

The Vacuum.Net Theory

Definition, Theorems and Tests

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Version 4 — 17 October 2026

This text replaces "The Vacuum.Net Theory: Definition" (versions 1–3) and "The Vacuum.Net Theory: A Formal Statement" (versions 1–5).

Abstract

The vacuum.net theory describes everything that stays as one strand that crosses itself. Its register is the balanced trit (+1, 0, −1). Its one selection rule is closure: what closes in phase stays.

Part I states the theory:

- a formal core with a signature and five axioms;
- a scope clause;
- the definitions;
- fourteen theorems with proofs;
- a translation procedure that assigns every named magnitude a place on one ladder.

Part II states what gives the theory content and how it is tested. It reports every test run so far.

The main result of the tests is clear. Where the theory counts closures, it holds. Where it fixes the size of a measured magnitude, it has not yet shown anything beyond chance. The theory is strong as a law of counting. As a law of size it is open.

Every number in this text was computed for this version, with CODATA 2018 values where constants enter.

Status conventions

Each statement carries one status.

Status	Meaning
proven	follows from the axioms and definitions by the proof given

Status	Meaning
computed	obtained by the stated procedure or algorithm
input	taken from a named source and used as given
corresponded	set beside a published measurement, with the numbers
reading	a pairing of a theoretical quantity with a measured one, without a test
hypothesis	a claim with a test fixed in advance, not yet decided
open	not yet settled

Part I — The theory

1. The frame

A theory of everything is expected to cover all phenomena, be consistent, relate the levels of nature, account for its constants, recover the established theories and predict. These are expectations, not laws of method. Each rests on a view of knowledge. This text states its own view first.

Measurement. A measurement is not an independent judge. An experiment is designed, run and read within a theory (Hanson; Kuhn; Duhem and Quine). This does not make measurements count for nothing. It means that a comparison with data must be fixed before the data are read, or it proves nothing.

Criterion. The theory is judged in two ways.

1. **Translation.** One procedure (Section 6) carries every named magnitude of every field to a place in the net. It is fixed before any case is read and leaves no free choice. Full interpretability in the sense of Tarski — statements to statements, theorems kept — is the aim. It is shown here for magnitudes and exponents, not yet for whole theories.
2. **Plans fixed in advance.** Every claim about the world is tested by a plan that names its data, its statistic and the outcome that counts as failure, before the data are read. The library of the theory already works this way: its plans are recorded and hashed before the data are opened.

Where the theory can fail.

- a named magnitude whose dimension has no rung (Section 6, Step 2);
- a claim of Part II whose plan returns the outcome named as failure.

2. The formal core

2.1 Primitive notions

- **strand**;
- **touching**, the strand meeting itself;
- **phase**, the state in which the strand returns;
- **closure**, the return of a configuration on itself in phase.

2.2 Signature

- an ordered index set I , the course of the strand;
- a set P of places;
- the strand, a map $\sigma: I \rightarrow P$;
- a **touching** is a pair $i < j$ in I with $\sigma(i) = \sigma(j)$;
- a **knot** is a place x with at least two indices in $\sigma^{-1}(x)$;
- a **trit** $\tau(i, j) \in \mathbb{Z}_3$ is assigned to each touching;
- a **window** is three touchings that follow each other in the order of I ;
- a window **closes** when the sum of its three trits is 0 in $\mathbb{Z}_3$.

2.3 Axioms

N1 (Strand). There is exactly one strand σ . Every distinction is a touching.

N2 (Closure). A touching persists if and only if it lies in a closed window. What does not close passes on as tension.

N3 (Memory). At every knot the passages are ordered by I . The first passage fixes the orientation. The trits of later passages are taken relative to it.

N4 (Context). Every constant of the theory is a function of σ , not a fixed number.

N5 (Scale). Let κ_λ merge places into blocks of λ^3 . The coarse strand $\kappa_\lambda \circ \sigma$ satisfies N1 to N4 again. What does not close at one scale is the material of the next.

3. Scope

The theory concerns every distinction that stays. Whatever has received an **accepted name** in a field is such a distinction: physics, life, mind, language, art, law, economy, history. An accepted name marks a closure. The scope is not a list of domains. It follows from N1 and N2, and it has no edge.

4. Definitions

D1 (Winding). A part of the strand that returns on itself in phase.

D2 (Observer). An observer is a knot. It is part of the strand and meets every passage through its place.

D3 (Mesh). An opening between strands, with an extent in space or in time.

D4 (Ladder). A named magnitude q , divided by its natural unit (D7), has position $p = \log_3 q$. The ladder is the set of positions of all numbers $2^a \cdot 3^b$, with a and b integers.

D5 (Address, depth, rest). The address of a position is the pair (a, b) found by the procedure of Section 6. Its depth is $|a| + |b|$. Its rest is $q / (2^a \cdot 3^b)$.

D6 (Closure depth). The closure depths are the k at which the rest of the pair (n, k) , $2^n/3^k$, becomes closer to 1 than at every earlier k . They are the denominators of the convergents of $\log_2 3$: 1, 2, 5, 12, 41, 53, 306, 665, ...

D7 (Inputs and natural units). The physical realisation takes its inputs from CODATA 2018:

- the Rydberg constant $R_\infty = 10,973,731.568160 \text{ m}^{-1}$;
- the proton-to-electron mass ratio $m_p/m_e = 1,836.15267343$;
- the speed of light $c = 299,792,458 \text{ m/s}$;
- Planck's constant $h = 6.62607015 \times 10^{-34} \text{ J}\cdot\text{s}$.

Status: input. In standard physics R_∞ is itself composed of the electron mass, the elementary charge, ϵ_0 , h and c .

The natural units follow by definition. Every deep address depends on the digits below, so they are given in full.

Unit	Definition	Value
R_H	$R_\infty / (1 + m_e/m_p)$	$10,967,758.340 \text{ m}^{-1}$
length S_0	$1/(2R_H)$	$4.5588167 \times 10^{-8} \text{ m}$
time T_0	S_0/c	$1.5206576 \times 10^{-16} \text{ s}$
mass M_0	$h \cdot T_0 / S_0^2$	$4.8482298 \times 10^{-35} \text{ kg}$
energy E_0	h/T_0	$4.3573716 \times 10^{-18} \text{ J} = 27.196575 \text{ eV}$

E_0 equals $2 \cdot h \cdot c \cdot R_H$, the Hartree energy of hydrogen with its reduced mass. *Status: computed.*

5. Theorems

5.1 The dimensional ladder

The physical realisation writes every magnitude as $S^x \cdot T^y$. Motion is S/T , with unit 1, the speed of light (Larson).

Theorem 1 (Passage). Energy per unit time has dimension $1/S$. *Proven.*

Proof. Energy has dimension T/S . Divided by T it gives $1/S$. ■

Passage through a mesh therefore scales with one over its open size.

Theorem 2 (Mass to energy). Mass times the square of motion has the dimension of energy. *Proven.*

Proof. $(T^3/S^3) \cdot (S/T)^2 = T/S$. ■

Theorem 3 (Reciprocity). The exchange R of S and T is an involution, $R^2 = I$, and it maps motion to energy. *Proven.*

Proof. $R(R(S^{x \cdot T} y)) = S^{x \cdot T} y$, and $R(S/T) = T/S$. ■

5.2 The closure register

Theorem 4 (Nine of twenty-seven). Exactly 9 of the 27 windows close. They form a subgroup of $\mathbb{Z}_3^3$ of index 3. *Proven; checked by enumeration.*

Proof. The sum map $\mathbb{Z}_3^3 \rightarrow \mathbb{Z}_3$ is a surjective homomorphism. The closing windows are its kernel, of order $27/3 = 9$. ■

Theorem 5 (Two kinds of closure). A window closes if and only if its trits are all equal or all different. *Proven; checked by enumeration: 3 and 6.*

Proof. All equal gives $3a \equiv 0$. All different gives $0 + 1 + 2 \equiv 0$. Two equal and one different gives $2a + b \equiv 0$, so $b \equiv a$, a contradiction. ■

Every open window joins a pair to a different third value. A seam between two differently closed structures is always open.

Theorem 6 (Crystal directions). Read as trit triples, the low-index directions close as follows: $\langle 100 \rangle$ 0 of 6, $\langle 111 \rangle$ 2 of 8, $\langle 110 \rangle$ 6 of 12. *Proven; checked by enumeration.*

Proof. $\langle 100 \rangle$: the sum is ± 1 . $\langle 111 \rangle$: the sum is ± 3 only when all signs agree. $\langle 110 \rangle$: the sum is 0 exactly when the two signs differ, 2 of 4 sign pairs at each of 3 positions. ■

Theorem 7 (The trit cube). In $\mathbb{Z}_3^3$ read as three axes, the number of cells of grade k is $C(3,k) \cdot 2^k$: 1, 6, 12, 8. The closing cells are the centre, the six grade-2 cells with opposite signs, and $(1,1,1)$ and $(-1,-1,-1)$. *Proven.*

Proof. Choose the k non-zero axes and their signs. The closing cells follow from Theorem 6 by grade. ■

The closing cells match the even subalgebra of the Clifford algebra of space, with its double cover. *Status: reading (structural).*

Lemma 1 (Closure probability). For independent trits with law (p_0, p_1, p_2) and $\hat{p}(z) = p_0 + p_1 z + p_2 z^2$, a window closes with probability $(1/3) \cdot [1 + \hat{p}(\omega)^3 + \hat{p}(\omega^2)^3]$, with $\omega = e^{(2\pi i/3)}$. *Proven.* The uniform law gives $1/3$. The law $(2/3, 1/6, 1/6)$ gives $5/12 = 0.4167$. *Computed.*

Proof. The indicator of $s \equiv 0 \pmod 3$ is $(1/3) \cdot \sum_k \omega^{ks}$. Take expectations over independent entries. ■

5.3 The ladder

Theorem 8 (No gaps). The positions $b + a \cdot \log_3 2$ lie dense on the line. *Proven.*

Proof. If $\log_3 2 = p/q$ were rational, then $2^q = 3^p$, an even number equal to an odd one. An irrational step generates a dense set (Kronecker). ■

There is no last depth.

5.4 The coupling law

Let $e(n)$ be a smooth closing energy as a function of a density n . Write $\bar{g} = e''(\bar{n})$, $\gamma = \bar{n} \cdot e'''(\bar{n})/e''(\bar{n})$ and $\delta = (n - \bar{n})/\bar{n}$.

Theorem 9 (Coupling law). The local coupling $e''(n)$ equals $\bar{g} \cdot (1 + \gamma\delta) + O(\delta^2)$. For a cubic $e(n)$ the relation is exact. *Proven.*

Proof. Expand $e''(\bar{n} + \bar{n}\delta) = e''(\bar{n}) + e'''(\bar{n}) \cdot \bar{n}\delta + O(\delta^2)$. ■

Theorem 10 (Estimator). If a density fluctuates with weight proportional to $\exp(-N \cdot f(x))$, where $f(x) = (a/2)x^2 + (b/6)x^3 + \dots$, then $-\bar{n} \cdot \kappa_3/\kappa_2^2 = \bar{n} \cdot b/a + O(1/N)$. With $f = e$ this is γ . *Proven.*

Proof. Put $x = y/\sqrt{Na}$ and $c = b/(6\sqrt{N} \cdot a^{3/2})$. To first order in c , the mean of y is $-3c$ and its third moment is $-15c$, using $E[y^4] = 3$ and $E[y^6] = 15$. The third cumulant is $-15c + 9c = -6c$. Returning to x gives $\kappa_2 = 1/(Na)$ and $\kappa_3 = -b/(N^2 a^3)$, to leading order. ■

5.5 The lever of a knot

Theorem 11 (Lever in the path realisation). Let σ be a free lattice path in $d \geq 3$ dimensions. Its returns to a visited place are independent, with probability P_d . For an observer that counts the passages it sees minus one, $\gamma = -(1 + P_d)/P_d$. *Proven.*

Proof. The count is geometric with ratio P_d . With $q = 1 - P_d$: mean $1/q$, $\kappa_2 = (1 - q)/q^2$, $\kappa_3 = (1 - q)(2 - q)/q^3$. Then $-\bar{n} \cdot \kappa_3/\kappa_2^2 = -(2 - q)/(1 - q) = -(1 + P_d)/P_d$. ■

For $d = 3, 4, 5$ (Pólya, Watson, Montroll): $\gamma = -3.937, -6.176, -8.398$. *Computed.* The independence of returns belongs to the free lattice path, not to the axioms. Within that realisation γ depends on the freedom of the strand, as N_4 requires.

5.6 Rotation

Theorem 12 (Four is two times two). Let a and b be unit vectors enclosing $\theta/2$, and $R = b \cdot a$. Then $v \mapsto R \cdot v \cdot \tilde{R}$ turns v by θ , $R = \cos(\theta/2) - B \cdot \sin(\theta/2)$, $R(2\pi) = -1$ and $R(4\pi) = +1$. R and $-R$ move v identically. *Proven.*

Proof. Two reflections, $v \mapsto -a \cdot v \cdot a$ and then the same in b , compose to $b \cdot a \cdot v \cdot a \cdot b = R \cdot v \cdot \tilde{R}$. Since $B^2 = -1$, $R(\theta) = \exp(-B\theta/2)$. ■

The rotated object returns after 2π . The rotor that describes it returns after 4π . Four belongs to the description of the path, not to its motion.

5.7 A model

Theorem 13 (A model of N1 to N4). The free lattice path, with a trit on each touching, satisfies N1 to N4. *Proven.*

Proof. It is one map $\sigma: I \rightarrow P$ (N1). Its touchings carry trits, and windows close or not (N2). The order of passages at each knot is the order of I (N3). Its lever is a function of σ through P_d (N4, Theorem 11). ■

N5 is checked on a second structure, the trit lattice (Section 8). A single structure that satisfies all five axioms has not yet been given. *Status: open.*

6. The translation procedure

The procedure takes one input: a subject with an accepted name, as its field describes it. It returns the subject's place in the net.

Step 1 — Entries. List every magnitude the field uses to define the subject, with the uncertainty u the field states. A count or a proportion fixed by definition is **exact** ($u = 0$). Each magnitude is one entry. Nothing is selected.

Step 2 — Rung. The dimension of the entry, $L^x \cdot T^y \cdot M^z$, fixes its role.

Dimension	Example	Role
L or T	size, duration, age, period	mesh (extent in space or time)
L/T	speed	strand (motion)
1/L or 1/T	wavenumber, frequency, rate	passage
$M \cdot L^2/T^2$	energy	winding
$M \cdot L/T$	momentum	impulse
M	mass	knot
none	count, proportion, exponent	window
charge, temperature, amount, luminous intensity	—	no rung yet

Step 3 — Natural value. Divide by $S_0^x \cdot T_0^y \cdot M_0^z$ (D7). A proportion is taken as larger over smaller.

Step 4 — Position. $p = \log_3$ of the natural value.

Step 5 — Address.

- *Measured entry* ($u > 0$). Find integers (a, b) with $|p - (b + a \cdot \log_3 2)| \leq \log_3(1 + u)$, and $|a| + |b|$ as small as possible. Ties go to the smaller $|a|$, then to $a \geq 0$.
- *Exact entry* ($u = 0$). If the value equals $2^a \cdot 3^b$, that is its address, with rest 1. Otherwise it has no address: it is an **open window**, with a rest different from 1 at every depth.

Step 6 — Depth and rest. Read off $|a| + |b|$ and $q / (2^a \cdot 3^b)$.

Laws. A law $\prod q_i^{(e_i)} = C$ is translated by its exponents e_i . Each exponent is an exact entry. It closes when it is $\pm 2^a \cdot 3^b$ and is an open window otherwise. The constant C is a measured entry like any other.

Why exponents. The addresses of measured magnitudes do not add. For the year and the day at $u = 10^{-6}$, the procedure gives $(-83,710, 52,864)$ and $(142,080, -89,599)$. Their difference is $(-225,790, 142,463)$. The address of their ratio is $(76,204, -48,074)$. Smallest addresses within a tolerance need not add, because the ladder is dense (Theorem 8). The exponents of a law are exact, and that is where it can close.
Computed.

Constants. A constant of a field is an entry. By N4 its value is read as a property of the local state.

What an address is. The address of a measured magnitude is a **coordinate**, not a finding. Its depth follows from the stated uncertainty. At $u = 10^{-6}$ the Bohr radius has depth 155,503 with S_0 at full precision. With S_0 rounded to 45.588 nm it has depth 49,575. *Computed.* Findings are closures of exact entries: counts, proportions and exponents.

Theorem 14 (The procedure is a function). Every measured entry with a rung receives exactly one address. Every exact entry with a rung receives exactly one address or is an open window. *Proven.*

Proof. Steps 1 to 4 are fixed computations. For $u > 0$ the admissible set is non-empty by Theorem 8. It is finite under each bound on $|a| + |b|$, so a least depth exists, and the tie rule picks one pair. For $u = 0$, a value is $2^a \cdot 3^b$ for at most one pair, by unique factorisation. ■

Worked cases. *Computed.*

Subject	Field	Rung	u	p	Address	Depth	Rest
octave	music	window	exact	0.631	2^1	1	1
fifth	music	window	exact	0.369	$2^{-1} \cdot 3^1$	2	1
Pythagorean comma	music	window	exact	0.012	$2^{-19} \cdot 3^{12}$	31	1
counts 2, 3, 4, 6, 8, 9, 12	arithmetic	window	exact	—	$2^a \cdot 3^b$	—	1
counts 5, 7, 10, 11, 13	arithmetic	window	exact	—	none: open window	—	$\neq 1$
group of about 150	sociology	window	0.1	4.561	$2^1 \cdot 3^4$	5	0.926
generation of about 30 years	demography	mesh	0.1	51.966	3^{52}	52	0.964

Subject	Field	Rung	u	p	Address	Depth	Rest
Kondratieff wave of about 50 years	economics	mesh	0.1	52.431	$2^{-1} \cdot 3^{53}$	54	1.071
Bohr radius	atomic physics	mesh	10^{-4}	-6.152	$2^{3558} \cdot 3^{-2251}$	5,809	0.99993
year	astronomy	mesh	10^{-4}	48.870	$2^{-6367} \cdot 3^{4066}$	10,433	1.00008
day	astronomy	mesh	10^{-4}	43.499	$2^{-7336} \cdot 3^{4672}$	12,008	1.00007

Part II — Content and tests

7. What gives the theory content

By Theorem 8 and Theorem 14, every measured magnitude receives an address. An address alone therefore says nothing. The content lies in three claims. Each is a counting claim or is tested against chance.

H1 (Sizes). Measured subjects with an accepted name lie shallower on the ladder than random positions with the same uncertainty. *Hypothesis.*

Plan. For each entry, draw 400 random positions uniformly in $[p - \frac{1}{2}, p + \frac{1}{2}]$ with the same u , and compute their depths. The entry's percentile is the share of random positions that are shallower, counting ties as half. If H1 is false, percentiles average 0.5. Failure: a mean percentile of 0.5 or more over the full catalogue.

H2 (Counts). Exact counts that a field names as stable — numbers of parts, of states, of members — are of the form $2^a \cdot 3^b$ more often than numbers of the same size.

Hypothesis.

Plan. Over a fixed list of stable named counts, compare the share of $2^a \cdot 3^b$ with the share among all whole numbers in the same range. Failure: no excess at the 5 % level.

H3 (Laws). The exponents of the established power laws are $\pm 2^a \cdot 3^b$ more often than reduced fractions of the same size. *Hypothesis.*

Plan. Over a fixed list of at least twenty established power laws, take each exponent p/q in lowest terms. Compare the share of exponents of the form $\pm 2^a \cdot 3^b$ with the share among all reduced fractions r/s with $r, s \leq \max(|p|, q)$. Small integers are mostly of that form, which is why the comparison is with fractions of the same size. Failure: no excess at the 5 % level.

8. Results so far

8.1 H1 on the worked cases

Computed, 400 random positions per case:

Subject	Depth	Median depth at random	Percentile
group of about 150	5	5	0.27
generation of about 30 years	52	53	0.20
Kondratieff wave of about 50 years	54	54	0.69
Bohr radius	5,809	6,270	0.47
year	10,433	7,006	0.67
day	12,008	7,334	0.72

The mean percentile is 0.50. These six cases do not support H1. The intervals of music are excluded, because they are built from 2 and 3 by construction. The full run belongs on the catalogue of the reference works and the MAZE; two of the reference works alone order 2,407 and 2,702 values.

8.2 The ledger of the library

The library of the theory fixed tests in advance between 11 and 17 October 2026. Its audit of 17 October reports the outcomes below. They were computed in the library and not re-run for this text. *Status: computed in the library.*

Where the theory counts closures.

Test	Outcome	Note
Colour confinement: $q - a \equiv 0 \pmod 3$	all six measured kinds of hadron inside	also standard SU(3) triality
Calendar cycles as convergents of year over month	2, 3, 8, 11, 19 years; Metonic rest 0.0868 day	not blind
Genetic code and the Klein group of the bases	14 of 16 boxes in the standard code	not blind
Particle and antiparticle equal	5 of 5 within 3σ	also standard CPT
Bonding within the derived potential	91 of 93 in PubChem; none outside	—
Alkanes as trees of degree at most four	all up to C ₁₂ inside	also standard valence
Layers of self-maintained hierarchies step by 2–4.5	two blind rounds, all decided cases fit	—

Test	Outcome	Note
Leaf pairs near the golden ratio	Spearman $\rho = -0.71$, $p = 0.0011$	—

Where the theory fixes a size.

Test	Outcome
Lamb shift from the net's rule	12.7 MHz against 1057 MHz: a factor 83. Failed
Cyclohexane twist within 5° of 60°	54.9° . Failed by the letter
Step between brain rhythms 2.85–3.15	2.73. Failed
Critical sensitivity exponent 1	measured 1.26 ± 0.02 . Not supported
Battery lengths on whole steps of three	not closer than chance, $p \approx 0.19$. Not supported
Realised fraction of alkanes falls with size	stays 1 up to C_{12} . Failed
Rhythms of history near half layers	28 %, $p = 0.18$ without the text's own lengths. Not shown
Fixed tension thresholds as alarms	failed three times

The pattern. The counts follow from the window rule and its group structure. Several of them are also standard results; there the theory reproduces, it does not yet discriminate. The sizes each needed a value the axioms do not supply: a coefficient, a threshold, a unit or a step. *Status: reading, summarising both tables.*

8.3 The models

Computed.

- **The trit lattice** has a first-order transition. Its coexistence temperature is $T^* = 1.64 \pm 0.02$ for sizes 12, 24 and 36, with no drift in size. This is the check of N5.
- **The free path** gives trit shares 0.667, 0.167, 0.167 against the proven $2/3$, $1/6$, $1/6$. It gives 0.224 knots per step against $(1 - P_3) \cdot P_3 = 0.2246$, and closed windows 0.424 against $5/12$ for independent trits.
- **The knot lever** over 7.2 million knots is -3.946 ± 0.006 against -3.937 from Theorem 11.
- **Near a wall**, on the half-space with the step towards the wall removed, the lever is $\gamma(1) = -3.44$, $\gamma(3) = -3.63$, $\gamma(10) = -3.85$ (400,000 walks per height). The library reproduced these values within 1.8 standard errors.
- **Rotors along the path**: one loop through a knot closes the object only in 98.4 % of cases, and two loops restore the rotor in 78.8 %. The trit closure does not distinguish the two classes (2.5 % against 2.6 %).

- **Staying events along one path** are correlated as roughly $1/t$, and their variance grows as $\ell \cdot \ln \ell$. The stretch estimator therefore measures this memory, not the lever.

8.4 Comparisons with published measurements

Statement	Measurement	Status
Open directions carry passage (Theorem 6)	$\text{Li}_4\text{Ti}_5\text{O}_{12}$ at 3C: (100) 313 > (111) 283 > (110) 277 mAh/g (Cunha et al. 2019)	corresponded
Same	LiMn_2O_4 : (100) 129 > (110) 113 > (111) 95 mAh/g; retention 87 % > 78 % > 76 % (Hendriks et al. 2018)	(100) first agrees; (110) against (111) not supported
Passage $\propto 1/S$ (Theorem 1)	cavity conductance $\propto 1/L$, 33–1,100 nm (Moddel et al. 2021; fit by Maclay 2024)	corresponded
Lever of a wall that changes density	GST: force contrast 0.40 over $\delta = 0.068$ gives +5.9; AIST gives +3.3 to +4.8	reading: mass density, not the passage density of Theorem 11

9. The expectations

Expectation	State in this version
All phenomena	Scope clause: every distinction with an accepted name.
Consistency	N1 to N4 have a model (Theorem 13). N5 is checked on the trit lattice. One structure for all five is open.
Relation of the levels	N5, checked: the lattice transition does not drift with size.
Self-reference	The observer is a knot on the strand (D2). The ladder has no last depth (Theorem 8).
Constants	N4: constants are functions of the strand; shown for the lever (Theorem 11). Inputs: four CODATA values (D7).
Established theories	Every magnitude with a rung and every power-law exponent is translated (Theorem 14). Whole theories with their theorems: open.
Prediction	

Expectation	State in this version
	Plans fixed in advance (Section 7). Counting claims hold in the library ledger. Size claims have not yet shown anything beyond chance.

10. Open, in order

1. **H2 and H3**: fix the lists and run the plans.
2. **H1** on the full catalogue.
3. **One theory translated in full**, with its axioms and theorems. Kepler's laws are a candidate: their exponents 2 and 3 are themselves of the form $2^a \cdot 3^b$.
4. **One structure** satisfying all five axioms, and the axioms written in Lean.
5. **Rungs** for charge, temperature, amount of substance and luminous intensity.
6. **The inputs**: derive R_∞ , the mass ratio, c and h , or show why they stay inputs.
7. **The sizes that failed**: the Lamb shift, the brain-rhythm step, the critical exponent.
8. **The remaining translations**: the forces of nature, the spectrum of particles, quantum mechanics and general relativity.

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Kuhn, T. S. (1962). *The Structure of Scientific Revolutions*. University of Chicago Press. *Why read?* Why observation is theory-laden.

Stanford Encyclopedia of Philosophy. "Underdetermination of Scientific Theory." <https://plato.stanford.edu/entries/scientific-underdetermination/> *Why read?* Duhem-Quine in its precise form: no single measurement decides, which differs from measurements not counting.

Lakatos, I. (1970). "Falsification and the Methodology of Scientific Research Programmes." In *Criticism and the Growth of Knowledge*, Cambridge University Press, 91-196. *Why read?* Why a programme needs claims it fixes in advance. The source of the plans of Section 7.

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