirical validation and not a completed theory of everything. It identifies a coherent ontology, supplies one explicit benchmark dynamics, proves several properties of that benchmark, and states the missing results that must be obtained before claims about quantum mechanics, the Standard Model, gravity, cosmology, or new particles are warranted. Here, "proof" always means a consequence of the stated benchmark assumptions; it never means that nature realizes those assumptions.

Abstract

Matrix Node Theory and the Evans Node Dialect propose that observed spacetime, matter, and fields are effective descriptions of persistent relational patterns within an ordered sequence of stabilized configurations, or frames. The latest ontology places a pre-geometric relational layer and a finite capacity for local change before the node lattice; older drafts instead treated a fixed lattice, particle spectra, and numerous fitted numerical targets as already fundamental or derived. We reconcile these generations by making the ontology controlling, defining frames and nodes as coarse-grained persistent structures, localizing the capacity constraint so it does not require instantaneous global coordination, and separating interpretation from dynamics. A minimal deterministic graph-field benchmark is then stated through a discrete action and explicit update equation. Its exact lattice dispersion relation, long-wavelength limit, stability condition, gauge-invariant extension, and one transparent numerical example are derived. A non-circularity protocol classifies every constant as a definition, calibration, matching coefficient, or genuine prediction; it shows why the present framework derives symbolic relations but no new numerical fundamental constant. The legacy amplitude-phase action is retained only after removing a dangerous fourth-time-derivative term, fixing dimensions and signs, and defining phase mismatch on links. Energy is redefined as the conserved generator associated with effective time translation, while frame-to-frame change is its proposed microscopic correlate rather than its definition. The Evans Quantum Energy Field is retained as a capacity-balance concept; it becomes a gravitating field only under an additional, testable effective action. Progression imbalance is mapped to geometric torsion as a hypothesis requiring an explicit coarse-graining theorem. Claims of derived constants, completed validation, exact particle masses, resonances, dark-sector signals, gravitational-wave echoes, Born probabilities, or Bell correlations are withdrawn unless regenerated by a fixed model, archived code, and held-out tests. The result is a falsifiable foundation from which the programme can be advanced or rejected without circular fitting.

Plain-language summary. The central idea survives: reality may be a sequence of constrained relational updates, and stable repeating structures in that sequence may appear to us as space, particles, fields, and gravity. What does not survive is the claim that naming those correspondences is already a derivation. This reconstruction supplies the cleanest mathematics currently justified and draws a bright line between a definition, a calibration, a consequence, and a prediction.

Contents

Part I — A feature for curious general readers

1 What if space is what survives?

Physics became simple once before. The great equations of the twentieth century compressed motion, gravity, and quantum behaviour into astonishingly economical forms. End Theory: Evans Node Dialect asks whether that simplicity may be the visible surface of a deeper process: a universe assembled from relations that repeatedly survive their own change.

1.1 Begin by taking away the stage

Nearly every picture of the cosmos starts with a stage. Galaxies drift through space. Clocks tick in time. Fields spread across positions that already exist. Even when the stage curves, as it does in general relativity, the mathematical story begins with a spacetime geometry on which matter and radiation live.

Now try a harder thought experiment. Remove the actors, then remove the stage. There are no coordinates, metres, seconds, or background grid waiting to be occupied. What could still be real?

One possible answer is *relation*: this potential state can influence that one; this joint change is allowed; another is forbidden. Relation is not yet distance. Order is not yet duration. Yet a network of allowed transitions can possess structure before it possesses geometry.

That is the beginning of END/MNT. Its central proposal is that observed physics may be the durable, large-scale description of a deterministic relational process with finite local transition capacity. The familiar world would not be made of little beads sitting in a pre-existing void. Instead, bead, void, and motion would all be effective ideas that become useful after patterns persist.

This places the project near several serious traditions without making it identical to them. Regge calculus replaces smooth geometry with discrete simplicial pieces; lattice gauge theory places gauge variables on links and keeps local symmetry exact at finite spacing; causal-set research asks whether order and discreteness can precede continuum geometry. END/MNT adds its own emphasis: stabilized frames, persistent relational patterns, and a locally bounded capacity for change.

The proposal is ambitious. Its repaired form is deliberately modest about what has been achieved. The ontology is a map of what should be derived. The scalar graph equation is a benchmark showing that part of the map can be made explicit. The bridges to quantum probability, the Standard Model, and gravity remain incomplete. That distinction is not a weakness to hide. It is the line separating an imaginative framework from a scientific theory that can survive contact with nature.

1.2 The flipbook is not the clock

Picture an endless flipbook. Each page contains a complete configuration, and each page follows the previous one according to a rule. A character inside the book may build a clock from a recurring pattern: a pendulum, an atomic transition, or a repeating pulse. The clock counts its own cycles as the pages turn. The page number and the clock reading are not the same thing.

This matters because END/MNT wants physical time to emerge. The fundamental label n merely orders updates. Operational time appears only when a stable subsystem supplies a repeatable observable. In a homogeneous regime, clock time might be proportional to update count. In a loaded or geometrically distorted regime, the local tick duration may differ.

The thought experiment immediately creates a burden. If progression imbalance is meant to reproduce gravitational time dilation, a clock pattern in one region must accumulate fewer operational cycles than a comparable clock elsewhere, even when both histories can be compared within the micro-description. Declaring each frame to be one universal instant will not do; the tick rate must come out of the dynamics.

The same discipline repairs the word "energy." Earlier versions spoke of energy as frame-to-frame change. Change may be a microscopic correlate of energy, but it is not yet energy in the physicist's quantitative sense. In an effective time-translation-invariant regime, energy should be a conserved Hamiltonian or Noether charge with measurable units. The theory must derive that bridge rather than define it by metaphor.

1.3 How persistence can become space

The next step is selection by survival. Suppose the microscopic process explores an immense variety of local arrangements. Most appear and disappear. Some recur. Others remain recognizable while moving, rotating, or changing phase. Recognizability can be formalized by coarse-graining the microstate at resolution R and asking whether the result stays within a declared tolerance of an allowed transformed copy over many updates.

The survivors are candidates for nodes. Connect persistent clusters that directly exchange influence and give each link a positive weight representing interaction strength or transfer capacity. The resulting graph has paths. If stronger relations correspond to shorter effective links, the cheapest path between two clusters defines a graph distance. Geometry has begun to appear.

But a graph is not automatically three-dimensional space. A successful model must show that neighborhoods possess a stable effective dimension, that long-distance behaviour becomes sufficiently isotropic, and that the same metric organizes the propagation of every relevant low-energy mode. It must explain why the continuum is Lorentzian and why there is one invariant speed to extraordinary precision. Drawing nodes is easy; deriving a 3+1-dimensional spacetime is a calculation.

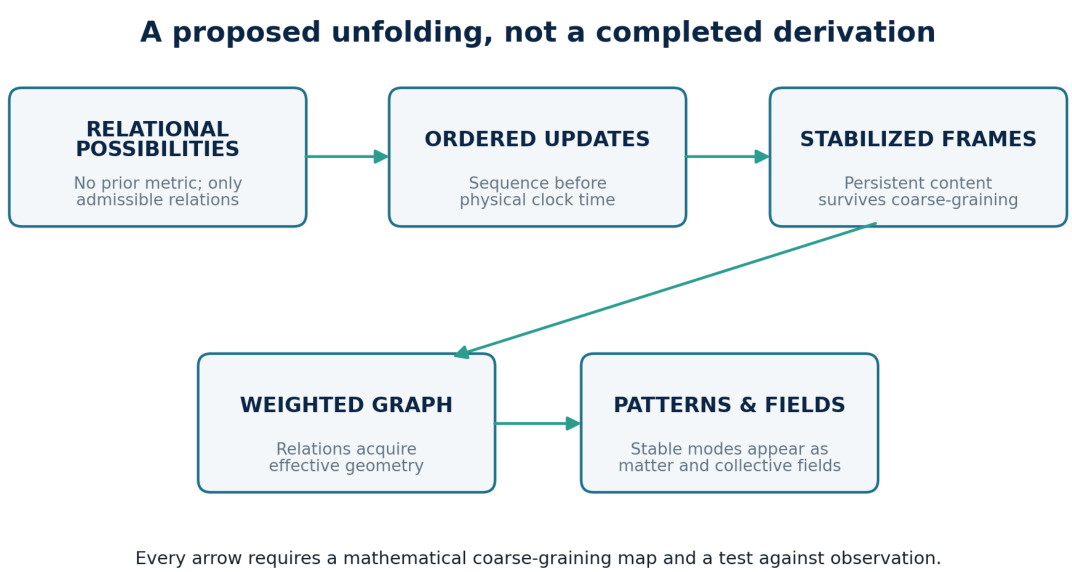

Figure 1: The proposed unfolding. Every arrow is a calculation still required: persistence, graph formation, continuum geometry, stable patterns, and effective observables.

1.4 A universe with a local speed limit on change

END/MNT's most distinctive structural idea is not simply discreteness. It is a finite *local transition capacity*. Imagine a road network in which every intersection can process at most one normalized unit of traffic during a tick. Congestion at one intersection changes nearby routes and its effects propagate, but a driver does not need the total traffic count for every road in the universe before moving through the next light.

The original ontology used a global capacity sum. On a large or infinite lattice that can diverge and can make distant regions instantaneously interdependent. The repaired law is local: every node i carries a demand $\mathcal{C}_i$, computed from changes at that node and its finite neighbourhood, and admissible evolution requires $0 \le \mathcal{C}_i \le 1$.

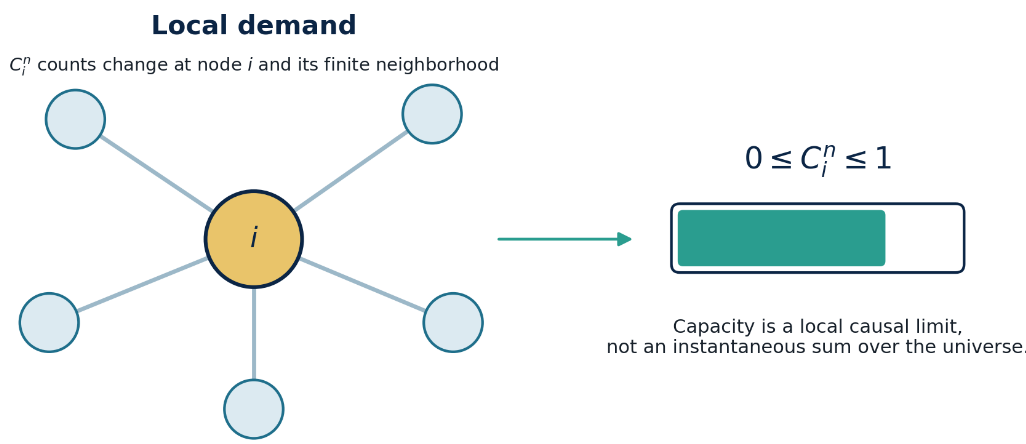

Figure 2: A local capacity bound avoids an instantaneous global accountant. Disturbances influence distant regions only through successive neighbourhood updates.

A bound like this could limit propagation, constrain local acceleration, create nonlinear thresholds, and force highly loaded regions to redistribute change. It could also do none of the hoped-for physical jobs if its detailed update rule produces instability or contradicts precision experiments. The value lies in making the idea concrete enough to find out.

The benchmark action below converts one version of the intuition into mathematics. Neighbouring coordinates resist disagreement like coupled springs; an onsite term sets a gap; a nonlinear potential permits richer patterns. The resulting update is explicit and deterministic. Its plane waves have an exact lattice dispersion relation, and its high-frequency stability condition can be checked before any comparison with particle data. A model that cannot preserve its own admissible set or converge under refinement should not be asked to explain the Higgs boson.

1.5 Why a particle might be a verb

In ordinary speech a particle sounds like a tiny noun: a thing occupying a location. In a relational theory a particle may be closer to a verb, a localized activity that keeps recreating its identity while moving through the network.

Think of a stadium wave. No spectator travels around the arena, yet a coherent pattern does. Now make the pattern nonlinear, self-stabilizing, and capable of carrying invariant labels. Such a structure could, in principle, possess a rest-energy gap, scatter from other structures, and survive transport.

The analogy is useful only if the mathematics goes further. A particle candidate needs a solution or invariant manifold. Perturbations around it must have a stable spectrum. Motion must obey a dispersion relation. Conserved labels must come from exact symmetries or topology. Interactions must produce calculable amplitudes and decay channels. Finally, the coarse observables must connect to what a detector records.

Mass then becomes a rest-energy gap or an eigenvalue of a stability operator. Charge becomes a representation label of a gauge symmetry or a topological invariant. Spin requires the correct transformation behaviour. None of these can be obtained by naming a frequency after a known particle and substituting $\omega = mc^2/\hbar$; that merely rewrites the measured mass.

1.6 Phase, loops, and the route to gauge fields

Phase is one of the theory's strongest surviving ideas because it has a natural exact language on a graph. Assign a complex value $\psi_i = \rho_i e^{i\theta_i}$ to node i. A direct phase difference depends on the local phase convention. To compare phases consistently, place a link variable $U_{ij} = e^{iqA_{ij}}$ between neighbouring nodes. The magnitude of the covariant difference $U_{ij}\psi_j - \psi_i$ stays unchanged when node phases and link phases transform together.

Take the ordered product of link variables around a closed elementary loop. The plaquette holonomy is gauge invariant and can become gauge curvature at long distance. For END/MNT the lesson is precise: phase alignment can be retained, but electromagnetism does not emerge from a suggestive line integral alone. The theory must specify node representations, link transformations, loop observables, dynamics, and the continuum limit. Chiral fermions create an additional obstacle because naive lattice formulations tend to produce unwanted doubled species.

1.7 EQEF, deferred change, and geometric imbalance

The Evans Quantum Energy Field has carried several meanings across the project's history. The canonical reconstruction narrows them. At the first level, EQEF is a ledger. If local demand is $\mathcal{C}_i$, residual capacity is $r_i = 1 - \mathcal{C}_i$. A causal balance equation may track how residual capacity is transported, stored, or released among neighbouring regions. The quantity is dimensionless until a physical normalization is supplied; it is not automatically a new form of energy.

At the second level, coarse-graining may produce a field $\chi(x)$ representing fluctuations of residual capacity around a background. One can write a conservative effective action with a kinetic term, potential, and couplings to curvature. Depending on the potential, such a field might influence cosmology. Many scalar fields can do that. END/MNT becomes distinctive only if its discrete update fixes the coefficients or produces a relation that survives held-out observations.

The same restraint applies to torsion. In Riemann–Cartan geometry, torsion measures the infinitesimal failure of a transported parallelogram to close. Imagine taking one tiny step east, one north, then reversing both moves. If local translation rules are imbalanced, the endpoint may miss the start. The mismatch per enclosed area is a geometrically meaningful candidate for "progression imbalance." The theory must still derive the tetrad, spin connection, torsion source, and effective coefficients.

1.8 The quantum challenge cannot be skipped

A deterministic micro-history does not by itself reproduce quantum mechanics. Quantum theory predicts probabilities, interference, and entanglement with astonishing accuracy. Bell experiments rule out a broad class of local, measurement-independent hidden-variable theories. A deterministic completion must state the complete ontic state λ, how preparations generate an ensemble, how settings enter, how outcomes are read, and which assumption behind the Bell bound is altered.

Logical options include operational nonlocality, measurement dependence, retrocausal structure, contextual outcomes, or another explicitly defined departure from the usual assumptions. "The two particles shared an earlier frame" is not enough. A common past produces ordinary correlations, but not the full Bell-violating pattern under local, measurement-independent conditions.

The Born rule is a separate demand. If stable amplification or a capacity threshold creates localization, the model must calculate outcome frequencies and recover the squared-amplitude rule in the appropriate regime. It must preserve operational no-signalling and state what happens to conservation laws during localization. END/MNT retains a deterministic intent and a useful language of frame histories, phase dispersal, and stable amplification. Its quantum completion remains open.

1.9 How the universe could unfold

With those cautions in place, the proposed cosmic story can be told as a sequence. First comes a pre-geometric relational regime: possible states and admissible joint changes, but no established physical distance. Ordered updates create histories. Recurrent structures begin to store information about their own past. Persistence separates durable patterns from transient noise.

As persistent clusters interact, a weighted graph stabilizes. Its large-scale neighbourhoods acquire regular dimension and approximately isotropic distance. Collective disturbances develop long-wavelength dispersion. Operational clocks emerge from repeating patterns. A shared conversion between graph propagation and clock readings produces an effective causal speed.

Nonlinear stable modes become particle candidates. Link phases and loop holonomies organize gauge-like interactions. Symmetry breaking in an effective scalar sector may generate mass matrices, but those matrices must ultimately be computed from the node operator rather than tuned to the observed spectrum. Regions approaching local capacity respond nonlinearly. If coarse-grained progression imbalance universally affects clock rates and trajectories, an effective geometry may emerge. If residual capacity develops a slowly evolving collective mode, an EQEF-like field may contribute to cosmic dynamics.

This is a proposed unfolding, not an established chronology of the observed early universe. A real cosmology requires background and perturbation equations, initial conditions, light-element abundances, microwave-background spectra, structure formation, and late-time expansion, all derived from the same frozen model. Substituting standard ΛCDM parameters into standard equations would test ΛCDM, not END/MNT.

1.10 What was removed, and why the project is stronger

The theory's history contains many numerical targets: particle masses, resonances, coupling values, dark-sector signals, gravitational-wave echoes, and aggregate alignment percentages. Some were suggestive. Several used measured constants as inputs and then counted their reappearance as predictions. Others mixed dimensions, changed parameter meanings, or proposed experimental windows without an interaction model. Those claims are retired from the canonical scientific record.

The removal includes unfrozen resonances at incompatible energies; a Higgs expression with inserted measured constants and incorrect dimensions; a dimensionally wrong gravitational formula; a cosmological-constant value with Planck-unit and SI units confused; masses generated by substituting measured frequencies; and "validation" scores without a common likelihood, covariance, parameter count, or held-out dataset.

What remains is less spectacular on a poster and more valuable in a calculation: an ordered ontology, local capacity law, concrete graph-field action, explicit update, exact dispersion relation, stability bound, gauge-invariant phase extension, disciplined meaning for EQEF and torsion, and staged falsification programme. Science does not become smaller when a weak claim is removed. The search space becomes clearer.

1.11 The experiment before the experiments

The first serious test should happen on a computer before another global data fit. Implement the scalar benchmark on square, cubic, and approximately isotropic irregular graphs. Verify the exact dispersion relation numerically. Map the stability boundary. Add compact phases and link variables, then unit-test gauge invariance. Construct one local capacity-preserving completion and measure its conservation residuals under refinement.

Only then search for stable localized nonlinear patterns. Freeze all parameters before comparing any pattern with a particle mass. Report dimensionless gaps, scattering behaviour, and failure regions. If patterns disappear under perturbation or continuum anisotropy does not shrink as predicted, say so.

Later gates are harder. A gauge and chiral sector must avoid doubling and anomalies. A quantum module must reproduce preparation-dependent probabilities and Bell correlations. A gravitational coarse-graining must yield universal free fall, the Newtonian limit, relativistic propagation, and allowed corrections. External tests require preregistration, versioned code, declared calibration data, held-out data, and comparison with simpler baselines. This programme can fail early and cheaply. That is an advantage: a theory that risks nothing teaches nothing.

1.12 Complexity returns with a purpose

The twentieth century gave physics equations of breathtaking compression. General relativity turned gravity into geometry. Quantum field theory organized particles as excitations of fields and interactions as symmetries. The Standard Model became extraordinarily successful even as its list of fields, parameters, and unexplained patterns grew.

END/MNT asks whether the next layer may be conceptually simple but dynamically complex: local relations updating under one rule, producing multiple effective descriptions at different scales. Complexity is not an excuse to fit anything. It is the complexity of emergence, the way a local rule can create phases, defects, collective modes, effective geometry, and information-processing structures.

The question is not whether a sufficiently elaborate network can imitate known physics. It can. The question is whether one constrained micro-model predicts several independent structures that were not inserted: a common invariant speed, stable dimension, gauge group, chiral content, mass ratios, quantum statistics, and gravitational response. If it can, physics will have become complex again beneath the equations we know while becoming more unified in its foundations. If it cannot, the failed attempt will still clarify what a relational theory must do.

That is the invitation of End Theory: Evans Node Dialect. Do not believe it because the picture feels complete. Follow the equations until the picture either becomes unavoidable or breaks.

Editorial note. Scientific American describes 2,000–4,000-word features but does not accept AI-generated pitches or drafts. Part I is a public research base, not a file to submit unchanged. Ryan would need to rewrite it independently and add reporting plus critical outside voices.

Part II — Canonical scientific specification

2 Outcome of the reconstruction

The source set contains three different generations of the theory. The earliest UMNT and END drafts contain valuable intuitions but also dimensional errors, inserted experimental values, incompatible particle forecasts, and prose that treats analogies as proofs. The November 2025 ontology, lexicon, structural, and validation documents impose a better conceptual hierarchy and explicitly reject circular fitting, but their mathematics remains partly schematic. The August 2026 technical audit correctly identifies the submission blockers, although it did not have the full later ontology available when it selected a fixed node lattice as the working starting point.

This reconstruction resolves that conflict with the following priority rule:

1. The ontology controls the meaning of the objects.
2. Mathematical consistency controls the equations.
3. Later explicit redefinitions supersede older prose.
4. An older formula is retained only if it has defined variables, compatible dimensions, a stable dynamical interpretation, and a map to the ontology.
5. A numerical claim is retained only if it has a frozen prediction function, parameter policy, data provenance, uncertainty model, and reproducible code.

Canonical scientific claim. The present END/MNT is a deterministic relational-frame hypothesis with an emergent graph-field phase and a finite local transition capacity. A scalar/phase lattice is one benchmark realization, not the uniquely derived microphysics. The programme becomes a physical theory only when one complete update law and coarse-graining map generate parameter-fixed, held-out observables.

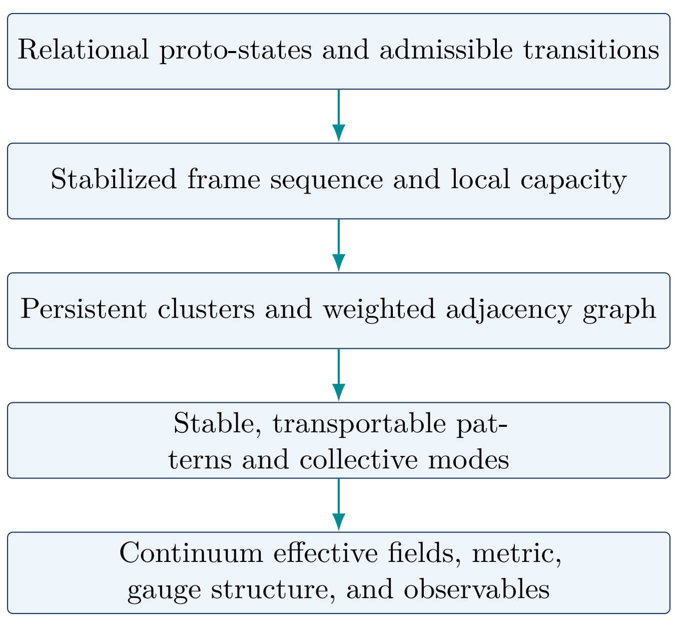

Figure 3: The repaired hierarchy. Arrows are required coarse-graining or emergence maps; they are not rhetorical equivalences. Every arrow must eventually be supplied as an explicit mathematical construction.

3 Canonical ontology

3.1 Axiom O1: relational proto-state, not a prior spacetime

Let $\mathcal{P}$ be a configuration space of proto-degrees of freedom. An element $p \in \mathcal{P}$ may carry internal coordinates such as an amplitude-like value, a compact phase label, and discrete type labels. These coordinates are not yet physical position, time, energy, spin, or charge. In particular, the earlier phrase "pre-geometric frequency" is replaced by *phase propensity*: physical frequency is cycles per physical time and therefore cannot be primitive if physical time is meant to emerge.

The primitive relational structure is an admissibility relation $R \subset \mathcal{P} \times \mathcal{P}$ or, more generally, a hypergraph of allowed joint transitions. Calling two proto-degrees "local" at this level means that the update rule couples them directly; it does not mean that they are close in a pre-existing metric.

3.2 Axiom O2: ordered updates precede metric time

The fundamental history is an ordered sequence of micro-configurations

$$X_0 \prec X_1 \prec X_2 \prec \cdots, \qquad X_n \in \mathcal{X}. \tag{1}$$

The index n is an update order, not automatically a clock reading. A physical clock is a persistent subsystem K with a monotonic observable $Q_K[X_n]$. The elapsed time assigned by that clock is

$$t_K(n_2) - t_K(n_1) = \sum_{n=n_1}^{n_2-1} \delta\tau_K(X_n), \tag{2}$$

where the local tick duration must be derived from the clock dynamics. A universal relation $t = n\delta\tau$ is therefore a homogeneous-limit approximation, not a foundational identity.

Thought experiment 1: the flipbook and the clock

A flipbook has an ordered page number, but the page number alone does not tell a character how long one second lasts. Put two oscillating patterns in the book, one in a quiet region and one in a highly loaded region. If END is to reproduce gravitational time dilation, the second pattern must complete fewer operational ticks between comparable frame records. Merely declaring each page to be one universal instant cannot produce that result. Equation (2) states what must be calculated.

3.3 Axiom O3: a frame is a stabilized coarse-grained equivalence class

Choose a coarse-graining map $C_R : \mathcal{X} \to \mathcal{X}_R$ at resolution R, a norm $\|\cdot\|_R$, and a tolerance ϵ_R. A macrostructure is persistent over N updates if

$$\|C_R X_{n+m} - \mathcal{T}_m C_R X_n\|_R \le \epsilon_R, \quad 0 \le m \le N, \tag{3}$$

for an allowed transport, phase, or symmetry operation $\mathcal{T}_m$. A *frame* $\mathcal{F}_n$ is the equivalence class of micro-configurations with the same resolved persistent content at update n. This replaces the earlier set notation $\mathcal{F}_n \subset \mathcal{P}^{N_n}$, which did not state the equivalence relation or stabilization test.

3.4 Axiom O4: space is the geometry of persistent relations

Persistent clusters become candidate nodes. Let V_n be the set of clusters satisfying (3); define a symmetric weight $w_{ij}^{(n)} \geq 0$ from direct interaction strength, transfer capacity, or a specified correlation functional. The effective graph is

$$G_n = (V_n, E_n, w^{(n)}), \qquad (i,j) \in E_n \iff w_{ij}^{(n)} > w_{\min}. \tag{4}$$

A graph distance can then be defined by

$$d_G(i,j) = \inf_{\gamma: i \to j} \sum_{e \in \gamma} \ell_e, \qquad \ell_e = \ell_0 f(w_e), \tag{5}$$

with a declared positive decreasing function f. An approximately smooth spatial metric is justified only if graph neighborhoods have stable dimension, isotropy, and scaling over a range of resolutions. Co-occurrence in one frame is insufficient by itself.

3.5 Axiom O5: the fundamental capacity is local and causal

The older ontology imposed a single sum $\sum_i \mathcal{C}_i(n) \leq \Lambda_{\text{lim}}$ over the whole lattice. On an infinite lattice that sum may diverge; on any large lattice it makes distant updates instantaneously interdependent. The canonical constraint is instead local:

$$0 \leq \mathcal{C}_i^n \leq 1 \quad \text{for every node and update}, \tag{6}$$

where $\mathcal{C}_i^n$ is a dimensionless demand constructed from changes in node i and its finite neighborhood. A regional budget is derived by summing (6) over a finite domain; it is not a separate instantaneous law.

For a generalized scalar benchmark introduced below, one admissible demand is

$$\mathcal{C}_i^n = \frac{1}{E_*}\left[\frac{\mu}{2}\left(\frac{q_i^{n+1} - q_i^n}{\delta\tau}\right)^2 + \frac{\kappa}{4}\sum_j w_{ij}(q_i^n - q_j^n)^2 + V_+(q_i^n)\right], \tag{7}$$

where $E_* > 0$ is a local energy-capacity scale and $V_+ \geq 0$. Equation (7) is a model choice, not yet a derivation from the proto-state layer.

Thought experiment 2: a road network with a local load limit

Imagine every intersection can process at most one normalized unit of traffic per tick. Congestion in one neighborhood changes later routes and can propagate outward, but a driver on the other side of the universe does not have to know the total traffic everywhere before moving. This is the difference between the local condition $\mathcal{C}_i \leq 1$ and an instantaneous global sum. Progression imbalance is the persistent pattern of delayed or redirected updates caused by the local limits.

3.6 Axiom O6: a complete theory requires a capacity-preserving update map

Define the admissible state set $\mathcal{A} = \{X : \mathcal{C}_i[X] \leq 1 \ \forall i\}$. Determinism requires a single-valued map

$$X_{n+1} = U_{\boldsymbol{p}}(X_n, X_{n-1}), \qquad U_{\boldsymbol{p}} : \mathcal{A} \times \mathcal{A} \to \mathcal{A}, \tag{8}$$

with parameter vector $\boldsymbol{p}$, boundary conditions, and a declared treatment of graph changes. Neither the phrase "the system reorganizes" nor a post hoc node-merging rule specifies $U_{\boldsymbol{p}}$. The uncapped benchmark in section 4 supplies an explicit update in one sector. A unique, conservation-compatible completion when $\mathcal{C}_i = 1$ remains open.

3.7 Axiom O7: patterns, particles, and fields

A pattern type P is an equivalence class of configurations that is localized or controlled in support, stable under $U_{\boldsymbol{p}}$, and transportable under graph symmetries. A particle claim requires at least:

1. a solution or invariant manifold representing the pattern;
2. a stability spectrum under perturbations;
3. a dispersion relation and conserved quantum numbers;
4. an interaction rule yielding scattering or decay amplitudes; and
5. a continuum map connecting the pattern to detector observables.

Fields are coarse-grained collective coordinates for ensembles of patterns. This definition preserves the ontology's core insight while preventing a name such as "electron pattern" from being treated as a calculated electron.

3.8 Axiom O8: deterministic intent is not yet a quantum completion

The micro-history may be deterministic, but agreement with quantum experiments does not follow from determinism or chaos alone. The model must specify an ensemble measure, preparation map, measurement setting, outcome map, and the assumption in Bell's theorem that is modified. This constraint is developed in section 8.

4 A minimal deterministic graph-field benchmark

This section gives one mathematically closed low-level sector. It is deliberately modest: it proves that the ontology can support explicit dynamics and testable continuum behavior. It does not derive the ontology uniquely, the Standard Model, or gravity.

4.1 State, graph, and discrete action

Take a fixed weighted graph $G = (V, E, w)$ during one stabilized phase. Each node carries a real coordinate q_i^n. Let $\mu > 0$ be a generalized node inertia, $\kappa > 0$ a link stiffness, $\Omega_0 \geq 0$ an onsite frequency, and $W(q)$ a nonlinear potential. The discrete action is

$$S_0 = \sum_n \delta\tau \left[\frac{\mu}{2} \sum_i \left(\frac{q_i^{n+1} - q_i^n}{\delta\tau} \right)^2 - \frac{\kappa}{2} \sum_{(ij)\in E} w_{ij} (q_i^n - q_j^n)^2 \right.$$
$$\left. - \frac{\mu\Omega_0^2}{2} \sum_i (q_i^n)^2 - \sum_i W(q_i^n) \right]. \tag{9}$$

All terms in the bracket have units of energy. The graph Laplacian is

$$(L_G q)_i = \sum_j w_{ij} (q_i - q_j). \tag{10}$$

Varying (9) with fixed endpoint configurations gives the explicit leapfrog update

$$q_i^{n+1} = 2q_i^n - q_i^{n-1} - \delta\tau^2 \left[\Omega_0^2 q_i^n + \frac{\kappa}{\mu} (L_G q^n)_i + \frac{1}{\mu} W'(q_i^n) \right]. \tag{11}$$

Given q^{n-1}, q^n, the graph, and the parameters, (11) determines q^{n+1} without a random draw.

Proposition 1 (Deterministic benchmark evolution)**.** *For a finite graph, fixed parameters $\mu > 0$, $\kappa > 0$, $\Omega_0 \geq 0$, and differentiable W, the map in (11) is single-valued for every pair $(q^{n-1}, q^n) \in \mathbb{R}^{2|V|}$.*

Proof. The weighted graph Laplacian is a finite linear operator, and $W'(q_i^n)$ is a single real number at each node. Every term on the right of (11) is therefore determined by the supplied pair of states. This proves algebraic determinism of the benchmark. It does not prove boundedness, admissibility, or physical completeness. □

Equation (11) is the explicit *uncapped* benchmark. A fundamental END update must additionally map admissible data back into the capacity set $\mathcal{A}$ whenever the tentative update would violate (6). Arbitrary clipping or merging is not acceptable because it can violate energy, momentum, reversibility, or locality.

4.2 A local transition limiter, and why it is not yet the final rule

One can make a narrow part of the capacity idea fully explicit. Let the static demand at the departure state be

$$S_i^n = \frac{\kappa}{4} \sum_j w_{ij} (q_i^n - q_j^n)^2 + V_+(q_i^n), \qquad 0 \leq S_i^n \leq E_*, \tag{12}$$

and let $v_i^* = (q_i^{*,n+1} - q_i^n)/\delta\tau$ be the velocity proposed by the uncapped update. Define

$$s_i^n = \begin{cases} 1, & v_i^* = 0, \\ \min\left\{1, \sqrt{\dfrac{2(E_* - S_i^n)}{\mu (v_i^*)^2}}\right\}, & v_i^* \neq 0, \end{cases} \qquad q_i^{n+1} = q_i^n + \delta\tau\, s_i^n v_i^*. \tag{13}$$

For the transition demand

$$\widetilde{\mathcal{C}}_i^n = \frac{\mu (s_i^n v_i^*)^2/2 + S_i^n}{E_*}, \tag{14}$$

(13) guarantees $0 \leq \widetilde{\mathcal{C}}_i^n \leq 1$ node by node.

Proof. If the tentative kinetic demand is no larger than $E_* - S_i^n$, then $s_i^n = 1$ and the inequality already holds. Otherwise the second branch gives $\mu(s_i^n v_i^*)^2/2 = E_* - S_i^n$, so $\widetilde{\mathcal{C}}_i^n = 1$. Every quantity uses only node i, its finite neighbourhood through S_i^n, and the tentative local update. □

This construction proves that a deterministic local limiter is possible, but it is not promoted to the canonical law. It may dissipate the benchmark energy, it need not preserve momentum or time reversal, and it does not by itself guarantee that the next static load S_i^{n+1} remains below E_*. A final completion must solve those three problems or identify a principled reason to relax the corresponding conservation law.

4.3 Exact dispersion relation

For $W = 0$ on a d-dimensional hypercubic graph with spacing a and unit nearest-neighbor weights, insert

$$q_i^n = A \exp[\mathrm{i}(\boldsymbol{k} \cdot \boldsymbol{x}_i - \omega n \delta\tau)] \tag{15}$$

into (11). Since the graph-Laplacian eigenvalue is

$$\lambda_G(\boldsymbol{k}) = 4\sum_{r=1}^{d} \sin^2\left(\frac{k_r a}{2}\right), \tag{16}$$

one obtains the exact relation

$$\frac{4}{\delta\tau^2}\sin^2\left(\frac{\omega\delta\tau}{2}\right) = \Omega_0^2 + \frac{4c_0^2}{a^2}\sum_{r=1}^{d}\sin^2\left(\frac{k_r a}{2}\right), \qquad c_0^2 \equiv \frac{a^2\kappa}{\mu}. \tag{17}$$

Theorem 1 (Exact free-field lattice spectrum)**.** *On a d-dimensional periodic hypercubic graph with $W = 0$, every plane-wave eigenmode of* (11) *satisfies* (17)*; conversely every real solution of* (17) *generates a free normal mode.*

Proof. For a plane wave, the second time difference is

$$q_i^{n+1} - 2q_i^n + q_i^{n-1} = -4\sin^2(\omega\delta\tau/2)q_i^n.$$

The nearest-neighbour graph Laplacian gives

$$(L_G q^n)_i = 4\sum_{r=1}^{d}\sin^2(k_r a/2)q_i^n.$$

Substitution into (11), followed by division by the nonzero mode amplitude, yields (17). Reversing the substitution proves the converse. □

At $|\boldsymbol{k}|a \ll 1$, $|\omega|\delta\tau \ll 1$,

$$\omega^2 = \Omega_0^2 + c_0^2|\boldsymbol{k}|^2 - \frac{c_0^2 a^2}{12}\sum_r k_r^4 + \frac{\omega^4\delta\tau^2}{12} + O(a^4k^6, \delta\tau^4\omega^6). \tag{18}$$

The leading continuum speed is therefore $c_0 = a\sqrt{\kappa/\mu}$, not automatically $a/\delta\tau$. The latter is a one-link-per-update kinematic scale. Equating it with the measured invariant speed requires an additional dynamical condition.

For $\Omega_0 = 0$, the group velocity in one dimension follows directly from implicit differentiation:

$$v_g(k) = \frac{\mathrm{d}\omega}{\mathrm{d}k} = c_0\frac{\cos(ka/2)}{\sqrt{1-(c_0\delta\tau/a)^2\sin^2(ka/2)}}. \tag{19}$$

At small ka, $v_g = c_0 + O(k^2a^2)$; near the Brillouin-zone edge it bends away from the continuum value. In more than one dimension the quartic term $\sum_r k_r^4$ in (18) distinguishes axes from diagonals. Thus a regular microscopic lattice generically predicts high-frequency dispersion and anisotropy. The scale a is not predicted until fixed by an independent part of the model, so no observational amplitude is claimed here.

4.4 Stability and the meaning of a mass gap

For the explicit update to have real ω for every lattice mode, the right side of (17) must not exceed $4/\delta\tau^2$. A sufficient free-field condition is

$$\frac{\delta\tau^2\Omega_0^2}{4} + d\left(\frac{c_0\delta\tau}{a}\right)^2 \le 1. \tag{20}$$

This is a concrete failure test: violating (20) produces unstable high-frequency modes in this benchmark.

Proposition 2 (Linear stability domain)**.** *For the free periodic hypercubic benchmark, all normal-mode frequencies are real if and only if*

$$0 \le \delta\tau^2 \left[\Omega_0^2 + \frac{4c_0^2}{a^2} \sum_r \sin^2(k_r a/2) \right] \le 4$$

for every lattice wave vector. Condition (20) is the resulting worst-case criterion.

Proof. The left side of (17) is $4\sin^2(\omega\delta\tau/2)/\delta\tau^2$. A real ω exists precisely when the dimensionless right side lies in $[0, 4]$. The maximum spatial eigenvalue is $4d$, attained at a Brillouin-zone corner, which gives (20). □

If a relativistic quantum field description is justified and an action-phase scale $\hbar_*$ has been independently fixed, the gap maps to an effective rest mass through

$$E^2 = \hbar_*^2\omega^2 \simeq c_0^2\hbar_*^2 k^2 + m_{\text{eff}}^2 c_0^4, \qquad m_{\text{eff}} = \frac{\hbar_*\Omega_0}{c_0^2}. \tag{21}$$

Equation (21) is a dictionary. It predicts no particle mass until Ω_0 is obtained from a fixed node model without using that mass.

Worked example: a result that is not fitted to nature

Choose lattice units $a = 1$, $\mu = 1$, $\kappa = 1$, $\Omega_0 = 0.4$, and $\delta\tau = 0.5$ in $d = 3$. Then $c_0 = 1$ and the stability number is

$$\frac{\delta\tau^2\Omega_0^2}{4} + 3\left(\frac{c_0\delta\tau}{a}\right)^2 = 0.01 + 0.75 = 0.76 < 1.$$

The entire free spectrum is therefore linearly stable. For a mode $\boldsymbol{k} = (\pi/3, 0, 0)$, (17) gives

$$\omega = \frac{2}{\delta\tau} \arcsin\left[\frac{\delta\tau}{2}\sqrt{\Omega_0^2 + 4\sin^2(\pi/6)}\right] \simeq 1.091,$$

whereas the leading continuum approximation gives $\sqrt{0.4^2 + (\pi/3)^2} \simeq 1.121$. The 2.7% difference is an internally predicted discretization effect for these chosen dimensionless parameters. It is not evidence about the physical universe because the parameters were not derived or calibrated to a real system.

Thought experiment 3: a wave crossing tiled space

Tap one tile and watch a long-wavelength ripple. Its speed depends on tile spacing, coupling stiffness, and tile inertia. Knowing only that updates happen every $\delta\tau$ does not tell you the ripple speed. The exact sine functions in (17) also show how a microscopic grid reveals itself: short waves bend away from the smooth relativistic relation and become direction-dependent. That deviation is a real prediction only after a, μ, κ are fixed elsewhere.

4.5 A gauge-invariant phase extension

The legacy theory emphasizes phase alignment. Let $\psi_i = \rho_i e^{i\theta_i}$ be a complex node coordinate and assign an oriented link variable $U_{ij} = e^{iqA_{ij}}$, with $U_{ji} = U_{ij}^{-1}$. The link difference

$$|D_{ij}\psi|^2 \equiv |U_{ij}\psi_j - \psi_i|^2 \tag{22}$$

is invariant under

$$\psi_i \to \mathrm{e}^{\mathrm{i}q\alpha_i}\psi_i, \qquad U_{ij} \to \mathrm{e}^{\mathrm{i}q\alpha_i}U_{ij}\mathrm{e}^{-\mathrm{i}q\alpha_j}. \tag{23}$$

For a closed plaquette $\square$, $U_\square = \prod_{(ij)\in\square} U_{ij}$ is also invariant. A gauge sector may therefore contain

$$S_{\text{gauge}} = \beta \sum_{\square} (1 - \operatorname{Re} U_\square), \tag{24}$$

which has the Maxwell/Yang-Mills form in an appropriate continuum limit. A line integral of a phase alone does not establish gauge emergence; (22)–(24) state the missing structure.

Proposition 3 (Exact link-gauge invariance)**.** *The quantities $|D_{ij}\psi|^2$ and $\operatorname{Re} U_\square$ are invariant under (23) at finite lattice spacing.*

Proof. The transformed link difference is

$$U'_{ij}\psi'_j - \psi'_i = \mathrm{e}^{\mathrm{i}q\alpha_i}(U_{ij}\psi_j - \psi_i),$$

whose norm is unchanged. In a closed loop the factor $\mathrm{e}^{-\mathrm{i}q\alpha_j}$ from one link cancels the factor $\mathrm{e}^{\mathrm{i}q\alpha_j}$ from the next, leaving $U_\square$ unchanged. This proves exact kinematic gauge invariance, not emergence of the observed gauge group or its coupling values. □

5 Repair of the legacy amplitude-phase action

Several END drafts center on a real amplitude Φ and compact phase θ. That idea is retained, but the published legacy form cannot be canonical without repair. Its coefficient N_c was called dimensionless even though a standalone phase kinetic term requires a mass scale; $\Delta\theta$ was undefined; and $(\square\Phi)^2$ generically gives fourth-time-derivative dynamics and an extra unstable degree of freedom unless treated through a controlled effective-field-theory prescription.

In natural units with metric signature $(+,-,-,-)$, a repaired low-energy representative is

$$\begin{aligned}\mathcal{L}_{\Phi\theta} = \frac{1}{2}Z_\Phi(\chi_\theta)\,\partial_\mu\Phi\,\partial^\mu\Phi - \frac{\lambda}{4}(\Phi^2 - v^2)^2 + \frac{f_\theta^2}{2}\,\partial_\mu\theta\,\partial^\mu\theta \\ - \frac{\eta a^2}{2}(\Delta_\perp\Phi)^2 + \mathcal{L}_{\text{links}} + \mathcal{L}_{\text{higher}},\end{aligned} \tag{25}$$

where $[\Phi] = [v] = [f_\theta] =$ mass, θ is dimensionless, λ, η are dimensionless, and $\Delta_\perp$ is a spatial operator defined relative to the frame foliation. The local phase-mismatch measure is

$$\chi_{\theta,i} = \frac{1}{2z_i}\sum_{j\sim i}\left[1 - \cos(\theta_j - \theta_i - qA_{ij})\right], \qquad 0 \le \chi_{\theta,i} \le 1, \tag{26}$$

and the legacy modulation may be represented by

$$Z_\Phi(\chi_\theta) = 1 - 2\delta\chi_\theta, \qquad 0 \le \delta < \frac{1}{2}, \tag{27}$$

so the kinetic coefficient remains positive. The spatial $(\Delta_\perp\Phi)^2$ term preserves the intended lattice-dispersion correction without adding fourth time derivatives. It also makes explicit that exact Lorentz invariance is not assumed at the cutoff and must emerge at long wavelengths.

Equation (25) is a candidate effective sector. It is not derived from the pre-geometric ontology, and it does not by itself generate fermions, gauge groups, Einstein gravity, a collapse law, or observed constants. Its scientific value is that every symbol now has a role, dimensions can close, and stability can be tested.

6 Continuum matching target

At scales large compared with the persistence length, a successful micro-model should match a local effective action. The most general conservative statement is

$$S_{\text{eff}} = \int d^4x\sqrt{-g}\left[\frac{M_*^2}{2}(R-2\Lambda_*) + \mathcal{L}_{\text{gauge}} + \mathcal{L}_{\text{chiral}} + \mathcal{L}_{\text{scalar}} + \mathcal{L}_{\text{pat}} + \mathcal{L}_{\text{EQEF}} + \sum_{D>4}\frac{c_a^{(D)}\mathcal{O}_a^{(D)}}{M_{\text{cut}}^{D-4}}\right]. \tag{28}$$

This is a matching target, not a derivation. Writing the Standard Model and Einstein-Hilbert terms inside S_{eff} demonstrates compatibility only if the node dynamics actually generate their field content, symmetries, coefficients, anomalies, and controlled corrections.

6.1 Fermion mass bookkeeping

The former lexicon wrote an explicit fermion mass in the kinetic term and also generated mass from Yukawa couplings, which double-counts mass before symmetry breaking. In a chiral gauge stage the correct structure is

$$\mathcal{L}_{\text{chiral}} = \sum_f \bar\psi_f i\gamma^\mu D_\mu\psi_f - \left(\bar\psi_L Y_H H\psi_R + \bar\psi_L Y_\Sigma \Sigma\psi_R + \text{h.c.}\right). \tag{29}$$

After H and Σ acquire vacuum expectation values,

$$M_f = \frac{v_H}{\sqrt{2}}Y_H + s_\Sigma Y_\Sigma + \cdots, \qquad U_L^\dagger M_f U_R = \text{diag}(m_1, m_2, \ldots). \tag{30}$$

The equation becomes an END prediction only when the matrices on the right are computed from a fixed node operator. A texture chosen to match the observed singular values is a fit.

6.2 Relativity and gravity

Recovering an invariant speed from (17) is not yet general relativity. The required chain is

$$\text{graph observables} \longrightarrow e^a{}_\mu, \omega^a{}_{b\mu} \longrightarrow g_{\mu\nu} = \eta_{ab}e^a{}_\mu e^b{}_\nu \longrightarrow S_{\text{grav}}[e,\omega]. \tag{31}$$

The coarse-graining must produce universal coupling to stress-energy, a weak-field Newtonian limit, local Lorentz symmetry within bounds, and correction operators with fixed coefficients. Until this is done, “gravity is progression adjustment” is an interpretation and research direction, not a derivation of Einstein’s equation.

6.3 Progression imbalance and torsion

In a Riemann-Cartan description, torsion is

$$T^\rho{}_{\mu\nu} = 2\Gamma^\rho{}_{[\mu\nu]}, \qquad T^a = de^a + \omega^a{}_b \wedge e^b. \tag{32}$$

It measures the infinitesimal non-closure of transported displacements:

$$\delta x^\rho = T^\rho{}_{\mu\nu}\,\delta A^{\mu\nu} + O(|\delta A|^{3/2}). \tag{33}$$

The ontology’s progression imbalance can map to (32) if neighboring local frame translations fail to close after coarse-graining. This is a precise hypothesis. The theory must still derive $e^a{}_\mu$, $\omega^a{}_{b\mu}$, the torsion source, and the Wilson coefficients. Torsion is not interchangeable with curvature, energy, chaos, or EQEF.

Thought experiment 4: the non-closing postage stamp

Draw a tiny parallelogram by taking one local frame-step east, one north, then reversing both moves. In ordinary torsion-free geometry the loop closes to leading order. If different progression rules make the endpoint miss the start, the mismatch per enclosed area is torsion. This gives the word "progression imbalance" an observable geometric meaning instead of treating torsion as a metaphor.

7 EQEF: retained meaning and permitted mathematics

The Evans Quantum Energy Field is retained because the later ontology clearly defines its intended role: it tracks expressed versus deferred transition capacity and is a framework within END for progression imbalance, not a separate fundamental theory. Two levels must remain distinct.

7.1 Level 1: capacity ledger

Define the residual local capacity

$$r_i^n = 1 - \mathcal{C}_i^n, \qquad 0 \le r_i^n \le 1. \tag{34}$$

This is bookkeeping. It is dimensionless and is not automatically energy. If residual capacity is transported or deferred, a causal balance law may be postulated,

$$r_i^{n+1} - r_i^n + \sum_j J_{ij}^n = s_i^n, \tag{35}$$

where $J_{ij} = -J_{ji}$ is a link flux and s_i is a locally defined source. Equation (35) becomes physical only after J and s are derived from the update rule.

7.2 Level 2: optional continuum field

A coarse field $\chi(x) \propto \langle r_i - \bar{r}\rangle_R$ may be introduced if the coarse-graining supports it. A conservative effective ansatz is

$$\mathcal{L}_{\text{EQEF}} = -\frac{Z_\chi}{2}\nabla_\mu\chi\nabla^\mu\chi - V_\chi(\chi) - \frac{\xi}{2}\chi^2 R + \sum_b \frac{d_b \mathcal{Q}_b}{M_{\text{cut}}^{\Delta_b - 4}}. \tag{36}$$

This can behave as a slowly varying cosmological component for some V_χ, but that behavior is shared by many scalar-field models. END distinguishes itself only if the discrete map fixes Z_χ, V_χ, ξ, d_b or produces a relation that survives held-out data. A fitted constant term is not a solution to the cosmological-constant problem.

8 Quantum claims: what is retained and what remains open

The frame language provides useful interpretations:

- a wavefunction may summarize allowed or weighted coarse-grained continuations;
- entanglement may reflect a non-factorizable common preparation history;

- decoherence may reflect dispersal of phase information into many environmental patterns;
- measurement may involve stable amplification or localization.

None of these statements by itself derives quantum statistics.

8.1 Minimum probability structure

Let λ denote a complete ontic initial state, a, b measurement settings, and A, B outcomes. A deterministic completion supplies functions

$$A = A(a, b, \lambda), \qquad B = B(a, b, \lambda), \tag{37}$$

and an ensemble density $\rho(\lambda \mid a, b)$. It must calculate

$$P(A, B \mid a, b) = \int \mathrm{d}\lambda\, \rho(\lambda \mid a, b)\delta_{A,A(a,b,\lambda)}\delta_{B,B(a,b,\lambda)}. \tag{38}$$

To reproduce Bell-inequality violations, END must explicitly relax at least one assumption used in the Bell bound: locality/factorization, measurement independence, forward causal structure, or ordinary noncontextual outcome assignment. "Shared frame origin" with local measurement-independent updates is insufficient.

8.2 Born rule and localization threshold

A localization module requires a dimensionally defined diagnostic, scale, and state map:

$$\mathcal{T}_R[X_n] \geq \tau_R \quad \Longrightarrow \quad X_{n+1} = C_R[X_n], \tag{39}$$

plus proofs or numerical bounds for conservation, covariance, no-signaling at the operational level, and outcome frequencies. A threshold estimated from the energy needed to create a known particle is a calibration. A node-merging rule with a discretionary kick is not a deterministic physical law. The universal-threshold proposal is therefore retained as a conjecture module, not part of the validated core.

Thought experiment 5: the two boxes and the settings

Two separated boxes receive correlated patterns. Later, two experimenters independently choose settings. A common past can produce ordinary correlations, but Bell experiments exceed the limit for local, measurement-independent hidden variables. END must say exactly whether the settings were correlated with the hidden state, whether the response is nonlocal, whether future constraints matter, or whether another standard assumption fails. Without that choice and Equation (38), saying "the frames remember" does not solve the problem.

9 Constants: definitions, calibrations, and predictions

The correct scientific classification is summarized in table 1. SI numerical values of c and h define units; reproducing them after choosing lattice units is not a prediction. Dimensionless ratios are preferred targets, but even a ratio is not predicted if free microscopic overlaps are tuned to it.

9.1 The non-circularity protocol

Definition 1 (Non-circular derivation)**.** A quantity Q is derived from END/MNT only if a frozen microscopic specification $\mathfrak{M} = (\mathcal{X}, G, U, \mathcal{C}, C_R, \boldsymbol{p})$, none of whose inputs were chosen using the measured value of Q, implies a unique prediction $Q = F_Q(\mathfrak{M})$ with uncertainty and domain of validity. If data for Q select any component of $\boldsymbol{p}$, the result is calibration. If a continuum coefficient is identified by matching two descriptions, the result is matching. If a unit convention fixes the numerical value, the result is a definition.

A reproducible calculation therefore needs four ledgers: an input ledger listing parameters, priors, units, boundary conditions, and data used to choose them; a derivation ledger showing the operator or update from which the output follows; a calibration ledger naming observables used to set scales or couplings; and a hold-out ledger naming observables that were not inspected until the model was frozen.

The *no free lunch* test is simple: after calibrating p independent combinations, the framework must predict more than p independent quantities and outperform an appropriate simpler baseline. Rewriting the p calibrators in new notation adds no predictive information.

9.2 Worked case A: propagation speed

From the free lattice spectrum, the long-wavelength coefficient is

$$c_0^2 = a^2 \frac{\kappa}{\mu}. \tag{40}$$

This is a genuine derivation inside the benchmark because it follows from the discrete action. It is not yet a numerical prediction of the physical speed of light. There are three logically different uses:

1. If a, κ, μ are fixed independently, (40) predicts c_0.
2. If the measured invariant speed is used to set $\kappa/\mu = c^2/a^2$, the relation calibrates one parameter combination.
3. If length and time units are chosen so $c = 1$, no physical parameter has been predicted.

The kinematic ratio $a/\delta\tau$ is an upper update scale, not the wave speed unless $\kappa/\mu = 1/\delta\tau^2$. The earlier statement $c = a/\delta\tau$ silently assumed that extra equality. Moreover, a viable relativistic limit requires every low-energy massless sector to share the same limiting cone; deriving c_0 for one scalar is not enough.

9.3 Worked case B: a dimensionless mass ratio

The cleanest potential predictions are dimensionless. On a cycle graph C_N, the Laplacian eigenvalues are

$$\lambda_m = 4\sin^2\left(\frac{\pi m}{N}\right), \qquad m = 0, \dots, N-1. \tag{41}$$

For a linear branch with $\Omega_m^2 = \Omega_0^2 + (\kappa/\mu)\lambda_m$, the effective mass dictionary (21) gives

$$\frac{m_r}{m_s} = \frac{\Omega_r}{\Omega_s}. \tag{42}$$

Choose a fully declared toy model $N = 8$, $\Omega_0 = 1$, and $\kappa/\mu = 1$ in lattice units. Then

$$\lambda_1 = 4\sin^2(\pi/8) = 2 - \sqrt{2}, \qquad \lambda_2 = 4\sin^2(\pi/4) = 2,$$

and

$$\frac{m_2}{m_1} = \sqrt{\frac{1+\lambda_2}{1+\lambda_1}} = \sqrt{\frac{3}{3-\sqrt{2}}} \simeq 1.375. \tag{43}$$

No measured mass was used, so (43) is a first-principles output of that toy model. It is not a prediction for any known pair of particles: the graph, branch identification, and parameters were chosen for illustration. A physical claim would require those ingredients to arise from the canonical micro-model before particle data are examined.

9.4 Worked case C: action-phase conversion and Planck's constant

Suppose a coarse mode has a physical phase advance $\Delta\varphi$ and a discrete action increment ΔS. One may define

$$\hbar_* = \frac{\Delta S}{\Delta\varphi}, \qquad E = \hbar_*\omega, \tag{44}$$

provided the ratio is constant across amplitudes, modes, preparations, and scales in the quantum regime. Equation (44) is a matching definition until the microdynamics derive both the physical phase measure and a universal ratio. Choosing $\hbar_* = \hbar_{\rm SI}$ from one atomic transition calibrates the action scale. The non-circular test is then whether the same fixed $\hbar_*$ predicts other interference, spectra, and quantum probabilities. No supplied END/MNT source completes that test.

9.5 Worked case D: gauge coupling and the fine-structure constant

For a compact $U(1)$ Wilson sector in Euclidean signature, choose the convention

$$S_g = \beta \sum_{\square} (1 - \cos\theta_\square), \qquad \theta_{\mu\nu}(x) = a^2 F_{\mu\nu}(x) + O(a^3). \tag{45}$$

Expanding at weak curvature gives

$$S_g = \frac{\beta}{4} \int \mathrm{d}^4x\, F_{\mu\nu}F^{\mu\nu} + O(a^2 F\partial^2 F, a^4 F^4). \tag{46}$$

Matching the continuum normalization $S = (4e_0^2)^{-1} \int F^2$ yields

$$e_0^2 = \frac{1}{\beta}, \qquad \alpha_0 = \frac{e_0^2}{4\pi} = \frac{1}{4\pi\beta}. \tag{47}$$

This is a clean matching relation, not a numerical derivation of α, because β is currently free. A prediction requires the node dynamics to fix β, the charged field content, threshold corrections, and renormalization flow; the resulting $\alpha(\mu)$ must then be compared at a held-out scale. Setting $\beta = 1/(4\pi\alpha_{\rm obs})$ is calibration.

9.6 Worked case E: gravitational strength

If coarse-graining produces the Einstein–Hilbert term in natural units,

$$S_{\rm grav} = \frac{M_*^2}{2} \int \mathrm{d}^4x \sqrt{-g}\, R, \qquad G_{\rm eff} = \frac{1}{8\pi M_*^2}. \tag{48}$$

If dimensional analysis of a lattice calculation gives $M_*^2 = Z_R/a^2$ with a computed dimensionless stiffness Z_R, then

$$G_{\rm eff} = \frac{a^2}{8\pi Z_R} \tag{49}$$

in the same natural-unit convention. Equation (49) becomes a prediction only if a and Z_R are fixed without using G. Defining a to be the Planck length, $a^2 = \hbar G/c^3$, and then solving (49) for G is circular because G entered the definition of a.

9.7 Cosmological term and the absence of a present solution

At the effective level, vacuum contributions have the schematic structure

$$\Lambda_{\mathrm{eff}} = \Lambda_{\mathrm{bare}} + \frac{\rho_{\mathrm{vac}}}{M_*^2} + \Delta\Lambda_{\mathrm{EQEF}} + \Delta\Lambda_{\mathrm{grav}} + \cdots . \tag{50}$$

Fitting one term to cancel the others and leave the observed residual is fine tuning, not derivation. A first-principles END/MNT solution would need a symmetry, constraint, sequestering mechanism, or dynamical attractor that fixes the residual without using late-time expansion data and remains stable under radiative corrections. No such mechanism is present in the supplied corpus.

9.8 SI defining constants, Planck units, and dependent quantities

The numerical SI values of c, h, e, and k_B are exact defining constants of the unit system. A microscopic theory can explain why physical relations contain invariant conversions corresponding to them, but recovering their SI digits after the units have been defined is not an independent prediction. The reduced Planck constant is $\hbar = h/(2\pi)$.

Likewise, the Planck length, time, mass, energy, temperature, charge, current, voltage, area, and luminosity are dimensional combinations of a smaller set of constants. Once $c, \hbar, G, k_B, \epsilon_0$ are specified, calculating Planck units is unit algebra, not a series of new confirmations. In the modern SI,

$$\alpha = \frac{e^2}{4\pi\epsilon_0\hbar c}, \qquad \mu_0\epsilon_0 c^2 = 1. \tag{51}$$

Thus ϵ_0 and μ_0 are not independent targets once the exact defining constants and measured dimensionless α are supplied. The Hubble constant is a cosmological parameter inferred from observations, not a fundamental conversion constant.

Table 1: Status of constants in the reconstructed framework.

Quantity	Model relation	Current status	Requirement for a derivation
c	$c_0 = a\sqrt{\kappa/\mu}$ in the benchmark long-wave sector	One parameter combination is calibrated to the invariant speed; $a/\delta\tau$ is only a kinematic scale	Derive a, κ, μ independently and prove universal coupling of all massless modes
$\hbar$	$\Delta S = \hbar_*\Delta\varphi$, $E = \hbar_*\omega$ after a quantum map exists	Action-phase conversion and unit calibration	Derive the phase measure and show one universal $\hbar_*$ governs all quantum sectors
G	$M_*^{-2} = 8\pi G_{\mathrm{eff}}$ in (28)	Effective Wilson coefficient, not yet derived	Coarse-grain a fixed micro-model to the Einstein-Hilbert term and predict the coefficient after non-gravitational calibration

Quantity	Model relation	Current status	Requirement for a derivation
Λ	Coefficient of $\sqrt{-g}$ plus vacuum contributions	Unresolved; fitting an EQEF constant is not a solution	Produce a stable cancellation or symmetry mechanism without inserting observed expansion data
$\alpha(\mu)$	$\alpha = e_R^2/(4\pi)$ in natural rationalized units	Gauge coupling plus standard running; generic overlaps are free	Compute the bare coupling and field content from fixed node dynamics, then run to a held-out scale
Masses	Rest-energy or stability eigenvalues; e.g. (21), (30)	Structural templates only	Fix the operator, boundary conditions, and parameters; calibrate at most an allowed scale; hold out the remaining spectrum
Decay rates	Amplitudes and phase space, such as $\Gamma_\mu \propto G_F^2 m_\mu^5$	Standard EFT scaling, not END-specific	Derive masses and couplings from the same frozen micro-model and compute the full numerical coefficient

10 What would happen in the benchmark if its assumptions hold?

The following statements are deliberately ranked. A theorem is proved from the benchmark equations. A generic expectation follows for a broad class of nonlinear choices but is not universal. A physical prediction requires a complete parameter map to observations.

10.1 Long waves look smoother than short waves

By (18), a gapless branch satisfies

$$\omega^2 = c_0^2|\boldsymbol{k}|^2 + O(a^2k^4, \delta\tau^2\omega^4).$$

Thus sufficiently long waves propagate approximately as continuum relativistic modes. Short waves reveal the substrate through dispersion and, on a regular cubic graph, direction dependence. This is a theorem about the benchmark. The observable frequency at which the deviation appears is not known because a and the clock map are not derived.

10.2 Gapped modes behave as massive collective excitations

For $\Omega_0 > 0$, the zero-momentum frequency is nonzero. If the action-phase and relativistic dictionaries are valid, (21) maps this spectral gap to a rest mass. The existence of a gap is proved for the linear benchmark; its identification with a particle requires a localized stable pattern, quantum normalization, and detector map.

10.3 Nonlinearity produces amplitude-dependent clocks

Consider the spatially uniform mode with $W(q) = \lambda_4 q^4/4$. In the continuum-time approximation it obeys

$$\ddot{q} + \Omega_0^2 q + \frac{\lambda_4}{\mu} q^3 = 0. \tag{52}$$

For small amplitude A, harmonic balance gives

$$\Omega(A) = \Omega_0 \left[1 + \frac{3\lambda_4 A^2}{8\mu\Omega_0^2} + O(A^4)\right]. \tag{53}$$

Positive λ_4 hardens the oscillation and negative λ_4 softens it within the stable range. If physical clocks are built from such patterns, local load can alter their operational rate. Equation (53) demonstrates a mechanism for load-dependent ticking, but it is not yet gravitational time dilation: universality across all clock types and the metric response remain to be derived.

10.4 Capacity saturation changes the high-load evolution

Whenever the tentative kinetic demand exceeds $E_* - S_i^n$, the limiter (13) forces $\widetilde{\mathcal{C}}_i^n = 1$ and reduces the local velocity magnitude. The immediate result is proved by construction. Repeated activation will generally introduce amplitude-dependent propagation, reflection, or dissipation, but the mixture depends on the final conservation-compatible completion. This is where progression imbalance could become a measurable phenomenon, and where the model could also fail through unacceptable energy loss.

10.5 Gauge loops carry exact invariant information

The plaquette product $U_\square$ is invariant at finite spacing, not only in the continuum. Nontrivial loop holonomy can therefore label flux-like sectors in a compact phase model. Whether those sectors are stable, confined, deconfined, chiral, or related to observed charges depends on the gauge action and matter content. Exact invariance is proved; the Standard Model identification is conjectural.

First forecast hierarchy. The benchmark most robustly forecasts a smooth long-wave sector plus lattice corrections at short wavelength. With nonlinearities it generically forecasts amplitude-dependent frequencies. With an active capacity limiter it forecasts a high-load departure from the uncapped dynamics. These become physical predictions only after one immutable parameter set converts lattice scales to clocks, metres, energies, and detector observables.

11 Keep, refine, demote, and discard

11.1 Ideas retained in the canonical core

- Relational pregeometry with no assumed physical metric.
- Ordered frames as stabilized coarse-grained configurations.
- Space as persistent weighted relations; the node lattice as an emergent phase.
- Deterministic local dynamics as the intended micro-level structure.
- Finite local transition capacity as the fundamental limit.
- Stable and transportable node patterns as candidates for particles and fields.

- Phase alignment as a potentially important interaction variable.
- EQEF as expressed/deferred capacity bookkeeping.
- Progression imbalance as a candidate microscopic origin of torsion.
- Cross-domain parameter closure, non-circular calibration, and held-out falsification as methodological requirements.

11.2 Ideas retained only after refinement

Earlier wording	Canonical refinement
Energy is frame-to-frame change	Change is a microscopic correlate. Effective energy is the Hamiltonian or Noether charge associated with time translation and must have conserved, measurable units.
$t = n\delta\tau$	n is update order. Physical time is read by clock patterns; a constant $\delta\tau$ is a homogeneous approximation.
$c = \ell_0/\delta\tau$	This is a possible causal ceiling. The propagation speed follows from the dispersion relation and depends on stiffness and inertia.
Global capacity	A local dimensionless capacity $\mathcal{C}_i \leq 1$, with regional sums and causal transport.
Mass is progression load or resonance inertia	Qualitative interpretation only; quantitatively mass is a rest-energy gap or eigenvalue of a specified stability operator.
Charge is phase or helicity	Candidate topological interpretation; quantitatively charge is a representation label of an exact gauge symmetry.
Line-integral phase gives electromagnetism	Replace with link transformations and plaquette curvature as in (22)–(24).
Legacy $(\Box\Phi)^2$ gravity term	Remove from the fundamental action; use a stable spatial lattice correction or a controlled EFT with extra degrees and a declared cutoff. It does not derive gravity.
EQEF explains dark energy	EQEF may generate a coarse scalar sector, but the action and coefficients must be derived before any cosmological claim.
Torsion is progression imbalance	Map the non-closure of local frame translations to $T^{\rho}{}_{\mu\nu}$ and derive the connection, source, and coefficients.
Structural proofs and global validation	Rename as derivation templates and validation protocols until numerical, reproducible results exist.

11.3 Claims demoted to the conjecture queue

The following may motivate later models but are not consequences of the current theory: a universal objective-collapse threshold; a derived Born rule; an EQEF origin for late acceleration; modified gravity replacing some or all dark matter; high-frequency photon or gravitational-wave dispersion; post-merger echoes; singularity resolution; black-hole information recovery; a normal neutrino hierarchy; no low-scale supersymmetry; a special 3+1-dimensional stability mechanism; and laboratory control of vacuum, inertia, mass, or progression.

Each conjecture may re-enter the main theory only with a unique equation, parameter provenance, numerical target, and falsifier.

11.4 Claims discarded from the scientific record

- All aggregate "over 90%" and "99.98%" alignment statements lacking a defined loss, covariance, parameter count, code, and held-out data.
- Numerical Planck-mass, G, weak-coupling, Higgs-VEV, fine-structure, axion, neutrino, and baryogenesis "derivations" that substitute measured inputs, have inconsistent dimensions, or disagree by orders of magnitude and are nevertheless called aligned.
- The formula $G = \hbar/c^3$ with an ad hoc node-velocity correction; it is dimensionally wrong.
- The claim that $10^{-122}\,\mathrm{m}^{-2}$ is the observed cosmological constant; 10^{-122} is the approximate dimensionless Planck-unit scale, not an inverse-square-metre value.
- Particle masses obtained by choosing $\omega = mc^2/\hbar$ from the measured mass.
- The Higgs formula and fit in the two-page JRE-MNT-PRL draft, whose parameters include measured constants and whose displayed expression does not have mass dimensions as written.
- Unfrozen resonance targets at 250 GeV, 1.5 TeV, 2–5 TeV, or 13.037 TeV; associated widths, cross-sections, and branching ratios.
- The claim that a Z-like spin-1 state can decay to two on-shell photons under ordinary assumptions.
- The two-node toy model as a "proof" of END. Its potential was chosen by hand, and the printed small-oscillation calculation contained a derivative and dimensional error.
- Pseudocode that inserts optional damping, random perturbations, externally supplied fields, arbitrary softening, and node merging while calling the result the fundamental deterministic update.
- Assertions that standard-model or Lambda-CDM calculations using their measured parameters validate END.
- Claims that ordinary redshift moves a Planck-frequency mode into the LIGO band without a transfer mechanism.
- Claims of controlled energy extraction, anti-gravity, mass modulation, propulsion, or vacuum engineering without an interaction Hamiltonian and safety analysis.

12 Relationship to established discrete and emergent frameworks

END/MNT is not made credible by resemblance alone, but comparison prevents the framework from relabeling known machinery as a new derivation.

Causal order and pregeometry. Causal-set theory begins with a locally finite order and asks how continuum spacetime can emerge [3]. END/MNT similarly distinguishes update order from metric time, but adds a persistence/coarse-graining criterion and local transition-capacity hypothesis. It has not yet supplied the reconstruction results available in mature causal-set work.

Discrete geometry. Regge calculus encodes curvature on a simplicial geometry [2]. END/MNT instead proposes that even the graph and its metric emerge from persistent relations. If a simplicial phase appears, Regge variables could provide a disciplined intermediate description rather than being rederived informally.

Lattice gauge theory. Wilson's link and plaquette construction demonstrates how exact gauge invariance can survive finite spacing [1]. The phase sector in this monograph deliberately adopts that proven architecture. This does not make gauge symmetry an END/MNT prediction; it states the minimum structure any phase-based derivation must reproduce.

Finite propagation from locality. Lieb–Robinson bounds show that broad classes of local lattice systems possess an effective causal cone even when the microscopic formulation is not relativistic [8]. END/MNT's local capacity may further constrain propagation, but it must derive its own bound for the chosen nonlinear update. Calling the update local is not enough.

Effective field theory. The principle that long-distance observables are organized by symmetry and operator dimension is standard effective-field-theory reasoning [9]. Equation (28) is therefore a target and bookkeeping device, not evidence that the microscopic model generates its coefficients.

Chirality and quantum no-go results. A lattice model claiming the Standard Model must confront fermion doubling and anomaly cancellation [6]. A deterministic model claiming quantum completion must identify which Bell assumption changes and reproduce the observed correlations [4, 5]. These are design constraints, not optional philosophical objections.

Torsion. Riemann–Cartan and Einstein–Cartan theory give torsion a precise geometric and dynamical meaning [7]. END/MNT's progression imbalance becomes more than analogy only if its coarse translation operators yield the non-closure in (33) and the resulting field equations.

Novelty presently claimed. The potentially distinctive combination is an ontology of stabilized frames and emergent relational graphs constrained by finite local transition capacity, with EQEF as the ledger of expressed and deferred capacity. The discrete scalar and gauge mathematics used to benchmark that ontology is intentionally standard. Novel physics would lie in a uniquely derived capacity-preserving update and its cross-domain consequences, which do not yet exist.

13 Falsification and build programme

The programme should proceed in gates. Passing a later gate cannot compensate for failure at an earlier one.

Gate	Deliverable	Required evidence	Failure condition
0	Canonical specification	Exact $\mathcal{X}, G, U, \mathcal{C}, C_R$; units; boundary conditions; parameter file; supersession ledger	An object or equation remains multiply defined or dimensionally inconsistent
1	Mathematical closure	Well-posedness, capacity preservation, conserved quantities, stability domain, deterministic reference trajectory	Non-unique evolution, runaway modes, or uncontrolled constraint violation
2	Continuum benchmark	Dispersion, anisotropy, spectral dimension, convergence across at least three resolutions	Corrections fail to shrink as predicted or exceed laboratory bounds
3	Gauge and pattern sector	Exact lattice symmetry; anomaly-safe chiral implementation; stable localized solutions; interaction amplitudes	Gauge-dependent observables, unresolved doubling/anomalies, or no robust patterns

4	Quantum completion	Preparation, measure, settings, outcomes, Bell assumption, Born frequencies, no-signaling test	Failure to reproduce full correlations or undisclosed measurement dependence/nonlocality
5	Gravity and EQEF	Derived tetrad/metric/connection; Newtonian and Einstein limits; torsion and EQEF coefficients	Non-universal free fall, unstable extra modes, or incompatible propagation
6	Frozen external predictions	Versioned code, training/held-out policy, preregistration, likelihood, baselines, uncertainty and falsifier	Parameters change after data inspection or predictive performance is not better than baseline

13.1 First executable project

The shortest honest route is the scalar/phase benchmark, not a global particle-and-cosmology fit.

1. Implement (11) on square, cubic, and approximately isotropic irregular graphs.
2. Verify (17) numerically and map the stability boundary (20).
3. Add the link sector (22)–(24); unit-test exact gauge invariance.
4. Select one capacity-preserving variational completion and prove or numerically bound its conservation residuals.
5. Search for stable localized nonlinear patterns with parameters frozen before examining any particle masses.
6. Report dimensionless gaps and scattering data. Only then decide whether any pattern can be compared with a physical species.

This project can fail decisively and cheaply. That is an advantage: it tests the theory's distinctive machinery before large claims are attached to it.

14 Limitations and present conclusion

The reconstructed framework does not yet establish that the pre-geometric layer uniquely produces frames, that the frame graph becomes 3+1-dimensional Lorentzian spacetime, that the capacity limit has the form (7), or that the scalar/phase benchmark is the correct microphysics. It does not yet contain a capacity-preserving completion, chiral fermions, anomaly cancellation, a quantum probability rule, a Bell-compatible causal model, a gravitational coarse-graining theorem, or a parameter-fixed new signal.

What has been achieved is narrower and more durable. The ontology has been made internally ordered; the central notions now have operational definitions; a concrete benchmark possesses an exact update, dispersion relation, and stability condition; the phase/gauge idea has a correct lattice implementation; the legacy higher-derivative and dimensional problems have been removed; EQEF and torsion have been separated and assigned testable mathematical meanings; and unsupported numerical claims have been retired.

The resulting scientific proposition is:

Observed physics may arise from persistent relational patterns in a deterministic sequence of locally capacity-limited configurations. A node lattice is an emergent stable phase of that process. The proposition is viable only if one frozen micro-model derives its continuum observables, quantum statistics, and gravitational response with fewer independent inputs than the phenomena it predicts.

This is not weaker than an unfalsifiable declaration of completion. It is the version of END/MNT that can be calculated, criticized, reproduced, and, if nature disagrees, discarded.

Methods and declarations

Source-concordance method. Twenty-two supplied PDFs were converted to layout-preserving text and compared by date, definition, equation, and claim. Exact duplicate files were counted once for scientific content. The November 2025 ontology was treated as the controlling conceptual source; the August 2026 audit controlled evidentiary standards; mathematical statements were independently checked for dimensions, sign consistency, locality, and circularity. Older items were retained only when they could be mapped to the controlling ontology without contradiction.

No empirical analysis. No experimental data were analyzed and no new numerical fit is reported. Consequently this document makes no empirical-validation claim.

Code availability. No canonical END/MNT simulator or immutable parameter set existed in the supplied materials. The benchmark equations in this paper are sufficient to begin an implementation, but code and tests must be archived before computational results are claimed.

Data availability. The source corpus consists of author-supplied working manuscripts listed in Appendix B. Public experimental datasets mentioned in older drafts were not treated as evidence in this reconstruction.

Use of generative AI. Generative AI assisted source comparison, mathematical consistency checking, organization, and drafting under the author's direction. It is not an author. Ryan remains responsible for verifying the scientific content, equations, references, and final claims. Any later computational result must be regenerated from archived code rather than accepted from conversational output.

Author contributions. Ryan: conceptualization, original theory development, source provision, review, and final scientific accountability.

Funding. No institutional funding is declared for this reconstruction.

Competing interests. The author declares no competing interests.

A Notation and unit discipline

Symbol	Meaning	Discipline
n	Micro-update index	Dimensionless ordering label, not physical time
t_K	Clock time	Operational time read by a persistent subsystem
$G = (V, E, w)$	Effective weighted graph	Emerges after persistence/coarse-graining; may be fixed within one phase
a	Graph spacing in a regular phase	Length after metric calibration; not automatically the Planck length

$\delta\tau$	Update interval in benchmark units	Time after a clock map; may be a numerical step rather than fundamental observable
q_i^n	Generalized real node coordinate	Units chosen so every term in (9) is energy
μ	Generalized inertia	Fixed by the chosen normalization of q
κ	Link stiffness	κ/μ has units of inverse time squared
E_*	Local capacity scale	Energy per node for (7); must be calibrated or derived
Φ	Continuum amplitude field	Mass dimension one in 3+1 natural units
θ	Compact phase	Dimensionless with period 2π
f_θ	Phase stiffness scale	Mass dimension one in 3+1 natural units
χ	Coarse EQEF candidate	Normalization model-dependent; residual capacity itself is dimensionless
$T^{\rho}{}_{\mu\nu}$	Geometric torsion	Antisymmetric part of an independently defined connection

Use $h = 6.62607015 \times 10^{-34}\,\mathrm{J\,s}$ for the exact SI defining constant and $\hbar = h/(2\pi)$. Do not attach m^{-2} to a dimensionless Planck-unit number. Natural-unit formulas and SI formulas must never be mixed without an explicit conversion line.

B Source register and disposition

Source	Role	Disposition
MNT_Axioms_Ontology.pdf	Controlling ontology	Retain hierarchy; repair pre-time frequency, global capacity, energy definition, and status of EQEF/torsion
MNT_Math_Lexicon.pdf	Notation and EFT templates	Retain useful dictionary; correct locality, signs, dimensions, double-counted fermion mass, and generic-EFT-as-derivation problem
MNT_Structural_Proofs.pdf	Derivation logic	Retain non-circularity criteria and scaling templates; relabel "proofs" because microscopic operators remain unspecified
MNT_Global_Validation.pdf	Test catalogue	Retain as protocol library; withdraw the word validation because most sections specify future calibration or tests
Evans MNT Technical Editorial Audit.pdf	Evidentiary audit	Retain submission blockers and exclusions; update its fixed-lattice starting point using the later ontology
Evans MNT Nature Style WIP.pdf	Clean working narrative	Retain bounded status language, disclosure, and reproducibility programme; revise ontology and action
The Evans Node Dialect Parts 1–3	Legacy idea reservoir	Retain phase, persistence, threshold, and resonance intuitions only; discard unsupported validations and numerical predictions

Source	Role	Disposition
MNT-Main Manuscript.pdf and duplicate deterministic-lattice manuscript	Audited legacy manuscript	Superseded; useful only for provenance of errors and proposed experiments
JRE-MNT-PRL.pdf	Claimed Higgs validation	Withdraw scientific claims pending the archived derivation, actual data audit, and dimensionally valid prediction
end8(1).pdf, end9.pdf, end11.pdf, end20.pdf, end21.pdf, end23.pdf, end25.pdf, end31.pdf, end33.pdf	Early UMNT notes	Preserve historical concepts; discard displayed constant derivations and quantitative conclusions
end33.pdf mass/charge note	Qualitative pattern idea	Retain topological-inertia and winding intuition as research questions; discard formulas $m = \tau_v/(f_n c^2)$, $q = \alpha\Delta\phi$
end31.pdf dimensionality note	Conjecture	No derivation of 3+1 dimensions is present; move to future graph/spectral-dimension study

C Submission readiness checklist

The technical presentation now contains a title, bounded abstract, source hierarchy, explicit state/update benchmark, derived results, uncertainty language, falsification programme, source disposition, code/data statements, author accountability, competing-interest statement, and AI disclosure. Those elements are necessary but do not make the theory empirically submission-ready. Replication remains impossible at the fundamental level because the canonical capacity-preserving update, immutable parameters, simulator, and external results do not yet exist.

Scientific American currently describes a different product: a 2,000–4,000-word feature for curious general readers, supported by reporting, context, and independent critical perspectives [16]. Part I matches the approximate voice and length of that form, while Part II is backup material for fact-checking and expert scrutiny. However, Scientific American states that it does not accept AI-generated pitches or drafts [17]. This manuscript must therefore not be submitted there unchanged. Ryan would need to rewrite a pitch and article independently, report the story with external physicists, and disclose the work honestly under the publication's then-current policy.

The appropriate scientific next step is a versioned theory-specification preprint clearly labeled as work in progress, followed by specialist criticism and a released benchmark implementation. It should not be represented as an empirical research article or completed theory of everything.

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D Unanswered work in progress — canonical completion page

Foundational dynamics

- Specify the proto-state space, admissible hypergraph, and probability-free initial-condition rule.
- Replace the illustrative scalar update with one unique local $U_{\boldsymbol{p}}$ that preserves the full capacity set, states boundary conditions, and declares whether graph topology changes.
- Prove well-posedness, finite propagation, conservation or controlled dissipation, stability, and convergence under refinement.

Emergence

- Derive the persistence map C_R, graph weights, and a scale range with stable 3+1-dimensional Lorentzian geometry.
- Derive operational clocks and show universal low-energy Lorentz symmetry rather than a scalar-only limiting speed.
- Find stable localized nonlinear solutions; compute dimensionless spectra, scattering, topology, and failure regions without particle-data tuning.

Known physics

- Generate the gauge group, chiral fermion content, anomaly cancellation, charge representations, and Yukawa structure from the node operator.
- Supply the ensemble/preparation/measurement map, Born frequencies, Bell-assumption choice, and operational no-signalling proof.
- Derive the tetrad, connection, metric, Einstein/Newtonian limits, equivalence principle, and a quantitative torsion source.
- Derive EQEF transport and continuum coefficients; calculate cosmological background and perturbations without fitting a residual vacuum term by hand.

Prediction and evidence

- Freeze a parameter file and calibration policy; derive at least one dimensionless held-out result with uncertainty.
- Release code, tests, environment, seeds, data identifiers, checksums, likelihood, baseline comparisons, and negative results.

Completion criterion. END/MNT graduates from a coherent research programme to a physical theory only when one immutable micro-model crosses these gates with fewer calibrated inputs than independent held-out outputs. Until then, every particle, gravity, quantum, cosmology, and technology claim remains provisional.