Evans Node Dialect (END)
Foundational Constant Quartet from a Single Lattice Triple

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Abstract

This note gives a self-contained derivation, within the Matrix Node Theory / Evans Node Dialect (MNT/END) framework, of a "foundational quartet" of physical constants — the speed of light c, the Planck constant $\hbar$, the effective Newton constant G_{eff}, and the electromagnetic fine-structure constant α — from a single discrete lattice triple $(\ell_0, \delta\tau, \Lambda_{\text{lim}})$ and a small set of dimensionless pattern overlaps.

The logic is non-circular: one measured quantity (here taken to be the invariant speed c) fixes an overall scale, while the remaining constants are expressed as constrained functions of the same microscopic objects. The derivation is consistent with the *Axioms & Ontology*, *Mathematical Lexicon*, and *Structural Proofs* documents: all symbols and assumptions can be traced back to those references.

For physicists, the key structural statement is that

$$\{c, \hbar, G_{\text{eff}}, \alpha\} = \mathcal{F}\big(\ell_0, \delta\tau, \Lambda_{\text{lim}}, \{q_f\}, g^{(\text{em})}_{\text{lat}}, \Xi\big),$$

where Ξ denotes a finite set of dimensionless pattern overlaps and stability eigenvalues already present in the MNT/END lexicon. For non-specialists, the upshot is that the "speed of light", "gravitational strength", and "charge of the electron" are not independent inputs but trace back to a single discrete architecture of nodes and progression steps.

1 Microscopic MNT/END Parameters

In the ontology and math-lexicon papers, the discrete layer is specified by (see Axioms/Ontology, Sec. 1; Math Lexicon, Sec. 1–2):

- a node lattice $G = (\mathcal{N}, \mathcal{E})$ with characteristic spacing ℓ_0;
- a progression step $\delta\tau$ between stabilized frames F_n;

- a fundamental limit functional $C_{\text{tot}}[F_n, F_{n+1}]$ bounding the allowed change per step:

$$C_{\text{tot}}[F_n, F_{n+1}] \le \Lambda_{\text{lim}}. \tag{1}$$

We take $(\ell_0, \delta\tau, \Lambda_{\text{lim}})$ as the *lattice triple*. All continuum constants must ultimately be functions of this triple and a finite set of dimensionless pattern quantities.

On top of the lattice triple, the math lexicon introduces:

- pattern charges q_f for each fermion species f;
- a lattice electromagnetic overlap $g_{\text{lat}}^{(\text{em})}$ that measures how θ-like phase patterns couple to $U(1)$ charge;
- pattern-stability eigenvalues and overlaps, collected here into a finite set of dimensionless parameters Ξ.

We will keep the derivation symbolic, then show how a SymPy script can be used to test numerical choices (without hiding tuning).

2 Emergent invariant speed c

The discrete frame stack defines an effective propagation speed through the ratio of spatial to temporal progression when the limit functional is saturated by a massless pattern.

Let $\Delta x = n_x \ell_0$ and $\Delta\tau = n_\tau \delta\tau$ be the increments in lattice units for a pattern that maximally samples the limit without triggering collapse or branching (see Structural Proofs, Example 1). We assume that for a massless excitation:

$$C_{\text{tot}}^{(\text{light})} \equiv C_{\text{tot}}[F_n, F_{n+1}] = \Lambda_{\text{lim}}\, \Xi_c, \tag{2}$$

where $\Xi_c \in (0, 1]$ encodes a dimensionless overlap factor for the light-like pattern.

The emergent invariant speed is then defined by

$$c \equiv \Xi_c \frac{\ell_0}{\delta\tau}. \tag{3}$$

Calibration step. We use the experimentally observed value of c to fix one combination of $(\ell_0, \delta\tau, \Xi_c)$:

$$\Xi_c \frac{\ell_0}{\delta\tau} = c_{\text{exp}}. \tag{4}$$

This is the only place where c_{exp} enters the derivation.

3 Effective Planck constant $\hbar$

In the discrete action language, the total action is a sum over frame-to-frame changes:

$$S_{\text{disc}} = \sum_n C_{\text{tot}}[F_n, F_{n+1}]\, \delta\tau. \tag{5}$$

For a minimal stable oscillation mode (one "quantum" of a pattern), the action associated with a single progression step is assumed to be a fixed fraction of the limit:

$$S_{\text{quant}} = \Xi_{\hbar}\, \Lambda_{\text{lim}}\, \delta\tau^2, \tag{6}$$

where $\Xi_{\hbar}$ is dimensionless and of order unity. Matching this to the effective continuum description identifies the Planck constant as

$$\hbar_{\text{eff}} \equiv S_{\text{quant}} = \Xi_{\hbar}\, \Lambda_{\text{lim}} \delta\tau^2. \tag{7}$$

Equations (3) and (7) already show the distinctive MNT/END angle: *both* c and $\hbar$ arise from the same discrete triple and pattern overlaps $(\Xi_c, \Xi_{\hbar})$, not as independent continuum postulates.

4 Effective Newton constant G_{eff}

In the math lexicon, the gravitational sector of the effective Lagrangian is written in the usual Einstein–Hilbert form (plus torsion/EQEF corrections):

$$\mathcal{L}_{\text{grav}} = \frac{1}{16\pi G_{\text{eff}}} R + \ldots, \tag{8}$$

but G_{eff} is understood as a function of the lattice quantities (see Math Lexicon Sec. 4.5.3 and Structural Proofs Sec. 1.3).

The discrete picture is that curvature corresponds to a systematic bias in how the limit is sampled across neighbouring nodes and frames. A natural scaling consistent with dimensional analysis is

$$\frac{1}{16\pi G_{\text{eff}}} = \Xi_G \frac{\Lambda_{\text{lim}} \delta\tau^2}{\ell_0^2}, \tag{9}$$

with Ξ_G dimensionless. This yields

$$G_{\text{eff}} = \frac{1}{16\pi \Xi_G} \frac{\ell_0^2}{\Lambda_{\text{lim}} \delta\tau^2}. \tag{10}$$

Combining (3), (7), and (10), we can rewrite G_{eff} entirely in terms of $(c, \hbar_{\text{eff}})$ and a single microscopic ratio:

$$G_{\text{eff}} = \frac{\Xi_{\hbar}}{16\pi \Xi_G \Xi_c^2} \frac{c^3 \delta\tau}{\Lambda_{\text{lim}}} \quad \text{or equivalently} \quad G_{\text{eff}} \propto \frac{c^3}{\hbar_{\text{eff}}}\, \ell_0^2, \tag{11}$$

where the proportionality hides only dimensionless combinations of overlaps. This explicitly ties the strength of gravity to the same discrete structure that sets c and $\hbar_{\text{eff}}$.

5 Electromagnetic coupling and α

The math lexicon and global-validation paper treat the electromagnetic sector as emerging from a pattern phase θ with lattice overlap $g_{\text{lat}}^{(\text{em})}$ (see Global Validation, Test 2.4). Symbolically, at the continuum level we have the usual Maxwell term

$$\mathcal{L}_{\text{em}} = -\frac{1}{4} F_{\mu\nu} F^{\mu\nu} + J^{\mu} A_{\mu}, \tag{12}$$

but here the continuum coupling e and thus the fine-structure constant

$$\alpha = \frac{e^2}{4\pi \hbar_{\text{eff}} c} \tag{13}$$

are functions of lattice overlaps.

A minimal END ansatz consistent with the structural proofs is:

$$e^2 = \Xi_{\alpha} \left(g_{\text{lat}}^{(\text{em})} \right)^2 \frac{\ell_0^2}{\delta\tau^2}, \tag{14}$$

where Ξ_{α} encodes the combinatorics of pattern overlaps and charge assignments. Inserting (14), (3), and (7) into the definition of α gives

$$\alpha = \frac{\Xi_{\alpha}}{4\pi \Xi_{\hbar} \Xi_{c}} \left(g_{\text{lat}}^{(\text{em})} \right)^2 \frac{\ell_0^2}{\Lambda_{\text{lim}} \delta\tau^4}. \tag{15}$$

Equations (10) and (15) together form the *foundational quartet relation*:

$$\boxed{\alpha = \Xi_{\alpha G} \left(g_{\text{lat}}^{(\text{em})} \right)^2 \frac{c^2}{\hbar_{\text{eff}}} G_{\text{eff}},} \qquad \Xi_{\alpha G} \equiv \frac{\Xi_{\alpha} \Xi_{G}}{\Xi_{\hbar} \Xi_{c}}. \tag{16}$$

In words: in END/MNT, the dimensionless electromagnetic coupling α is proportional to the dimensionless gravitational strength $G_{\text{eff}} m^2 c / \hbar_{\text{eff}}$ (for a suitable reference mass), up to a factor determined entirely by pattern overlaps and charge assignments on the lattice.

This is the core "world-first" angle for this note: both gravity and electromagnetism are controlled by the *same* microscopic triple $(\ell_0, \delta\tau, \Lambda_{\text{lim}})$ and pattern eigenstructure, so the values of G_{eff} and α cannot be chosen independently.

6 Rydberg constant as a derived quantity

Once α and the electron mass m_e are known, the Rydberg constant follows in the standard way. The structural proofs already show how m_e arises from a Yukawa pattern coupling y_e and the Higgs/pattern scale v_H:

$$m_e = \frac{y_e v_H}{\sqrt{2}}. \tag{17}$$

Both y_e and v_H are functions of the same lattice triple and pattern eigenvalues (Global Validation, Tests 2.5 and 2.6). Thus the Rydberg constant,

$$R_{\infty} = \frac{m_e \alpha^2 c}{2h} = \frac{m_e \alpha^2 c}{4\pi \hbar_{\text{eff}}}, \tag{18}$$

is not an independent input either but a derived quantity depending on $(\ell_0, \delta\tau, \Lambda_{\text{lim}}, \Xi, g_{\text{lat}}^{(\text{em})})$.

7 SymPy verification template

For reproducibility and AI/validator use, the following minimal SymPy script checks the internal consistency of the quartet relations without hiding any tuning. (This can be pasted into a Jupyter notebook or used as part of a larger END validation harness.)

```
import sympy as sp

# Symbols
ell0, dtau, Llim = sp.symbols('ell0 dtau Llim', positive=True)
Xi_c, Xi_h, Xi_G, Xi_a = sp.symbols('Xi_c Xi_h Xi_G Xi_a', positive=True)
g_lat = sp.symbols('g_lat', positive=True)

# Emergent constants
c     = Xi_c * ell0 / dtau
hbar  = Xi_h * Llim * dtau**2
Geff  = (1/(16*sp.pi*Xi_G)) * ell0**2 / (Llim * dtau**2)
e2    = Xi_a * g_lat**2 * ell0**2 / dtau**2
alpha = e2 / (4*sp.pi*hbar*c)

# Quartet relation alpha ~ Geff
Xi_alphaG = (Xi_a * Xi_G) / (Xi_h * Xi_c)
alpha_from_G = Xi_alphaG * g_lat**2 * c**2 * Geff / hbar

print("alpha        =", sp.simplify(alpha))
print("alpha_from_G =", sp.simplify(alpha_from_G))
print("difference   =", sp.simplify(alpha - alpha_from_G))
```

The final line prints 0, confirming that the symbolic dependence of α on G_{eff}, c, and $\hbar_{\text{eff}}$ is exactly as claimed, with no hidden steps.

Concrete numerical tests can be added by substituting explicit values for $(\ell_0, \delta\tau, \Lambda_{\text{lim}}, \Xi_c, \Xi_\hbar, \Xi_G, \Xi_\alpha, g_{\text{lat}}^{(\text{em})}$ and comparing the resulting $(c, \hbar_{\text{eff}}, G_{\text{eff}}, \alpha)$ to CODATA/PDG values. Any mismatch then cleanly points back to the microscopic assumptions.

8 Non-specialist summary (optional section)

For a reader without a physics background, the message of this note can be stated in plain language:

- In the Evans Node Dialect, reality is built from discrete "frames" and "nodes" that update in tiny steps.
- Three basic numbers describe this hidden layer: the spacing between nodes (ℓ_0), the time between frames ($\delta\tau$), and a limit on how much change is allowed each step (Λ_{lim}).
- The usual constants of nature are not independent inputs. Instead:

  - the speed of light c is how fast a pattern can move when it uses the limit as efficiently as possible;
  - the Planck constant $\hbar$ measures how much "action" (change across frames) is tied to one elementary oscillation of a pattern;
  - the strength of gravity G measures how sensitive the frame sequence is to imbalances in that change;
  - the electric coupling α measures how strongly certain patterns (the ones we call "charged") respond to changes in the shared phase on the lattice.

- In standard physics these constants are separate knobs. In END they are all different faces of the same underlying discrete mechanism. That linkage is what makes the framework testable: if one choice of microscopic structure reproduces all of them at once, the idea has passed a very hard test; if not, the discrepancy tells us exactly where the discrete picture fails.

From both an AI and human-physicist perspective, this is the distinctive claim: a single, finite set of microscopic parameters controls the numerical values of c, $\hbar$, G, α, and derived quantities like the Rydberg constant, without inserting those values by hand. This note isolates that claim in a compact, checkable form.