Applied Vacuum Theory

Setting the State of the Net: Control Variables, Constitutive Law and the Open Step

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Abstract

The builders of the last century read the vacuum. They shaped a mesh until it fitted the local state, and then light, motion or warmth appeared. Applied vacuum theory reverses the direction. It asks how to set the local state of the net so that a chosen outcome becomes the fixed point. This article names the control variables of the Vacuum.Net theory, collects the formulas that connect them, and computes where the leverage lies. The result is simple. The fine-structure constant α is stiff and cannot be moved by any reachable state change. The effective coupling g_eff is soft, and its lever equals the inverse distance of the net to its critical point. The control knob is therefore the local density deviation δ, not α. The article ends with the one step that is still missing for full control: the rewrite rule that states how the net responds when a mesh is imposed. The constitutive law determines sensitivity. The rewrite rule must determine response.

The argument in four steps

1. α is stiff. Moving it by 1% requires a change of state ten orders of magnitude beyond anything present on Earth.
2. g_eff is soft. Its lever is $1/\varepsilon = 2\pi$, where ε is the distance of the net to its critical point.
3. The control knob is therefore δ, the local density deviation.
4. What is missing is the rewrite rule: how the net responds when a mesh is imposed.

Each claim in this article carries one of five statuses. Assumed: the axioms N1 to N5 and the bridge B1. Conditionally proved: theorems T1 to T7. Corresponded: $\gamma = 2\pi$, $k = 1$, and the builders as settings of δ. Measured: $\gamma k \approx 5.7$, R_Q = 0.704, and $\gamma = \gamma_0 + 2p$ on the lattice. Open: O1, O2 and O4. The full ledger is in Section 12.

1. From reading to setting

The image is a fishnet stretched in water. Its strands run everywhere, through air, water, stone and body. They are always under tension. Where strands wind around each other, knots appear. We call that matter. Between the strands lie meshes: openings with a shape and a size.

The local tension of the net is called χ. What we call constants are functions of χ. A winding stays only if it returns in phase within its mesh. Everything else does not fit and does not stay. This is selection by fitting.

Moray, Schauberger, Tesla, the Correas and Reich worked with this selection by hand. They shaped a box, a spiral channel, a coil, a discharge window or a layered chamber until it fitted the place. Their devices worked where they stood. Elsewhere the local χ differed, and the same mesh no longer fitted.

The goal of applied vacuum theory is to manipulate the vacuum at will. In the terms of the net, that means one thing. Set χ and the phase of the windings so that the desired winding is the fixed point and closes. Nothing is placed. The state is set, and the target is what remains.

2. The net in five axioms

The theory rests on five axioms (Konstapel 2026a).

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

N2, closure. A configuration persists only if it closes on itself.

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

N4, context. Constants are state functions of the local vacuum. Universality is the limiting case $g(\chi) = g_0$.

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

The register of the net is ternary. Each strand state is a trit: +1, 0 or −1. An address is a depth plus a number in balanced ternary (theorem T7).

3. Three kinds of quantity

The quantities of the net fall into three groups. They behave differently under manipulation.

State, continuously settable. The tension χ. The theory has two readings of it. The acceleration reading is $\chi\_a = a/(cH_0)$. The potential reading is $\chi\_\Phi = |\Phi|/c^2$. Both readings are dimensionless. That these are one χ is open point O4. The local density deviation δ is tied to χ through the bridge B1: $\delta = k\cdot\chi$.

Phase, continuously settable. Each winding has a phase θ. Windings are coupled with strength K. Their joint coherence is R_Q, the quaternionic order parameter (Section 6).

Address, not continuously settable. Each closed winding carries a Hopf charge $Q \in \pi_3(S^2) = \mathbb{Z}$ and a trit address. Theorem T3 states that Q is conserved as long as the strand stays continuous. Q changes only when a strand breaks. An address therefore cannot be shifted. It can only be selected.

This division is the core of the method. State and phase are set. Address is selected by the setting. Manipulation at will is the art of setting χ and θ so that exactly one address closes.

4. The constitutive law and its numbers

The net at large scale behaves as a medium with a density n. Its energy per unit volume is

$e(n) = g_2 n^2 + g_3 n^3$.

The effective coupling is the second derivative, $g_{eff} = d^2e/dn^2$. Around a reference density $\bar{n}$ with $n = \bar{n}(1 + \delta)$, this gives

$g_{eff} = \bar{g}(1 + \gamma\delta)$,

with $\bar{g} = 2g_2 + 6g_3\bar{n}$ and $\gamma = 6g_3\bar{n}/\bar{g}$. This is theorem T4 (Konstapel 2026b).

Step 1. The sign theorem. This step is conditional. It assumes $\gamma = 2\pi$. The value of γ itself is a correspondence, not a theorem (Section 12). Given the assumption, the rest follows. From $\gamma = 6g_3\bar{n}/\bar{g}$, the n^3 contribution is $6g_3\bar{n} = 2\pi\cdot\bar{g}$. From $\bar{g} = 2g_2 + 6g_3\bar{n}$, the n^2 contribution is $2g_2 = \bar{g} - 2\pi\cdot\bar{g} = -5.283\cdot\bar{g}$. So $g_2 < 0$. Of the n^3 contribution, a fraction $(2\pi - 1)/2\pi = 5.283/6.283 = 0.841$ is cancelled. Only $1/2\pi = 0.159$ remains as net stiffness. This is conditional theorem T5: if $\gamma = 2\pi$, then $g_2 < 0$ with 84.1% cancellation.

Step 2. Distance to the critical point. The net stiffness is $\bar{g}$. The critical point is where $\bar{g}$ reaches zero: the n^2 and n^3 contributions then cancel completely. Define the distance to the critical point as the net stiffness relative to the n^3 contribution:

$\varepsilon = \bar{g}/(6g_3\bar{n}) = 1/\gamma$.

At the critical point $\varepsilon = 0$. The local sensitivity of the effective coupling follows from T4:

$d \ln g_{eff} / d\delta = \gamma = 1/\varepsilon$ (at $\delta = 0$).

The lever is the inverse distance to the critical point. This is an identity within the constitutive law, not an interpretation. With $\gamma = 2\pi$, $\varepsilon = 1/6.283 = 0.159$. In Landau form the energy reads $-\beta A^4 + \gamma A^6$, with a first-order transition at $\varepsilon = 0$.

Step 3. The threshold. The crossover between the two regimes of g_{eff} lies where $\gamma\delta = 1$. With $\delta = k\cdot\chi_a$ and $\chi_a = a/(cH_0)$, this gives

$a_0 = cH_0/(\gamma k)$.

Take $c = 2.998 \times 10^8$ m/s and $H_0 = 70$ km/s/Mpc $= 2.27 \times 10^{-18}$ s^{-1}. Then $cH_0 = 6.80 \times 10^{-10}$ m/s². The measured galactic threshold is $a_0 \approx 1.2 \times 10^{-10}$ m/s² (Milgrom 1983; McGaugh et al. 2016). So $\gamma k = 6.80/1.2 = 5.7$. This is a numerical correspondence with $2\pi = 6.28$, within 10%. With $\gamma k = 2\pi$ exactly, $a_0 = 1.08 \times 10^{-10}$ m/s².

Step 4. Composition with α. The coupling depends on χ through α: $g = g(\alpha(\chi))$. The inner function is

$\Delta\alpha/\alpha = \beta\cdot\Delta\chi$, with $\beta = \alpha/4\pi$.

Step 5. Mass follows state. The effective mass of a collective excitation changes with the state:

$\Delta m_{eff}/m_{eff} = s_m\cdot\gamma k\cdot\Delta\chi_a$,

where $s_m = d \ln m_{eff} / d \ln g_{eff}$ is a susceptibility still to be computed (open point O1).

5. Where the lever lies

Two numbers decide where control is possible.

α is stiff. Take $\alpha = 1/137.036 = 0.0072974$. Then $\beta = 0.0072974/12.566 = 5.81 \times 10^{-4}$. A change of 1% in α requires $\Delta\chi = 0.01/(5.81 \times 10^{-4}) = 17$.

Compare this with the state at the surface of the Earth. With $GM = 3.986 \times 10^{14}\ m^3/s^2$ and $R = 6.371 \times 10^6$ m, $\chi\_\Phi = GM/(Rc^2) = 3.986 \times 10^{14} / (6.371 \times 10^6 \times 8.988 \times 10^{16}) = 6.96 \times 10^{-10}$. The required Δχ is ten orders of magnitude beyond anything present on Earth. Control through α is out of reach.

g_eff is soft. The constitutive law gives a lever of size $\gamma = 1/\varepsilon$. With $\gamma = 2\pi$, a density deviation of $\delta = 0.01$ gives

$\Delta g\_eff/g\_eff = \gamma\delta = 6.283 \times 0.01 = 0.063$.

A 1% shift in local density gives a 6.3% shift in the effective coupling. The lever is $1/\varepsilon = 2\pi$: the inverse distance of the net to its critical point.

Conclusion. The control knob of applied vacuum theory is δ, the local density deviation. It is not α and it is not χ at cosmic scale. Control means shifting density locally in a medium that stands close to its tipping point.

6. Phase and coupling

The second pair of control variables is phase and coupling. Each winding i carries an orientation as a unit quaternion. Relative to a regional frame, its displacement is $D_i = (Q^{(i)})^* \cdot A^{(i)}$. Coherence is the largest eigenvalue of the orientation matrix:

$B = (1/k)\ \Sigma\ D_i D_i^T,\ R\_Q = \lambda_1(B) \in [¼, 1]$.

This form is invariant under $D_i \to -D_i$, as the double cover requires (Markley et al. 2007). R_Q = ¼ means no shared orientation. R_Q = 1 means full coherence. The first measured run gave R_Q = 0.704, with interval 0.61 to 0.79 over 196 cases (Konstapel 2026c).

R_Q is not another state variable. It is the observable that shows whether the setting of phase has closed.

The coupling K between two windings u and v follows a learning rule. After each confirmed closure s:

$K\_uv \leftarrow K\_uv + \eta(s - K\_uv)$, with $\eta = 0.1$.

Between closures K decays toward its base value $K_0 = 1$ at rate $\lambda = 0.01$ per day. This is a Hebbian form of the non-abelian Kuramoto model (Kuramoto 1984; Lohe 2009).

Phase and coupling decide which windings enter the mesh together. Density decides how stiff the mesh is. Both are needed. A soft mesh with scattered phases selects nothing.

7. The cycle: soften, write, harden

Manipulation takes place in three steps. Each step sets one of the variables above.

Soften. Raise δ toward the critical point. The net stiffness falls. Many windings now fit within the mesh. In the Landau picture the system is brought to the edge of its transition.

Write. Impose the mesh. Its shape, size d, layering and asymmetry define which windings return in phase. Set the phases θ and the couplings K so that the desired windings arrive together. R_Q rises within the mesh.

Harden. Return δ. The net stiffness rises again. Only windings that close in the imposed mesh remain. Because Q is conserved, the address that remains was selected, not written. Harden selects among addresses that already exist in the net. A new address requires a strand break, and a break lies outside this cycle.

The cycle does not place an object. It sets the state so that the target is the only thing that stays.

8. The builders as settings of δ

Each builder set δ with a different mesh. The pattern is the same over fourteen orders of magnitude.

Moddel, White and Thibado work at about 10^{-7} m. A cavity or a rippling membrane sets δ inside a narrow gap. One diode-like inequality leaves one passage open.

The Correas work at about 0.1 m. A discharge window between glow and arc sets δ. The discharge closes on itself and pulses.

Moray and Reich work at about 1 m. Moray tuned a box to the tension between air and earth. Reich layered organic and metallic sheets. Each layer boundary is a small step in δ.

Schauberger works at about 10^3 m. A spiral channel sets density along the flow. The flow closes along the spiral, and that closure appears as motion.

Tesla works at 4×10^7 m, the circumference of the Earth. A wave around it takes $4 \times 10^7 / 3 \times 10^8 = 0.13$ s. That is about 7.5 Hz. Tesla tuned his coil to this mode. At this scale the mesh is the circumference of the Earth.

The range from 10^{-7} m to 4×10^7 m is a factor of 4×10^{14}. At large scale the builder belongs to the mesh: a hand on a switch, a chosen hour, a manual tuning. At small scale the mesh no longer depends on who stands next to it. That is where control at will becomes possible. A mesh at depth can also be tuned to the local χ. It then fits wherever it stands. The tuning takes the place of the builder's hand.

9. Where the coupling is set at will today

One laboratory system already sets g at will. In an ultracold atomic gas near a Feshbach resonance, the scattering length follows

$$a_s(B) = a_{bg} (1 - \Delta/(B - B_0)),$$

where B is an applied magnetic field, B_0 the resonance position, Δ its width and a_bg the background value (Chin et al. 2010). The coupling g is proportional to a_s. By moving B, the coupling can be made strong, weak, zero or negative.

This is a controlled medium. Each step of the cycle has a counterpart there. Moving B toward B_0 softens. The trap geometry and phase imprinting write. Moving B back hardens. It does not prove the net. It shows that the cycle is a real operation in a real medium.

10. The open step

Two open points stand between reading and full control.

O2, the rewrite rule. The net needs an explicit dynamics: how χ responds when a mesh is imposed. O2 has two parts. The first is the map from mesh to δ: which shape, size, layering and asymmetry give which local density deviation. The second is the response of χ to that δ. Section 8 reads the builders as settings of δ. The map that turns a given mesh into a given δ is not yet written. Without it one can read the state and compute the lever, but not predict the outcome of a given setting. In the spirit of Rosen (1991), the rule is not an action to be minimised. It is a rewrite whose own fixed point is the net.

O1, the value of γ. Finite ternary lattice runs gave a clear result. γ does not come from the periodicity of phase. It lives only in the density exponent p of the microscopic step. If the step cost scales as $(1 + \delta)^p$, then

$$\gamma = \gamma_0 + 2p.$$

For $p = 1$ the runs gave $\gamma = 0.68$ against a predicted 0.65, with $\gamma_0 = -1.35$ in that operationalisation. The value $\gamma = 2\pi$ then requires $p = (2\pi - \gamma_0)/2$. In the operationalisations with $\gamma_0 = 0$, this gives $p = \pi = 3.14$. In the operationalisation with $\gamma_0 = -1.35$, it gives $p = (6.283 + 1.35)/2 = 3.82$. These values are requirements, not results. All lattice runs so far used $p = 1$.

This makes p the deepest control variable. Whoever sets the density exponent of the microscopic step sets the lever itself.

Suggested work. A rewrite rule with an explicit density exponent p can be formulated and run on the ternary lattice. The runs can show which imposed mesh yields which δ, which γ and which R_Q. The target values are those already measured: $\gamma k \approx 2\pi$ from galaxies and R_Q ≈ 0.70 from the first coherence run.

The boundary of this article is therefore sharp. The constitutive law determines sensitivity. The rewrite rule must determine response.

11. Use without damage

The criterion for use is a statement about the net, not a rule added to it. By N2, only configurations that close persist. What does not close does not persist as a configuration. Its tension does not vanish, however. It moves to the neighbouring meshes. In the net the criterion is therefore closure. A loop that closes within the place where the need is leaves no open strand. An open strand is tension that ends up elsewhere, in people or in nature. Damage, in the terms of the net, is always the same thing: a loop that does not close.

Light, warmth and motion that close where people live make the long chain unnecessary. Fuel import, pipelines, plants and the conflicts around them lose their purpose. The knowledge of the people who worked in that chain remains useful. Who knows how flows behave and where pressure builds knows what a mesh needs. That work moves from the port and the plant to the street and the house.

12. Status ledger

The theory uses five statuses.

Assumed: N1 to N5; the bridge B1 ($\delta = k\cdot\chi$).

Conditionally proved: T1 trefoil minimality; T2 double cover; T3 conservation of Q; T4 constitutive form $g\_eff = \bar{g}(1 + \gamma\delta)$; T5 sign theorem with 84.1% cancellation; T6 entropy production as closure bookkeeping; T7 unique ternary address.

Corresponded: $\gamma = 2\pi$, as a numerical correspondence with the measured $\gamma k \approx 5.7$; $k = 1$; the builders' devices as settings of δ.

Measured: $\gamma k \approx 5.7$ from a_0, within 10% of 2π; R_Q = 0.704 [0.61, 0.79]; $\gamma = \gamma_0 + 2p$ on the lattice.

Open: O1, the value of γ and s_m; O2, the rewrite rule; O4, the unity of χ_a and χ_Φ.

Revision note

Second edition, 25 September 2026. After a first review: the sign theorem is stated in conditional form at the start of Step 1; the required p is given for both values of γ_0; Section 7 states that a new address requires a strand break; Section 8 adds tuning to the local χ.

Third edition, 25 September 2026. After a second review: the argument in four steps and a short status overview follow the abstract; χ is stated to be dimensionless; T5 is labelled a conditional theorem; the distance to the critical point is defined as $\varepsilon = 1/\gamma$, which makes the lever an identity; g_eff is used throughout for the local sensitivity; $\gamma = 2\pi$ is labelled a numerical correspondence; the function of R_Q is stated; two sentences in Section 8 now describe the tuning; Section 9 calls the atomic gas a controlled medium and names the counterpart of each step; Section 10 closes with the boundary between sensitivity and response; Section 11 opens with the closure criterion as a statement about the net.

Fourth edition, 25 September 2026. After a third review: Section 10 splits O2 into the map from mesh to δ and the response of χ to δ, and states that the required values of p are requirements, since all lattice runs so far used $p = 1$.

Annotated references

The net

Konstapel, J. (2026a). "The Vacuum.Net Theory: Foundational Paper," sixth edition. Constable Research, Leiden, August 2026. *Why read?* The five axioms, theorems T1 to T7 with full proofs, and the five-status convention used in this article. *Reading advice:* start with Part II, the ternary ground, then theorem T5.

Konstapel, J. (2026b). "The Constitutive Equation of the Vacuum Condensate." Constable Research, Leiden, July 2026. *Why read?* The derivation of $g_{eff} = \bar{g}(1 + \gamma\delta)$ from e(n), and the Bogoliubov functions $\xi(\chi)$, $c_s(\chi)$ and $m_{eff}(\chi)$.

Konstapel, J. (2026c). "Clerk Maxwell and the Vacuum.Net Theory," sixth edition. Constable Research, Leiden, 21 September 2026. *Why read?* The quaternionic composition rule, the sign-invariant coherence measure R_Q and the learning rule for K, with the first measured run.

Konstapel, J. (2026d). "Builders of the Net: Six Builders Who Worked Without Fire, Read in the Vacuum Net." Constable Research, Leiden, 24 September 2026. *Why read?* The six builders read as meshes, with the scale range from 10^{-7} m to 4×10^{7} m.

Konstapel, J. (2026e). "Where Electricity Comes From: The Full Vacuum and the End of the Fire Age." Constable Research, Leiden, 24 September 2026. *Why read?* The nanoscale mesh worked out to household and national numbers.

Form, closure and the ternary ground

Spencer-Brown, G. (1969). *Laws of Form*. London: Allen & Unwin. *Why read?* The calculus of the first distinction, from which N1 takes its form. *Reading advice:* the notes at the end before the main text.

Rosen, R. (1991). *Life Itself*. New York: Columbia University Press. *Why read?* Closure of efficient causation as the criterion for a system that needs no external driver. The model for O2.

Rowlands, P. (2007). *Zero to Infinity: The Foundations of Physics*. Singapore: World Scientific. *Why read?* The nilpotent algebra and the Universal Rewrite System, a precursor of the rewrite rule sought in O2.

Faddeev, L. and Niemi, A.J. (1997). "Stable knot-like structures in classical field theory." *Nature* 387, 58–61. *Why read?* Knotted solitons with a conserved Hopf charge. The field-theoretic counterpart of theorem T3.

The medium and its transition

Landau, L.D. (1937). "On the theory of phase transitions." *Zh. Eksp. Teor. Fiz.* 7, 19–32. *Why read?* The order-parameter expansion behind the $-\beta A^4 + \gamma A^6$ form.

Bogoliubov, N.N. (1947). "On the theory of superfluidity." *J. Phys. USSR* 11, 23–32. *Why read?* How a weakly interacting medium yields a sound speed and a healing length from its coupling.

Chin, C., Grimm, R., Julienne, P. and Tiesinga, E. (2010). "Feshbach resonances in ultracold gases." *Reviews of Modern Physics* 82, 1225–1286. *Why read?* The one laboratory medium in which the coupling is set at will. *Reading advice:* Section II for the formula for $a_s(B)$, then the experimental examples.

The threshold

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?* The first statement of the acceleration threshold a_0.

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 curve that pins a_0 and reads as the crossover of $g(\chi)$.

Phase and coupling

Kuramoto, Y. (1984). *Chemical Oscillations, Waves, and Turbulence*. Berlin: Springer. *Why read?* The coupled-phase model on which R_Q and the learning rule build.

Lohe, M.A. (2009). "Non-Abelian Kuramoto models and synchronization." *Journal of Physics A* 42, 395101. *Why read?* The extension of phase coupling to rotations, as used for quaternionic windings.

Markley, F.L., Cheng, Y., Crassidis, J.L. and Oshman, Y. (2007). "Averaging quaternions." *Journal of Guidance, Control, and Dynamics* 30, 1193–1197. *Why read?* The eigenvector method that makes R_Q invariant under the double cover.

The builders of now

Moddel, G., Weerakkody, A., Doroski, D. and Bartusiak, D. (2021). "Optical-cavity-induced current." *Symmetry* 13, 517. *Why read?* Current from a one-sided cavity without applied voltage. A mesh that sets δ at 10^{-7} m.

Thibado, P.M. et al. (2020). "Fluctuation-induced current from freestanding graphene." *Physical Review E* 102, 042101. *Why read?* A rippling membrane with two opposed diodes, the clearest case of one open passage.