Applied Vacuum Theory, Part Four

Energy as Passage: The Step from Mesh to Output

J. Konstapel, Leiden, 27 September 2026 — Third edition

Abstract

Part One read six builders through the Vacuum.Net theory. Part Two named the control variables of the net. Part Three designed a machine that tunes its own mesh. All three stopped at the same step: how a mesh of a given size turns into output in watts. That step was listed as open point O2. This part closes it. The closure is not a new law. It is a translation. On the ladder of Larson and Grassmann, energy is a winding, T/S, and passage per period is 1/S: one over the open dimension of the mesh. On the one published mesh with an adjustable dimension, that row predicts a slope of −1 in the mesh size, and the measured slope is −0.9 ± 0.15. With that step in place, the machine of Part Three changes character: its loop no longer hunts for a peak that the rule does not give; it holds the smallest stable mesh and corrects drift. The difference between a planet and a star is then the second road on the same ladder, and it is Larson's: a knot opens when its outward stretch equals one of its own closures, and grade 3 falls to grade 2. That road has a fixed limit per element, a total of 236 mass units, and an environment level that sets which elements are at it. Both roads are written out with their numbers. No reference needs to be opened to follow either.

1. Where the series stood

The image throughout this work is a fishnet in water. Its strands run everywhere and are always under tension. Where strands wind around each other, knots appear: matter. Between strands lie meshes: openings with a shape and a size. A winding persists only if it returns in phase inside its mesh.

Part One (Builders of the Net) read Moray, Schauberger, Tesla, the Correas, Reich and Moddel as makers of meshes. Each imposed an opening of a chosen size and asymmetry on the local net, and read the passage as light, motion, warmth or current.

Part Two (Setting the State of the Net) named the variables: the state χ, the density deviation δ, the lever $\gamma = 2\pi$, the stiff constant α with $\beta = \alpha/4\pi$, and the soft response of the coupling, $g\_eff = \bar{g}(1 + \gamma\delta)$. It measured the threshold of the lever on the galactic scale: $\gamma k = 5.7$.

Part Three (The Self-Tuning Mesh) designed a machine: a mesh with one adjustable dimension L, an electrostatic mirror to move it, and a loop that reads the electrical output s and adjusts L.

All three parts recorded the same open point. O2: the rule that turns a mesh geometry into a δ, and a δ into output. Part Three split it in three. O2a, mesh to δ. O2b, δ to coupling. O2c, coupling to watts. Only O2b was written. O2a was a counting rule that predicted a shape. O2c was left as a function F of the material, unwritten.

Without O2, every number in watts was an input. Part Three's 70 W/m² was Moddel's measurement recomputed, not a result of the theory.

2. Why O2 was not a gap

The Vacuum.Net theory is not a new theory beside physics. It is physics rewritten in a shorter notation. Every rewriting in it can be reversed. Where the notation seems to lack a rule, the reverse step finds the rule where it always was, in the existing notation, and the forward step writes it in net terms.

O2 is that case. In the existing notation, the step from a cavity of size L to the energy removed from it is Casimir's count of 1948, and the step from that energy to a current is Moddel's measurement of 2021. Neither is missing. What was missing was the translation into the net's own terms, and the translation turns out to be one line.

3. The ladder

The one line comes from a ladder with three notations. It is set out in full in the companion essay (Motion, Extension and the Net, third edition); here only the rows that Part Four uses.

Larson (1959) writes every physical quantity as a power of the ratio of space to time, S/T:

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

Grassmann (1844) writes the same ladder as grades: a directed stretch (grade 1), an oriented plane element (grade 2), an oriented volume element (grade 3). The net writes it as strand, winding, knot.

net	Larson	Grassmann
strand	S/T	grade 1
winding	T/S	grade 2
knot	T^3/S^3	grade 3
mesh	S, open	grade 2, empty
passage per period	1/S	—

Two rows carry this part.

A winding is what current physics calls energy. A strand that returns on itself spans a plane: grade 2 in Grassmann, T/S in Larson, motion turned back. There is nothing inside it. It is the strand, closed.

Passage per period is 1/S. Energy per time, in Larson's notation, is (T/S)/T = 1/S. What current physics calls power is one over the open dimension of the mesh. Smaller mesh, more passage. This is the line that closes O2.

4. O2 closed

O2a, mesh to passage. For a mesh with one open dimension L, passage per period is proportional to L^{-1}. The exponent is −1, not a fitted number: it is the ratio (T/S)/T read off the ladder.

O2b, δ to coupling. Unchanged from Part Two: $\Delta g/g = \gamma\delta$, $\gamma = 2\pi$.

O2c, passage to watts. Write the output of one mesh element as $s(L) = K \cdot L^{-1} \cdot F(L)$, with K a scale in watt·metre per element and F the part that belongs to the walls and the filling. The theory fixes the exponent −1. The material fixes K and F.

Check against the one published mesh. Moddel, Weerakkody, Doroski and Bartusiak (2021) built a mesh of two walls a distance L apart, one reflecting, one open, and measured the short-circuit current from L = 1100 nm down to 33 nm. The slope of their Figure 4b, read from the published curve, is −0.9 ± 0.15. The interval contains −1. So F carries L^(+0.1): almost flat. The material adds little to the shape; the shape is the ladder's.

A count of standing windings between the walls, the route Part Three took, gives L^{-3} and leaves F to carry L^(+2.1). Of the two candidates for O2a, the ladder's row is the one that leaves the least to the material. By the program-length measure of the Foundational Paper, it is the shorter program, and it is the one this part adopts.

Numbers. At L = 33 nm the measured maximum output is 1.4 pW from an active area of 0.02 μm^2. So $K \cdot F = 1.4 \times 10^{-12}$ W × 33 × 10^{-9} m = 4.6 × 10^{-20} W·m per element. With F flat, the prediction at L = 1100 nm is 1.4 pW × 33/1100 = 0.042 pW, a factor 33 below the 33 nm value. Per unit area, 70 W/m² at 33 nm and 2.1 W/m² at 1100 nm.

Measurement places. L: the cavity thickness, by ellipsometry (Moddel, Table 1). s: the short-circuit current and open-circuit voltage on a source meter, s = |I_sc V_oc|/4 for a linear current–voltage curve. The slope reading and its interval, with the digitisation method and the per-point values, are booked in uitkomst-o2c-aflezing.md of the MAZE platform, as a reading, not a pre-registered test. The ladder identities themselves (momentum = mass × speed, energy = momentum × speed, power = E/T = 1/S, the bivector count 3 + 9 + 3 = 15, dim Cl(3,3) = 64) are machine-checked in larson.py, eleven checks passing. Both files are on the platform's deploy branch; Claude Code runs them.

5. What this does to the machine of Part Three

Part Three's loop was written to find the maximum of s(L): discovery over the whole range, then tracking of the local slope. Row 5 says s(L) has no interior maximum. It rises monotonically as L falls, and below the shortest wavelength the walls still reflect (for aluminium, 80–100 nm; for an air gap, L below about 40–50 nm) the passage no longer grows. The curve has a knee, not a peak.

So the loop's job changes.

- **Discovery** is not a search for a peak. It is a measurement of the knee: the L below which s stops rising. That L is set by the wall material, not by the site.
- **Tracking** is not a hill-climb. It is a hold at the smallest L the actuator keeps stably, which for an electrostatic mirror is about two-thirds of its rest gap, and a correction for drift and ageing (10–20% in six months, measured).
- **Independence of place** follows from row 5 itself. Nothing in 1/S depends on where the mesh stands. A mesh at the same L passes the same amount anywhere. Part Three claimed this without a formula behind it; the formula is now the row.

Two consequences for the prototype specification. The rest gap of 300 nm in Part Three, with one-third of travel before pull-in, reaches 200 nm at best; it cannot reach the 33–50 nm region where the output is largest. A rest gap of 60–75 nm, with 20–25 nm of travel, does. And the open-loop curve s(L) of measurement 1 is taken on a series of fixed stacks of different thickness, as Moddel did, not by moving one mirror across 10–1000 nm.

Three corrections to Part Three are carried into its next edition: the thermal tuning rate has a sign error (dn/dT is negative; the two terms nearly cancel, giving 0.0004 nm/K, not 0.014, which strengthens the conclusion); the element thickness of 248 nm mixes two of Moddel's device stacks (the 33 nm device is 232 nm); and the actuator range above.

6. Energy without its family

Current physics writes energy with a family of words: source, stock, consumption, conservation, flux per area. Each is a separate rule. On the ladder, all of them are one rung, T/S, and one operation, closure. Read the ladder for what is not on it.

There is no source. A winding is the strand, closed. It comes from nowhere.

There is no reservoir. Larson's quantities are ratios. A ratio holds nothing.

There is no conservation rule. N2 says what persists: what closes. What does not close does not persist as a configuration; its tension moves to the neighbouring meshes.

There is no flux per area. Passage is 1/S per mesh. Meshes are counted, not integrated over a surface.

This is why the perpetual-motion prohibition does not arise. A mesh passes; it does not make. The builders of Part One were not violating a rule about closed systems. They were setting meshes in a net that is under tension everywhere and has no closed system in it. The question that remains about each of them is only the question of Section 4: what was L, and what was F.

The same holds for the two ways output can disappear. A mesh that ages passes less because F changes, and the loop corrects it. A body that goes dark, in Larson's terms, is one whose knot has changed sector, not one that has run out. Nothing runs out on the ladder.

7. The second road: a knot opens

Row 5 is written for a mesh. A body has no adjustable mesh. Yet a star puts out many orders more than a planet of similar surface conditions. On the ladder that difference sits one rung higher: not in a mesh that passes, but in a knot that opens. Larson wrote that rule in 1959 (Chapter 32) and again in 1988 (Chapter 17). Reversed to his notation and written forward in the net's, it is one sentence.

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, then 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, so they reach the equality at lower temperature.

On the ladder. $T^3/S^3 \rightarrow T/S$ is one rung down: 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, and Larson says so in the same chapter: 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 that stretch equals one of the three closures, that closure opens. The knot is a winding again. What leaves is the winding itself, 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 here.

Planet and star, now derived. 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. 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.

8. The second road in numbers

Larson gives two limits, and both are fixed numbers, not temperatures.

The vibrational mass. 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, Chapter 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. The result is the centre of a zone of isotopic stability, not a single isotope. Check on lead: $m_r = 82$, $I = 1$ gives $m_v = 82^2/156.444 = 43.0$, total mass $2 \times 82 + 43 = 207$ 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.

The overall limit: 236. 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 has rotational mass 236 on its own and disintegrates at once. U-238 is written 184-54: 184 rotational, 54 vibrational, 238 in all, just over the line, half-life 4.5×10^9 years. The decay chain runs by alpha steps that shed rotational mass and beta steps that rebalance the vibrational part, down to Pb-206, 164-42, inside the limit on both counts.

The level and the limit. At I = 0 all 117 possible elements are stable and there is no alpha radioactivity. At the Earth's surface I is close to 1. Larson gives the drop of the stability limit in atomic number 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, and so on, roughly halving each step. So: 117 elements stable at I = 0; uranium and heavier unstable at I = 1; gold and heavier at I = 2; lutetium and heavier at I = 3. The level rises with the age of the aggregate, by capture of magnetically charged neutrinos; Larson calls the concentration the magnetic temperature, and the transfer from neutrino to atom is irreversible under terrestrial conditions. Radioactivity on Earth is therefore not an exception to the ladder. It is the second road at I = 1.

Below the limit: thorium and bismuth. Th-232 (Z = 90) sits at its equation-24-1 centre with one charge, total 232, under the limit, yet it is alpha-active with a half-life of 1.4×10^{10} years. Larson's Chapter 24 carries this: some atoms carry no gravitational charge and some carry two. A second charge doubles m_v. For thorium that gives 180 + 104 = 284, over 236, and 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). Bi-209, 166 + 88 = 254 with two charges, was measured alpha-active in 2003, fifteen years after the book, with a half-life of 1.9×10^{19} years. The rule as written in 1988 has that case in it.

The thermal limit. The other way to reach stretch = closure is heat plus ionization, the stellar route of Section 7. Larson gives the rule and the order (heaviest first, then lighter with rising temperature), not a table of temperatures per element. That table is not in the sources and is not written here.

What the second road is not. 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, it runs against the probabilities at high temperature, and it is a one-way process where the postulates require cycles. On the ladder the same objection reads: joining knots does not open a closure; only stretch = closure does.

The lever. For a mesh the lever is L. For a knot the lever is I, the magnetic ionization level of the environment, or the stretch. Raise I and lighter knots pass 236; raise the stretch and lighter knots reach their closure. Neither is a mirror on a spring. Larson gives two ways I changes: age, by cumulative neutrino capture, and displacement of matter into an environment of higher magnetic temperature; alpha radioactivity on Earth is mainly matter that arrived from regions of lower level. A way to raise I by construction does not appear in his chapters. That is an absence, not a denial, and it is the one open item on the second road. The isotope distribution is the measurement place for I: equation 24-1 with I = 1 runs through the centre of the natural isotope distribution, and that distribution is uniform over the Earth. So I = 1 everywhere on Earth, within the resolution of the standard atomic weights.

Why the second road cannot yet be engineered. Two things are missing, and they are missing in both notations.

There is no source. To raise I, matter must take up more magnetically charged neutrinos than age supplies. Larson names where they arise: in atomic transformations inside matter already above level 0, and from cosmic rays. That is nature, not a tap. In the existing notation a neutrino that carries a magnetic charge and stays in matter is not a measured thing. For O2 the reverse step led to Casimir and Moddel, and the forward step wrote their result in net terms. Here there is nothing to reverse to. On both sides of the rewriting the cell is empty.

There is no instrument. I has one measurement place, the centre of the isotope zone, and that centre moves with I on geological time. No meter reads I = 1.02 on a piece of matter after a year. Without such a meter no lever can be searched for, because nothing shows whether it works. Larson wrote the same in 1959: of the ionization level there is no direct evidence except the isotopes.

So the second road does not wait on a derivation. It waits on a measurement.

The one measurement that exists in principle. Take a material that does not capture neutrons, keep one sample for years beside a strong neutrino source (a reactor, or a long solar exposure) and a twin sample elsewhere, and measure the isotope centre of both. Equation 24-1 predicts a shift with exposure; the existing notation predicts none. Neutron capture must be excluded, since it moves isotopes too. This is a measurement order, not a build order, and it is the only door to the second road that the ladder shows.

Two roads, one table.

road	what happens	quantity	number
1,	a mesh passes	1/L per mesh	70 W/m² per layer at 33 nm
2, openi	a knot drops from grade 3 to 2	stretch = closure; limit 236; level I	117 stable at I = 0; from uranium at I = 1; from gold at I = 2; from lutetium at I = 3

9. Stacking and series, restated

Part Three's two extrapolations stand as hypotheses, now with a reason on the ladder.

Stacking in depth. Each layer is a mesh. Meshes are counted. So $P_N = N \cdot P_1$ is the ladder's default, and the two-layer measurement (P_2 against $2P_1$) tests whether adjacent meshes leave each other's passage alone. Three outcomes: less than $2P_1$ (the meshes share strands and saturate), $2P_1$ (independent), more than $2P_1$ (they close jointly across layers, which on the ladder would be a mixed closure at small scale).

Series for voltage. One element gives microvolts. A 1,000-element series string is a fabrication choice; the 4 × 4 arrays measured by Moddel show current in parallel and voltage in series each four times the single-element value.

Sizing, unchanged. A house at 1,450 W average needs 20.7 m² of one layer at 70 W/m²; 100 layers of 232 nm, 23 μm thick, give 7,000 W/m² if $P_N = N \cdot P_1$ holds, and the house needs 0.21 m², about 45 by 45 cm.

10. Measurement order

Each measurement names who runs it. Lattice runs are Claude Code's. Physical measurements are for whoever fabricates the prototype. Each result is attested by hand.

1. Mirror characterisation: L(V), pull-in, hysteresis, settling, repeatability, temperature shift. One afternoon with an interferometer.

2. The open-loop curve s(L) on fixed stacks at 10, 15, 20, 25, 30, 33, 40, 50, 75, 100, 150, 250, 500, 750 and 1000 nm. This is the direct test of the exponent −1 and locates the knee. An identical element with a fixed mirror alongside as reference.

3. The same element under the loop, from a random start: does it settle at the knee, and how fast.

4. A 100-element series string.

5. A two-layer stack: P_2 against $2P_1$.

6. The same prototype at a second site: the spread in L* and s* is the measured meaning of independence of place.

7. Six months under the loop: the measured meaning of independence of time.

8. Lattice, Claude Code: a knot with three independent closures, on a lattice of two or three dimensions; impose outward tension on one strand in steps; record the step at which one closure opens and what leaves. Output: the opening threshold in lattice units and the released winding, for knots of increasing depth. This is the lattice form of stretch = closure. Baseline, already run (Claude Code, booked in uitkomst-opening.md, plan hash 0b7c462b…): on the one-dimensional ternary lattice family (rules 698, 696, 697; objects of increasing depth P, B, BB; fine masses 5, 10, 20), stepwise outward tension gives no opening. One unit of opposite displacement is digested: the knot re-closes as a lighter stable object, m → m − 1, and nothing leaves, 0 of 9. The condition of Section 7 says why: these one-dimensional knots carry at most one closure, the composition ladder stacks closures on a single axis, so stretch = closure cannot be met there. The digestion rule, one opposite unit annihilating one mass unit with re-closure, is the lattice analogue of Larson's beta adjustment, not of alpha opening. Hence the two- or three-dimensional condition above.

9. Isotope centre under neutrino exposure, for whoever has access to a reactor or a long solar exposure and a mass spectrometer: two samples of a non-neutron-capturing material, one exposed for years, one not; the shift of the isotope centre per equation 24-1. The only measurement that bears on raising I.

11. Status

Five statuses, as in the Foundational Paper.

- **Taken from the sources.** Larson's table, the destructive-limit rule, the 236 limit, the 117 elements, equation 24-1 and Table 35, the Earth at level 1, the drop 118 → 92 → 79 → 71, the double-charge rule and the uranium decay chain (1959, Chapters 31–32; 1988, Chapters 17 and 24–25; 1984, Chapter 4). Grassmann's grades (1844). Moddel's curve and numbers (2021). Williamson and van der Mark's 2π and 4π (1997). Milgrom's a_0 (1983).
- **Derived.** Passage per period = 1/S (Section 3), machine-checked in larson.py. O2a closed by it (Section 4). Independence of place as a consequence of 1/S (Section 5). Knot → winding as one rung down, $T^3/S^3 \to T/S$ with factor $T^2/S^2 = c^2$ (Section 7). Planet reads, star opens (Section 7).

- **Corresponded.** $\gamma = 2\pi$ as the phase of one closure. S = L for the Moddel cavity: the reading chooses which open dimension is the S of row 5, and with that choice the exponent −1 in L follows.
- **Deduction without direct observation, as Larson marks it.** The atomic destructive limit as the extension of electron–positron cancellation.
- **Checked against measurement.** Slope −1 predicted, –0.9 ± 0.15 read from Moddel's Figure 4b. Equation 24-1 on lead: 207 against 207.2. The double-charge rule on Bi-209: alpha decay predicted as negligible but present in 1988, measured in 2003.
- **Designed, not built.** The loop as knee-finder and drift-holder; the actuator with a 60–75 nm rest gap.
- **Extrapolated, not measured.** P_N = N · P_1; linear scaling beyond 0.01 mm^2.
- **Open.** F(L) in magnitude (K in watt·metre per element, per material). The table of thermal limits per element. How the level I is raised by construction: no source and no instrument in either notation; measurement 8 is the one door. The row for h: larson.py shows the 2024 blog value $h = S^2/T$ incompatible with the table; the consistent candidates are T^2/S (frequency as 1/T) or T^2/S^2 (frequency read as a speed); which one holds is open.

O2 no longer appears in the open list. O2a is a row of the ladder; O2b is Part Two; O2c is K and F, which are the material's, and are measured, not derived. The second road is Larson's rule, read one rung down the same ladder.

Annotated references

Konstapel, J. (2026a). *Builders of the Net*. Constable Research, Leiden. Part One. *Why read?* The six builders as makers of meshes. Section 6 of this part rereads them.

Konstapel, J. (2026b). *Applied Vacuum Theory: Setting the State of the Net,* fourth edition. Constable Research, Leiden, 25 September 2026. Part Two. *Why read?* χ, δ, γ, β and the constitutive law; O2b is there. *Reading advice:* Sections 4 and 5.

Konstapel, J. (2026c). *Applied Vacuum Theory, Part Three: The Self-Tuning Mesh,* third edition. Constable Research, Leiden, 25 September 2026. *Why read?* The loop, the actuator, the prototype specification. Section 5 of this part corrects its loop and its actuator range; its next edition carries the three corrections listed there.

Konstapel, J. (2026d). *Motion, Extension and the Net: Larson, Grassmann and the Vacuum.Net Theory,* third edition. Constable Research, Leiden, 27 September 2026. *Why read?* The full ladder, row by row, with the trit as orientation. Section 3 of this part takes its rows 2 and 5. Its Section 8 placed the star in a mixed bivector; this part replaces that placement by Larson's rule.

Konstapel, J. (2026e). *The Vacuum.Net Theory: Foundational Paper,* sixth edition. Constable Research, Leiden. *Why read?* The five axioms, the ternary register, the status convention and the program-length measure used in Section 4.

Larson, D. B. (1959). *The Structure of the Physical Universe*. Portland: North Pacific Publishers. Reworked as *Nothing But Motion* (1979). *Why read?* Motion as S/T and the table of powers from which row 5 is one line. *Reading advice:* the first chapters, to mass as T^3/S^3.

Larson, D. B. (1959b). *The Structure of the Physical Universe,* Chapters 31 "Radioactive Decay" and 32 "The Destructive Limits." Portland: North Pacific Publishers. *Why read?* The 236 limit, the 117 elements, the Earth at level 1, the uranium chain in rotational–vibrational notation, and the destructive-limit rule with the electron–positron case as its smallest instance. Section 8 rests on these two chapters. *Reading advice:* Chapter 32 first, then the uranium chain in Chapter 31.

Larson, D. B. (1984). *The Universe of Motion,* Chapter 4 "The Giant Star Cycle." Portland: North Pacific Publishers. *Why read?* The stellar route of Section 7: heaviest elements first, then lighter with rising central temperature; the Wolf–Rayet stars at the nickel limit and the Type I supernova at the iron limit. *Reading advice:* the first six pages.

Larson, D. B. (1988). *Basic Properties of Matter.* Salt Lake City: ISUS. Chapters 17 "Ionization", 24 "Isotopes" and 25 "Radioactivity." *Why read?* Chapter 17: the destructive limit as outward displacement equal to one magnetic rotational unit. Chapter 24: equation 24-1, Table 35, the magnetic temperature, the Earth close to level 1, and the double-charge paragraph that carries thorium and bismuth. Chapter 25: the 236 limit, element 118, the drop 118 → 92 → 79 → 71, and radioactivity as displacement between environments. *Reading advice:* Chapter 24 in full; it is the quantitative core of the second road.

Grassmann, H. (1844). *Die lineale Ausdehnungslehre*. Leipzig: Wigand; reworked 1862. *Why read?* The grades and orientation. *Reading advice:* the 1862 edition, the definitions, then stop.

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. Figure 4b is the check of Section 4; Table 1 gives every layer thickness and the measurement places. Read in full; it is the empirical floor of the series.

Casimir, H. B. G. (1948). "On the attraction between two perfectly conducting plates." *Proceedings KNAW* 51, 793. *Why read?* The existing-notation form of the step from cavity size to removed energy. Section 2 says why it is the reverse of O2a.

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 winding and the knot as a photon on a loop and a double loop; the 2π and 4π.

Milgrom, M. (1983). "A modification of the Newtonian dynamics." *Astrophysical Journal* 270, 365. *Why read?* $a_0 \approx 1.2 \times 10^{-10}$ m/s², the calibration of γk in Part Two. *Reading advice:* the first section.

Rowlands, P. (2007). *Zero to Infinity: The Foundations of Physics*. Singapore: World Scientific. *Why read?* The 64 of the nilpotent structure that Section 7 sets beside Cl(3,3). *Reading advice:* the chapters on the nilpotent structure.

Revision note

Third edition, 27 September 2026. Section 8 completed from Larson's Chapters 24 and 25, read in full: equation 24-1 with the lead check, Table 35, the drop of the stability limit per level (118 → 92 → 79 → 71), the double-charge rule that carries Th-232 and the 2003 measurement of Bi-209, the two ways the level changes (age, displacement), and the isotope distribution as the measurement place for I, uniform over the Earth. The level is now written I, Larson's symbol. Section 8 closes with why the second road cannot yet be engineered (no source, no instrument) and the one measurement that bears on it; that measurement is number 8 in Section 10. After review by Claude Code: provenance of the slope reading corrected (uitkomst-o2c-aflezing.md, not larson.py); derived and corresponded split for 1/S and S = L; measurement 7 given its lattice condition and its one-dimensional null baseline; the h row given the larson.py result.

Second edition, 27 September 2026. Section 7 rewritten: the star is no longer placed as a mixed bivector $s \wedge t$; it is Larson's destructive limit, read one rung down the ladder (knot → winding, factor c^2). Section 8 new: the second road in numbers, the 236 limit, the 117 elements, the environment level m with the Earth at 1, the uranium chain, the thermal limit as rule without table, and Larson's own rejection of fusion as the stellar source. Measurement 7 changed to the lattice form of stretch = closure. Status list: the second road as taken from Larson, with his own marking as deduction. First edition, same day: the first road, O2 closed by 1/S, the loop as knee-holder.