The Vacuum.Net Theory

Complete Derivation, from Axioms to the Two Roads of Energy

Part One of two. Part Two, the application, is separate and not public.

J. Konstapel, Leiden, 28 September 2026 — First edition

Abstract

The Vacuum.Net theory is physics rewritten in a shorter notation. Its image is a fishnet in water: strands under tension, knots where strands wind around each other, meshes between them. Five axioms fix the notation. From them, with the ladder of Grassmann and Larson and the natural units of Larson, this document derives what current physics calls energy, mass and power, and places them on one ladder: strand, winding, knot, mesh. It then derives the two ways in which energy leaves the net. A mesh passes: what comes through is one over the open dimension of the mesh, with an independently known size at one natural unit of space, 45.6 nm, and a measured slope on the one published mesh (−1 predicted, –0.9 ± 0.15 read). A knot opens: when the outward stretch of a knot equals one of its closures, grade three falls to grade two, and $E = mc^2$ is that one rung read off. The second road is Larson's, with its equation for the vibrational mass, its stability limit of 236, its ladder of levels 118 → 92 → 79 → 71, and its correct 1988 placing of bismuth-209 as barely radioactive, measured in 2003. Planets read; stars open. Every derivation is written out with its numbers. Every statement carries one of five statuses. No reference needs to be opened to follow any step. The application that follows from the first road is named in Appendix A as a possibility and worked out in Part Two.

1. The image and the claim

The image throughout is a fishnet in water. Its strands run everywhere, through air, stone and body, and are always under tension. Where strands wind around each other, knots appear. That is matter. Between strands lie meshes: openings with a shape and a size. A winding persists only if it returns in phase inside its mesh. What does not fit does not stay.

The claim is not that this is a new physics beside the existing one. The claim is that it is the existing physics written shorter. Every rewriting in it can be reversed: where the short notation seems to lack a rule, the reverse step finds the rule in the existing notation, and the forward step writes it in net terms. Casimir, Larson, Grassmann, Williamson, Milgrom, Moddel: none of them is overruled. Each is read one rung up or down the same ladder.

A notation is good when it makes the next step short. The measure of this document is how many steps are one line.

2. The five axioms and the register

N1, Strand. There is one strand. Every distinction is the strand touching itself.

N2, Closure. A configuration persists only if it closes on itself. What does not close does not persist as a configuration; its tension moves to the neighbouring meshes.

N3, Memory. The net keeps the orientation of what was first laid down.

N4, Context. Constants are state functions of the local vacuum. Nothing is universal; everything is local and read.

N5, Scale. The same winding appears at every depth.

The register. From N1 and N3 follows a three-valued state per strand: $+1, 0, -1$. A strand passes in one sense, in the other sense, or does not pass. This is the trit. An address in the net is a depth plus a number in balanced ternary. Section 3 shows that the trit is not an extra assumption: it is the orientation of Grassmann's elements and the scalar direction of Larson's motion, written as a digit.

Four words. A strand is the net itself, under tension. A winding is a strand that returns on itself in phase. A knot is windings holding each other in three directions. A mesh is an opening between strands, with one or more open dimensions.

Five statuses. Every statement below carries one: taken from a source; derived; corresponded (a net quantity set beside an existing one, without a derivation of their identity); checked against a measurement; open. The ledger is in Section 11.

3. The ladder

3.1 Grassmann: extension and orientation

Grassmann's *Ausdehnungslehre* (1844) rests on one operation, the outer product $a \wedge b$, with $a \wedge a = 0$ and $b \wedge a = -a \wedge b$. From this follow the grades:

- grade 0: a number;
- grade 1: a directed stretch, a vector;
- grade 2: $a \wedge b$, an oriented plane element, a bivector;
- grade 3: $a \wedge b \wedge c$, an oriented volume element, a trivector.

In three dimensions the ladder ends at grade 3. Orientation is not a number but a sign that travels with the element. A bivector has two orientations. A degenerate bivector, spanned by parallel vectors, has area zero and no orientation. Every element therefore has three states: +, −, none.

3.2 Hamilton, Clifford, Maxwell: one product, two parts

Hamilton's quaternion (1843) is $q = a + v$, a scalar and a three-vector in one number. For pure vectors, $ab = -a\cdot b + a\times b$: one product, a metric part and an oriented part. Clifford (1878) joined Grassmann and Hamilton in the geometric product $ab = a\cdot b + a \wedge b$. Maxwell's *Treatise* (1873) uses this: the operator ∇ on a vector gives one quaternion whose scalar part is what is now called divergence and whose vector part is what is now called curl. One operation, two grades.

This is all the algebra the theory needs: grades, orientation as a sign with a degenerate case, and a product that carries two parts.

3.3 Larson: nothing but motion

Larson's reciprocal system (1959) has one postulate: the universe consists of motion, the ratio of space to time, S/T. Space and time are reciprocal; unit motion is S/T = 1. Every quantity is a power of that ratio:

quantity	dimension
motion, speed	S/T
energy	T/S
momentum	T^2/S^2
mass	T^3/S^3

Speed is grade 1; momentum grade 2; mass grade 3. Energy is speed inverted: motion turned back. Two things follow. Mass is three-dimensional motion in reverse, not a substance. And no quantity is a stock: a ratio holds nothing.

Larson adds a distinction that vector algebra does not hold. Every motion has a scalar direction, inward or outward, and a vectorial direction, such as east or west. A photon moving east and one moving west from the same source are both moving outward. A scalar motion can rotate: its vectorial direction turns while its scalar direction stays. Gravitation is inward scalar motion. Scalar motion has three dimensions of its own, S, and time three, T. Together $V = S \oplus T$, six dimensions. Reciprocity is an involution R: $R(S) = T$, $R(T) = S$, $R^2 = I$.

3.4 The net's rows

net	Larson	Grassmann	Williamson–van der Mark
strand	S/T	grade 1	free photon
winding	T/S	grade 2	photon on a closed loop
knot	T^3/S^3	grade 3	electron as torus
mesh	S, open	grade 2, empty	—
passage per period	1/S	—	—
trit +1 / −1	scalar direction out / in	orientation + / −	—
trit 0	no scalar motion	degenerate element	—
N3	scalar direction kept under rotation	the sign travels	double cover, 4π

Row 1, strand. One ratio, one directed stretch, one photon on an open path. One extension in one direction.

Row 2, winding. A strand that returns on itself spans a plane: grade 2. In Larson, motion that returns is motion inverted: T/S, energy. So a winding is what current physics calls energy. Nothing is inside it. It is the strand, closed.

Row 3, knot. Windings holding each other in three directions span a volume: grade 3, T^3/S^3, mass. A knot is what current physics calls mass.

Row 4, mesh. An opening with area and orientation and no strand inside: a bivector without content, open space S.

Row 5, passage. Energy per time is (T/S)/T = 1/S. Passage per period is the inverse of the open space. What current physics calls power is one over the open dimension of a mesh. Derived in one line, without a source.

Rows 6 and 7, the trit. Larson's scalar direction has two values. Grassmann's orientation has two signs and the degenerate case. The register has +1, −1, 0. The trit is scalar direction written as a digit; zero is the degenerate element.

Row 8, memory. N3, Larson's constancy of scalar direction under rotation, Grassmann's carried sign, and Williamson's 4π are four writings of one rule.

Machine check. The identities momentum = mass × speed, energy = momentum × speed, power = E/T = 1/S, the bivector count 3 + 9 + 3 = 15 on S ⊕ T, and dim Cl(3,3) = 2^6 = 64 are checked symbolically on the MAZE platform (larson.py, eleven checks, run by Claude Code).

4. Williamson and van der Mark: 2π and 4π

Williamson and van der Mark (1997) write the electron as a photon confined to a double loop, a torus. One loop of one wavelength is one winding; its phase advances 2π per return. The double loop needs 4π to return to its starting frame: spin one half, the double cover. That is why row 8 keeps a sign through a half-turn.

Two numbers enter the theory from here. 2π is the phase of one closure. 4π is the return of a knot's frame. Both are taken from the source, and both reappear in Section 6 as the lever of the net and in Section 8 as the geometry of the knot.

5. Larson's natural units

Larson derives natural units from two measured constants, the Rydberg frequency R_∞c = 3.290×10^{15} Hz and the speed of light c = 2.998×10^{8} m/s. The unit of time is one half-period of the Rydberg frequency; the unit of space is that time times c.

- unit of time: $T_0 = 1/(2 \times 3.290 \times 10^{15}$ Hz$) = 1.521 \times 10^{-16}$ s
- unit of space: $S_0 = c \times T_0 = 2.998 \times 10^{8} \times 1.521 \times 10^{-16} = 4.559 \times 10^{-8}$ m = 45.6 nm
- unit of energy: $E_0 = 1.492 \times 10^{-10}$ J (Larson's unit mass times c^2)
- inter-regional ratio: 156.444 (Larson's ratio between the region outside unit space and the region inside it)
- unit of space inside the time region: S_0 / 156.444 = 0.291 nm

Which unit belongs to which rung. E_0 is mass times c^2: the energy of a unit knot, grade 3. It does not belong to a mesh, grade 2. The energy that belongs to a mesh is derived in Section 7 by the reverse step and is ten orders smaller. Confusing the two rungs is the one error this theory has made on its own path, and it is recorded in Section 11.

The knee. A mesh of one open dimension L closes windings in proportion to 1/L (row 5). Below S_0 no winding fits: the smallest winding is one unit of space. So the curve of passage against L rises to $L = S_0$ and is flat below. The knee is at 45.6 nm, and that is a prediction of the theory, not a reading from any device.

6. The state of the net

6.1 χ, the local state

χ is dimensionless. Two readings are in use.

- $\chi\_\Phi = |\Phi|/c^2$, the gravitational potential at the site over c^2. At the Earth's surface: $GM = 3.986 \times 10^{14}\ m^3/s^2$, $R = 6.371 \times 10^6$ m, $c^2 = 8.988 \times 10^{16}\ m^2/s^2$; $\chi\_\Phi = 3.986 \times 10^{14} / (6.371 \times 10^6 \times 8.988 \times 10^{16}) = 6.96 \times 10^{-10}$. It is what sets gravitational redshift and clock rate.
- $\chi\_a = a/(cH_0)$, the local acceleration over cH_0. With $H_0 = 2.27 \times 10^{-18}\ s^{-1}$, $cH_0 = 6.80 \times 10^{-10}\ m/s^2$. At the Earth's surface, $a = 9.81\ m/s^2$, $\chi\_a = 1.44 \times 10^{10}$; in the outskirts of a galaxy, $a \approx 10^{-10}\ m/s^2$, $\chi\_a \approx 0.15$.

Whether the two readings are one χ is open.

6.2 δ, γ and the constitutive law

δ is the local density deviation, $(n - n_0)/n_0$, with n the density of the medium and n_0 the reference. The energy per volume of the medium is $e(n) = g_2 n^2 + g_3 n^3$. The effective coupling is the curvature, $g\_eff = d^2e/dn^2$ around $\bar{n}$; with $n = \bar{n}(1 + \delta)$:

$$g\_eff = \bar{g}\,(1 + \gamma\delta), \text{ with } \bar{g} = 2g_2 + 6g_3\bar{n} \text{ and } \gamma = 6g_3\bar{n}/\bar{g}.$$

γ is the lever. It is the phase of one closure, 2π, taken from Williamson and van der Mark (Section 4): the coupling of the net responds to a density deviation with one full turn of the winding per unit of deviation. Then $2g_2 = (1 - 2\pi)\bar{g} = -5.283\ \bar{g}$. Of the gross stiffness, $(2\pi - 1)/2\pi = 84.1\%$ is cancelled and $1/2\pi = 15.9\%$ remains. A medium with most of its stiffness cancelled stands near its critical point, and there a small δ gives a large response.

6.3 The threshold

The bridge from δ to χ is $\delta = k\cdot\chi\_a$. The crossover between the two regimes of g_eff lies at $\gamma\delta = 1$, hence at $a_0 = cH_0/(\gamma k)$. The measured threshold of galactic rotation is $a_0 \approx 1.2 \times 10^{-10}\ m/s^2$ (Milgrom 1983; McGaugh, Lelli and Schombert 2016). So $\gamma k = 6.80/1.2 = 5.7$, and with $\gamma = 2\pi$ the bridge factor is $k = 0.91$. And $cH_0/2\pi = 1.08 \times 10^{-10}\ m/s^2$, within 10% of a_0: the phase of one loop and the galactic threshold are one number read at two depths. That is N5.

6.4 α stiff, δ soft

The fine-structure constant $\alpha = 1/137.036 = 0.0072974$ composes with χ as $\Delta\alpha/\alpha = \beta\ \Delta\chi$, with $\beta = \alpha/4\pi = 5.81 \times 10^{-4}$. A 1% shift in α needs $\Delta\chi = 0.01/5.81 \times 10^{-4} = 17$. The Earth's χ_Φ is 7×10^{-10}. Nothing reachable moves α. Atomic-clock comparisons confirm α constant to better than one part in 10^{17} per year. By contrast, $\delta = 0.01$ gives $\Delta g\_eff/g\_eff = 2\pi \times 0.01 = 6.3\%$. All control goes through δ, none through α. Section 7 says how δ is set: by a mesh.

7. The first road: a mesh passes

7.1 The rule

Row 5: passage per period is 1/S. For a mesh with one open dimension L, passage $\propto L^{-1}$, exponent −1. Smaller mesh, more passage, down to the knee at S_0.

7.2 The size, by the reverse step

The existing notation of what a two-wall mesh closes is Casimir's count of 1948: per unit area of a cavity of size L, the field energy removed is $\pi^2\hbar c/(720\ L^3)$. Per mesh of L × L that is

$E\_mesh(L) = \pi^2\hbar c/(720\ L)$,

the same 1/L as the ladder, now with a size. The Casimir expression is not taken as a mechanism. It supplies an independently known 1/L scale, which the ladder assigns to a mesh of the same dimension. At $L = S_0 = 45.6$ nm:

$E\_mesh = (9.87 \times 1.055 \times 10^{-34}\ \text{J·s} \times 2.998 \times 10^{8}\ \text{m/s}) / (720 \times 4.559 \times 10^{-8}\ \text{m}) = 9.5 \times 10^{-21}$ J.

7.3 The rate

How often a mesh releases what it closes, the theory does not yet fix. The model takes one passage per natural unit of time: $P\_model = E\_mesh/T_0 = 9.5 \times 10^{-21} / 1.521 \times 10^{-16} = 6.3 \times 10^{-5}$ W per mesh. This is a conditional prediction and is labelled so.

7.4 The test

Moddel, Weerakkody, Doroski and Bartusiak (2021) built a mesh with one adjustable dimension: two walls a distance L apart, one reflecting (aluminium, 150 nm), one open (palladium, 8–12 nm), with a filling of 33 to 1100 nm. They measured the current at each L, with eight artefact tests, and found a maximum of 1.4×10^{-12} W from 0.02 μm^2 at L = 33 nm, stable to within 10–20% after six months.

Row 5 predicts a slope of −1 in L. The slope of their published curve (Figure 4b), read from the figure, is -0.9 ± 0.15. The interval contains −1. The ladder matches the measured slope within the reading error, not only its sign. Write $s(L) = L^{-1} \cdot F(L)$ with F the part that belongs to the walls: F carries L^(+0.1), almost flat. A count of standing windings between the walls, the usual route, gives L^{-3} and leaves F to carry L^(+2.1). The ladder's row leaves the least to the material.

Of what the mesh closes, the palladium wall delivers 1.5×10^{-13} W per mesh of one unit (Moddel's 1.4 pW scaled to $(45.6\ \text{nm})^2 = 2.08 \times 10^{-15}\ \text{m}^2$), that is 2.4×10^{-9} of the model passage. That fraction is the coupling of that wall, at the model rate. It is measured, not derived.

7.5 The choice of material

The theory does not compute the coupling of a wall. It does say which side should close and which should not, and at which depth.

N5: the same winding appears at every depth. The unit of space outside is S_0 = 45.6 nm; inside the time region it is S_0/156.444 = 0.291 nm (Section 5). A wall closes a winding of one unit at both depths when its own atoms stand one unit apart at the inner depth. Metals whose nearest-neighbour spacing sits at 0.291 nm: aluminium 0.286, silver 0.289, gold 0.288. Metals away from it: palladium 0.275, tungsten 0.274, copper 0.256.

So the theory's guidance for the highest yield is:

- **Closed wall:** a metal at the inner unit, 0.291 nm. It closes at both depths. Aluminium, silver or gold. Moddel's aluminium mirror is on this side, and it is why his stack closes at all.
- **Open wall:** a metal as far from the inner unit as possible, so that it closes as little as possible and passes the most. Palladium is already off the unit; copper is further off. The prediction is that coupling rises as the open wall's spacing moves away from 0.291 nm.
- **Mesh:** one unit, 45.6 nm, for every choice of walls.

This is a prediction of the theory, from N5 and Larson's ratio, not a measured result. It gives the order in which materials should be tried and the direction in which to move. How far each step gains is the optimisation, and that is Part Two.

7.6 What the first road removes

There is no source: a winding is the strand, closed. There is no reservoir: a ratio holds nothing. There is no conservation rule as a separate statement: N2 says what persists. There is no flux per area: passage is per mesh, and meshes are counted, not integrated. Current physics writes energy with a family of words, source, stock, consumption, conservation, flux, and each is a separate rule. On the ladder all of them are one rung, T/S, and one operation, closure. The ladder introduces no reservoir variable; any device built on it is therefore tested on its measurable energy balance, not on an assigned reservoir.

8. The second road: a knot opens

8.1 Larson's rule

An atom is rotation with a time displacement, inward. Thermal motion and electric ionization are space displacements, outward. Ionization runs up to the atomic number; beyond that only thermal motion adds. When the sum of the outward displacements equals one full unit of the atom's two-dimensional (magnetic) rotation, the two cancel, that rotational unit ends, and its displacement reverts to the linear basis. Mass, T^3/S^3, becomes energy, T/S, and leaves as radiation. The element drops to a lower magnetic group. Heavier elements carry more ionization units and reach the equality at lower temperature (Larson 1959, Ch. 32; 1988, Ch. 17).

8.2 One rung down

$T^3/S^3 \rightarrow T/S$ is knot → winding. The factor between them is T^2/S^2, grade 2, and that factor is what current physics calls c^2:

$E = m \cdot c^2 = (T^3/S^3) \cdot (S^2/T^2) = T/S$.

Einstein's equation is the ladder read one rung down. Larson says the same: mass and energy differ only in dimension. In net terms: a knot is a winding closed in three directions; the outward stretch of the strand is what is called heat and ionization; when the stretch equals one of the three closures, that closure opens; the knot is a winding again; what leaves is the winding, T/S, into the net. No source, no stock: one closure fewer.

The smallest case. Electron and positron: one unit inward in space against one unit inward in time. On contact both closures cancel and two windings leave in opposite directions. Larson takes the atomic case as the extension of this one and marks it as deduction without direct observation. That status is kept.

8.3 The vibrational mass and the level

An element's mass is rotational mass m_r plus vibrational mass m_v. The vibrational part is set by the environment's magnetic ionization level I (Larson 1988, Ch. 24, equation 24-1):

$m\_v = I \cdot m\_r^2 / 156.444$,

with m_r in units of atomic number, m_v in units of atomic weight, and 156.444 the inter-regional ratio of Section 5. The result is the centre of a zone of isotopic stability. Lead: m_r = 82, I = 1: m_v = $82^2/156.444 = 43.0$; total $2 \times 82 + 43 = 207$ against 207.2 measured. Larson's Table 35 runs Z = 1 to 92 on this equation; sixty percent of the elements fall within one unit of the measured centre. Note the form: a vibrational quantity proportional to the square of the rotational one, divided by a region ratio.

The level I is the concentration of magnetically charged neutrinos taken up by the matter; Larson calls it the magnetic temperature. It rises with the age of an aggregate, by cumulative capture; the transfer from neutrino to atom is irreversible under terrestrial conditions. At the Earth's surface I is close to 1.

8.4 The limit and the levels

An element whose total mass exceeds 236 units must shed mass: alpha decay, the emission of a helium unit, 4-0 in Larson's notation. Element 118, rotational mass 236 on its own, disintegrates at once. U-238 is 184-54: 184 rotational, 54 vibrational, 238, just over the line, half-life 4.5×10^9 years. Its chain runs by alpha steps that shed rotational mass and beta steps that rebalance the vibrational part, to Pb-206, 164-42, inside the limit on both counts.

At I = 0 all 117 possible elements are stable and there is no alpha radioactivity. Larson gives the drop of the stability limit per level: the first unit of ionization lowers it from 118 to 92, the second by 13 to 79, the third by 8 to 71, roughly halving each step. So at I = 1 uranium and heavier are unstable; at I = 2, gold and heavier; at I = 3, lutetium and heavier.

8.5 Thorium and bismuth

Th-232 (Z = 90) sits at its equation-24-1 centre with one charge, total 232, under the limit, yet alpha-active with a half-life of 1.4×10^{10} years. Larson's Chapter 24 carries it: some atoms carry no gravitational charge and some carry two, and a second charge doubles m_v. Thorium with two charges: 180 + 104 = 284, over 236; that atom disintegrates. The element is stable; the doubly charged fraction of its atoms is not. Larson sets the lowest element that could become unstable this way at gold (Z = 79) and calls the instability negligible below bismuth (Z = 83). Bismuth with two charges: 166 + 88 = 254. Bi-209 was measured alpha-active in 2003, fifteen years after the book, half-life 1.9×10^{19} years. The rule as written in 1988 has that case in it.

8.6 Planet and star

A planet: no knot reaches stretch = closure. It reads, passage 1/L per mesh, and nothing more. A star: the central stretch reaches it for the heaviest knots present, and with rising mass for successively lighter ones (Larson 1984, Ch. 4: the Wolf–Rayet stars at the nickel limit, the Type I supernova at the iron limit). That is the output. It is set per element, not per place. So the star is not a mesh, and the mesh is not a star. Radioactivity on Earth is the second road at I = 1, for everything past 236.

Larson also computes the secondary-mass difference in 4 H → He, 0.0259 amu, and accepts it as a source of kinetic energy in principle. He rejects it as the stellar source: the reaction is reversible, runs against the probabilities at high temperature, and is a one-way process where the postulates require cycles. On the ladder: joining knots does not open a closure; only stretch = closure does.

8.7 Why the second road is not yet engineered

To open a lighter knot, I must rise. Two things are missing, in both notations. There is no source: matter must take up more magnetically charged neutrinos than age supplies, and a neutrino with a magnetic charge that stays in matter is not a measured thing in the existing notation; for the first road the reverse step led to Casimir, here there is nothing to reverse to. There is no instrument: I has one measurement place, the centre of the isotope zone, which moves on geological time; and the isotope distribution is uniform over the Earth, so I = 1 everywhere, within the resolution of the standard atomic weights. The second road therefore waits on a measurement, not on a derivation: two samples of a non-neutron-capturing material, one kept for years beside a strong neutrino source, and the shift of the isotope centre per equation 24-1. Larson predicts a shift; the existing notation predicts none.

9. What the theory says, in one table

what current physics calls	on the ladder	how it is set
energy	a winding, T/S	closure (N2)
mass	a knot, T^3/S^3	three closures
power	passage per period, 1/S	one over the open dimension
c^2	the factor T^2/S^2 between rungs 3 and 2	reading one rung down
the fine-structure constant	stiff; $\beta = \alpha/4\pi$	not a control
the density deviation δ	soft; $\Delta g/g = 2\pi\delta$	the control, set by a mesh
the galactic threshold a_0	$cH_0/2\pi$	the lever at galactic depth
radioactivity	the second road at I = 1	Larson's limit, 236

the sun	knots opening from the heaviest down	stretch = closure
a planet	a body that reads	no knot at its limit

Two roads. A mesh passes: 1/L per mesh, counted. A knot opens: one rung down, per element. The first can be set by construction; the second, on Earth, runs by itself for everything past 236 and waits on a measurement for anything lighter.

10. Open rows

- **The rate per mesh.** One passage per T_0 is a model assumption. The theory fixes the energy per mesh, not yet the frequency of release.
- **h.** The 2024 reading $h = S^2/T$ does not fit the table. From row 2 and h = E/f: $h = T^2/S$ if $f = 1/T$, $h = T^2/S^2$ if frequency is read as a speed. The second gives h the dimension of momentum: h would be the winding itself, counted once. Which holds is open.
- **The two readings of χ.** Whether χ_Φ and χ_a are one χ. The threshold of Section 6 is calibrated on χ_a alone.
- **Mixed closure.** Larson's six-dimensional structure $S \oplus T$ admits bivectors $s \wedge s$, $t \wedge t$ and mixed $s \wedge t$. The algebra Cl(3,3) has $2^6 = 64$ elements, the same count as Rowlands' nilpotent structure; whether they are the same structure is an isomorphism question, answerable. On the one-dimensional ternary lattice, stepwise outward tension on a knot gives no opening: one opposite unit is digested and the knot re-closes lighter (0 of 9 emissions; MAZE platform, plan hash 0b7c462b…). That lattice carries at most one closure per knot; stretch = closure needs three, so the test belongs on a two- or three-dimensional lattice.
- **The raising of I.** No source, no instrument; one measurement bears on it (Section 8.7).

11. Status

- **Taken from the sources.** Grassmann's grades and orientation (1844). Hamilton's scalar-plus-vector (1843). Clifford's product (1878). Maxwell's quaternionic ∇ (1873). Larson's table, scalar direction, six dimensions, reciprocity (1959; 1988), natural units and inter-regional ratio (1959, Ch. 13), destructive-limit rule (1959, Ch. 32; 1988, Ch. 17), equation 24-1 and Table 35, the 236 limit, the 117 elements, the levels 118 → 92 → 79 → 71, the double-charge rule, the uranium chain (1988, Ch. 24–25), the stellar order (1984, Ch. 4). Williamson and van der Mark's loop and double loop (1997), and with them $\gamma = 2\pi$ as the phase of one closure. Casimir's count (1948). Milgrom's a_0 (1983); McGaugh, Lelli and Schombert's measurement (2016). Moddel's device and numbers (2021), and the 2024 analysis that no closed model of that device yet exists.
- **Derived.** The ladder's rows 1–5 and their identities (machine-checked). The trit as scalar direction with the degenerate element as zero. Reciprocity as $R^2 = I$. Passage per period = 1/S. The knee at $S_0 = 45.6$ nm. $E\_mesh = 9.5 \times 10^{-21}$ J at one unit, as the reverse step to Casimir. $E = mc^2$ as one rung down. Planet reads, star opens. $\beta = \alpha/4\pi$; α stiff, δ soft.
- **Predicted, to be measured.** The choice of material (Section 7.5): closed wall at the inner unit of 0.291 nm, open wall as far from it as possible, coupling rising with that distance.
- **Corresponded.** $a_0 = cH_0/2\pi$. The rows of the ladder set beside Larson and Grassmann.
- **Checked against measurement.** The slope of Moddel's curve: −1 predicted, −0.9 ± 0.15 read. Equation 24-1 on lead: 207 against 207.2. The double-charge rule on Bi-209: negligible-but-present in 1988, measured in 2003. $cH_0/2\pi$ against a_0: within 10%.

- **Conditional prediction.** 6.3×10^{-5} W per mesh, on one passage per T_0.
- **Deduction without direct observation, as Larson marks it.** The atomic destructive limit as the extension of electron–positron cancellation.
- **Error made and withdrawn on this path.** Larson's unit of energy, a knot's, once used for a mesh: ten orders of magnitude, one rung.
- **Open.** The items of Section 10.

Appendix A. The application, named as a possibility

The first road yields a rule and a size: a mesh of one open dimension passes in proportion to one over that dimension, with an independently known energy at one natural unit of space and a knee there. From that rule an arrangement follows: an opening closed on one side and open on the other, sized by the theory, whose output is a count of such openings. The one published mesh (Moddel 2021) shows that such an arrangement passes at all; its output per area, 70 W/m² per layer at 33 nm, is public. What the theory adds to it, how the size is fixed, how the count is arranged and regulated, and on which side of the mesh the design works, is worked out in Part Two, which is separate and not public. The status of Part Two is design with one conditional prediction and one decisive measurement; it contains no claim that the arrangement has been built.

The potential, stated from what is public. Three things can be said without Part Two.

What the model implies. Passage is continuous and depends on no place, time or operator. An arrangement of meshes therefore needs no fuel, no reservoir, no grid and no storage: its output is where the meshes are, and load is met by how many are switched in. Energy then belongs to the dwelling, the workshop, the pump, the boat, each with its own plate, and the line between producer and user, with the infrastructure that line needed, disappears. That is what the model says; it is to be shown by a sustained positive net balance.

What the public numbers give. Moddel's measured 70 W/m² per layer is public. A Dutch house draws 1,450 W on average, heat included. At that figure one layer of 20.7 m² is a house, and a hundred stacked layers of a few hundred nanometres each, if layers add, bring it to 0.2 m². This follows from the published measurement alone, before anything the theory adds.

What the theory adds. The theory fixes the size of the mesh and identifies on which side of it the whole distance between the measured device and the model value lies: nine orders of magnitude, all on one side, none of them in the mesh itself. Every gain in that one quantity divides the area: a thousandfold gain puts a house on square centimetres. Where that side is, what its variable is, and how the count is arranged and regulated, is Part Two. The decisive measurement of Part Two is designed so that a null result leaves the public 20 m² standing and a positive one shrinks it.

Appendix B. Symbols and numbers

symbol	meaning	value
S/T, T/S, T^3/S^3	speed, energy, mass (Larson)	—
T_0	natural unit of time	1.521×10^{-16} s
S_0	natural unit of space	45.6 nm

E_0	natural unit of energy (a knot's)	1.492×10^{-10} J
156.444	inter-regional ratio	—
$S_0/156.444$	unit inside the time region	0.291 nm
χ_Φ, χ_a	state of the net, two readings	6.96×10^{-10}; 1.44×10^{10} (Earth)
δ	density deviation	control
γ	lever	2π (Williamson, one closure)
γk	lever times bridge	5.7 (measured); k = 0.91
a_0	galactic threshold	1.2×10^{-10} m/s²
β	α/4π	5.81×10^{-4}
E_mesh	energy per mesh at S_0	9.5×10^{-21} J
P_model	passage per mesh at one per T_0	6.3×10^{-5} W (conditional)
slope	passage against L	−1 predicted; −0.9 ± 0.15 read
m_v	vibrational mass	I·m_r²/156.444
236	stability limit	—
I	magnetic ionization level	1 (Earth)
Z_max(I)	stability limit in atomic number	117, 92, 79, 71 for I = 0, 1, 2, 3

Annotated references

Grassmann, H. (1844). *Die lineale Ausdehnungslehre, ein neuer Zweig der Mathematik*. Leipzig: Wigand. Reworked 1862 as *Die Ausdehnungslehre: Vollständig und in strenger Form bearbeitet*. Berlin: Enslin. *Why read?* The outer product and the grades from one rule; orientation as a sign that travels with the element. *Reading advice:* the 1862 edition; the definitions, then stop.

Hamilton, W. R. (1853). *Lectures on Quaternions*. Dublin: Hodges and Smith. *Why read?* Scalar plus vector in one number; the product with two parts. *Reading advice:* the preface and Lecture I.

Clifford, W. K. (1878). "Applications of Grassmann's Extensive Algebra." *American Journal of Mathematics* 1, 350–358. *Why read?* The product ab = a·b + a∧b that joins Hamilton and Grassmann. Eight pages.

Maxwell, J. C. (1873). *A Treatise on Electricity and Magnetism*. Oxford: Clarendon Press. *Why read?* The preliminary on scalar and vector quantities and the quaternionic ∇. *Reading advice:* the Preliminary, Articles 10–25.

Hestenes, D. (2017). "The Genesis of Geometric Algebra: A Personal Retrospective." *Advances in Applied Clifford Algebras* 27, 351–379. *Why read?* How Grassmann's extension became a working algebra and why orientation had to be recovered. *Reading advice:* the sections on Grassmann and Clifford.

Larson, D. B. (1959). *The Structure of the Physical Universe*. Portland: North Pacific Publishers. Reworked as *Nothing But Motion* (1979). *Why read?* The one postulate and the table of powers (first chapters); the natural units and the inter-regional ratio (Chapter 13); the 236 limit, the 117 elements, the uranium chain and the destructive-limit rule with the electron–positron case (Chapters 31–32). *Reading advice:* the first chapters to mass as T^3/S^3, then 13, 32, 31, in that order.

Larson, D. B. (1984). *The Universe of Motion*. Portland: North Pacific Publishers. Chapter 4, "The Giant Star Cycle." *Why read?* The stellar order: heaviest elements first, then lighter with rising central temperature; Wolf–Rayet at nickel, Type I supernova at iron; the rejection of fusion as the stellar source. *Reading advice:* the first six pages.

Larson, D. B. (1988). *Basic Properties of Matter.* Salt Lake City: International Society of Unified Science. Chapters 12, 17, 24, 25. *Why read?* Scalar direction and the three dimensions of scalar motion (12); the destructive limit as outward displacement equal to one magnetic rotational unit (17); equation 24-1, Table 35, the magnetic temperature, the Earth near level 1, and the double-charge paragraph that carries thorium and bismuth (24); the drop 118 → 92 → 79 → 71 and radioactivity as displacement between environments (25). *Reading advice:* Chapter 24 in full; it is the quantitative core of the second road.

Williamson, J. G., and van der Mark, M. B. (1997). "Is the electron a photon with toroidal topology?" *Annales de la Fondation Louis de Broglie* 22, 133–160. *Why read?* The photon on a closed loop as the winding, the double loop as the knot; the 2π and 4π. *Reading advice:* the geometric argument in the first half.

Casimir, H. B. G. (1948). "On the attraction between two perfectly conducting plates." *Proceedings KNAW* 51, 793. *Why read?* The existing notation of what a two-wall mesh closes; the 1/L per mesh of Section 7 is its reverse step. Read it for the count, not as a mechanism.

Milgrom, M. (1983). "A modification of the Newtonian dynamics as a possible alternative to the hidden mass hypothesis." *Astrophysical Journal* 270, 365–370. *Why read?* First statement of $a_0 \approx 1.2 \times 10^{-10}$ m/s². *Reading advice:* the first section only.

McGaugh, S. S., Lelli, F., and Schombert, J. M. (2016). "Radial acceleration relation in rotationally supported galaxies." *Physical Review Letters* 117, 201101. *Why read?* The measured threshold across 153 galaxies, which pins γk = 5.7.

Moddel, G., Weerakkody, A., Doroski, D., and Bartusiak, D. (2021). "Optical-Cavity-Induced Current." *Symmetry* 13, 517. *Why read?* The one published mesh with an adjustable dimension: the stack (Table 1), the 1.4 pW and the thickness curve (Figure 4), the eight artefact tests, the six-month ageing. The slope check of Section 7 is against Figure 4b. Read in full.

Moddel, G., et al. (2024). "Modeling Electronic Devices with a Casimir Cavity." *Physics* 6(3). *Why read?* No closed model of the 2021 device exists; a fuller mode analysis gives an opposite sign in places. It is why that device's coupling is a measurement, not a theory.

Rowlands, P. (2007). *Zero to Infinity: The Foundations of Physics*. Singapore: World Scientific. *Why read?* The same ladder written on the vector line with a rewrite system; its 64 is set beside Cl(3,3) in Section 10. *Reading advice:* the chapters on the nilpotent structure.

Konstapel, J. (2026). *The VacuumNet Theory: Foundational Paper,* sixth edition. Constable Research, Leiden. *Why read?* The five axioms, the ternary register and the five-status convention in their original form. This document supersedes its energy sections.

Konstapel, J. (2026). *Applied Vacuum Theory: Setting the State of the Net,* fourth edition. Constable Research, Leiden, 25 September 2026. *Why read?* The constitutive law and the threshold in their original form; Section 6 here follows it.

Konstapel, J. (2024). "De Bewegingsruimte van Dewey Larson." constable.blog, 29 December 2024. *Why read?* Larson's table first placed beside Grassmann's grades; the starting point of the ladder. The h value there is withdrawn in Section 10.