Spatial Field Model: Space as a Process of Inflation

PITHINESS THEORY

Abbasov's P-theory. Ontology, Fifteen Propositions with Derivations, and the Formalism.

All known interactions and cosmology as manifestations of a single process - the isotropic inflation of the spatial field at rate c.

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Contents

Abstract

P-theory is a model in which space is not a passive stage but a process itself: a continuous isotropic inflation of the energy field, with an influx of energy q_0 into every point of the three-dimensional manifold and internal transit of the medium at the rate c. The constant c here carries two levels of meaning: operationally it sets the limiting speed for the motion of matter and the propagation of localized disturbances, while ontologically it is the spatial field's own tempo of inflation. Matter, gravity, inertia, electromagnetism, the weak and strong interactions, antimatter, dark matter and cosmological expansion are derived from this single assumption - without adding separate entities for each phenomenon.

Matter in this picture is a local lag behind the tempo of inflation - a desynchronization. A stable configuration of the field (a capture) loops part of the influx into internal circulation instead of free transit; quantitatively this lag is expressed by the local deficit $\delta\rho(x) = \rho_E - \rho(x)$, whose integral gives the mass. All observable properties of matter - proper time, position, measurable distance, gravitational response - are functionals of the single quantity $\delta\rho$. The field itself remains operationally non-metric: physical distance is defined only between captures through the radar-ranging procedure, while the symbols r and ∇^2 in the equations belong to the auxiliary language of notation, not to the physical distance structure.

The theory stands on two independent axioms - A1 (pointwise inflation) and A2 (metastable power balance) - and relies on the honest register of inputs: the structural dimension d = 4 (derived from the incompatibility of A1 and A2 in the free background; the three-dimensionality of space is closed by a spinor argument); one low-energy calibration point - the proton mass m_p (it sets the scale m_q, and through it ρ_E, ℓ_b, τ_b); the irreducible numerical core of the frequency $\omega_p \approx 0.47016$ (the single independent frequency of the boundary-value problem; its uniqueness is proven, a closed-form formula has not been found); and one ultraviolet scale - the fine-structure constant α as the canonical entry window for ℓ_P (the transit pixel), relative to which $G = \hbar c/M_P^2$ is a derived quantity. A reverse reading of the α-sector equation yields the gravitational constant: $G = 6.674415\cdot10^{-11}$ $m^3/(kg\cdot s^2)$, a deviation of +0.0017 % = 0.8σ from CODATA, - so the link α ⟺ G is a rigid structural prediction of the theory, whereas an independent first-principles pinning of the ℓ_P scale itself remains an acknowledged boundary (the wall-input). The structural cascade $s_c = 1/4$, p = 1/5, γ = 5/4, u_W = 1/2 and the 5/6 bridge follow from d = 4 as exact rational identities.

Two kinds of results follow from this picture. Structural identities without fitting: the dimension d = 4 and its cascade, the ratio $m_H/m_W = \pi/2$, the magnetic ratio $\mu_p/\mu_n = -3/2$ (leading order), the baryon asymmetry η/ε. Numerical cross-checks after the inputs are fixed: the W-boson mass (−0.10 %), the electron mass with dressed screening (+0.0027 %), the proton mass via channel A as an internal overdetermining cross-check (+0.071 %), the gravitational constant G (0.8σ), the dark-matter acceleration scale $a_0 = c\cdot H_0/6$, the spectral index of the sky imprint n_s = 0.96658 (0.40σ), the primordial helium yield Y_p = 0.2453 (0.1σ), the positions of the acoustic peaks of the cosmic microwave background (CMB) (~1.4 %) on the natively derived sound horizon (acoustic ruler), the deuteron binding energy and the nuclear binding curve from the α-aggregate assembly (RMS 0.348 MeV/nucleon without fitting), α-decay half-lives across 24 orders of magnitude. The blind cosmological prediction ΔN_{eff} = 0 agrees with Planck (0.32σ). Sectors with a larger residual ($\sin^2\theta_W$ at leading order; the absolute magnetic moment of the proton) are explicitly flagged in the tables together with the reason for the residual.

The gravitational sector reproduces the observed static, post-Newtonian, and radiative predictions of general relativity (the Schwarzschild metric natively from rarefaction - the envelopment construction,

light deflection with the factor of 4, $\gamma\_PPN = \beta\_PPN = 1$, the vanishing Nordtvedt and preferred-frame PPN parameters, tensor gravitational waves propagating at speed c), while remaining non-metric and emergent; the operational translation of the deficit law into metric language reproduces the vacuum Einstein equations ($G\_\mu\nu \equiv 0$) in the tested static and dynamic regimes, with the explicit Sakharov induced action and the numerical prefactor $c^4/(16\pi G)$. This nonlinearity is a property of the metric description, not an independent native nonlinearity of the P-field. Quantumness in the theory has two roots - integrity (portionedness of outcomes) and resonance (portionedness of states); Born's rule is derived from three established properties of the medium, and wave-particle duality is resolved: a particle is a node of desynchronization together with the wave of medium response induced by it.

The methodological charter of the theory (M.1): physics leads, mathematics expresses.
The formal apparatus in P-theory is not picked to fit the answer but follows strictly from the ontology closed on itself: if a standard formalism distorts the nature of the process, it is rejected as incompatible, and its place is taken by the unique apparatus that answers to that nature. Hence the hybrid formalism is not chosen but forced, and the proton size is reformulated as an open dynamical steady state of a flow-through medium rather than a static energy minimum - the ontology demands this, not computational convenience. At the foundation of the author's position “physics leads, mathematics expresses” lies the demand that every phenomenon be explained from minimal principles, one and the same for all phenomena.
Every statement is marked with one of nine epistemological statuses; the blind protocols and the history of major revisions are collected in a separate appendix - together with the register of falsifiable bets declared in advance. Honestly outside the genre of pithy derivation there remain only a few items, each with a clear reason: the independent pinning of ℓ_P (an input of nature, not a gap - the known internal routes yield a proven no-go obstruction), a closed-form formula for ω_p (it is computed exactly and reproducibly, and the anatomy of the number has been laid bare) and a set of O(1) numerical coefficients of the subtle sectors (a computational residual). The present monograph brings the ontology, fifteen Propositions with derivations in place, the formal apparatus, the computational tables and the reproducibility appendix for the key numbers into a single text, from which a reader who does not know the project can understand everything and verify everything.

Introduction

Pithiness Theory: an ontological sketch

1. Problems of the current picture

Contemporary fundamental physics rests on two theoretical platforms that have not yet been joined into a single system. The Standard Model describes elementary-particle physics and three of the four interactions with high precision, but for this it requires on the order of two dozen independent parameters, a distinguished gauge group SU(3)×SU(2)×U(1), a separate Higgs mechanism for the origin of masses and a separate sector for each particle. Gravity does not fit into this framework and is described separately, by general relativity, in which spacetime is an independent dynamical entity.

In recent decades several more inputs have been added to these two platforms. Dark matter - a substance whose physical nature has not been established, introduced to reconcile galactic rotation curves and the dynamics of clusters with the observed mass.
Dark energy - a parameter in the Friedmann equations needed to explain the accelerating expansion of the Universe. The baryon asymmetry, the hierarchy of particle masses, the absence of a mathematical proof of confinement, the postulated character of the constancy of the speed of light - each of these places requires either a separate hypothesis or is acknowledged as an open problem.

The number of independent inputs in the standard program grows faster than the number of phenomena explained with its help. This is not a reproach to the program, for it remains the most accurate description of nature available. It is a statement of the fact that the ratio of postulates to consequences is moving in the direction opposite to the one in which a mature physical theory usually moves.

One firm statement at the outset: singularity-level density does not exist in this theory in principle - it is forbidden by the medium's floor $\rho \geq 0$ (in the language of the deficit - the incompressibility bound $\delta\rho \leq \rho_E$). Infinite density occurs nowhere, ever: neither at the beginning of the Universe nor in the core of a black hole.

The present work proposes to look at the same physics from the other side: to build an ontology with a minimal number of inputs and to see what follows from it structurally.

2. One idea

Before building, let us note two things that modern physics accepts as given, although within its picture they hang as an unexplained coincidence - while in the proposed ontology each becomes a simple consequence.

The first is the photon's proper time. A photon flies from a star for a billion years, but zero proper time elapses along its worldline; that is pure special relativity. If not a single instant has passed for it, in what sense was it moving? Motion is path covered over time, and there is no time - so "the photon flew" is meaningless in the old picture. Here, by contrast, the photon is synchronous with the medium and has nothing to keep count with; "it flew for a billion years" was recorded by the observer's clock while inflation was carrying it and the star apart. It was not a point of light that moved - what changed was the operational distance between two captures.

The second is the addition of velocities. Name a single velocity of an object in nature that does not depend on the motion of the observer - there is none, except light. The velocity of an object must add to the velocity of the observer; c does not add. So c behaves not like the velocity of an object but like a property of that in which things move - the medium. Special relativity postulates this; here it is a consequence.

The assumption on which the entire work stands is formulated in one line: the speed of light c is not primarily the speed of an individual object in space; it is the structural tempo of the spatial field itself. Therefore, for material objects and localized disturbances c manifests itself as the limiting speed, while ontologically it is the tempo of the medium, not a property of light as an independent body. Space is not a passive stage on which physical processes play out; space is a process - a continuous inflation of the energy field, occurring at every point simultaneously and isotropically, at the rate c.

From this single ontological assumption a unified physical picture unfolds: three ways of existing in the field, four manifestations of matter, the constancy of c, cosmological expansion and the absence of any need for a separate dark energy. This ratio - the maximum of explanatory content from the minimum of principles - is what gives the theory its name: Pithiness Theory. Quantitative derivations require additional inputs, listed below in the honest register. The subsequent sections of the work show this formally. This section presents the end-to-end picture of the work.

3. Three points of view on existence in the field

Definition - the spatial field is the primary physical medium underlying the model. It exists as a continuous self-sustaining process - an influx of energy whose source is not located inside the three-dimensional manifold, with subsequent isotropic distribution at every point of the three-dimensional description, and its internal transit through the medium itself at the rate c. The constant c has two levels of meaning: operationally it sets the limiting speed for the motion of matter and the propagation of localized disturbances, while ontologically it is this very process's own tempo.

The spatial field is not metric, and it is not a stage on which physical phenomena unfold. It is an independent physical entity, and all observable forms - matter, light, the fundamental interactions, the expansion of the Universe - are its states and its manifestations. The local energy density of the field is the primary scalar quantity of the theory; in the unperturbed background it has a constant value, denoted ρ_E.

For the field itself neither position, nor direction, nor an internal clock is defined: the notions of “here”, “there” and “when” arise only for configurations that are in local desynchronization with the inflation. The spatial field has no reference frame of its own and is therefore not a medium in the sense of the classical ether program.

An essential consequence is visible at once: the density of this process has a finite background value ρ_E and can neither turn to infinity nor drop below zero. Infinite density does not exist in this picture in principle, anywhere or ever - neither at the beginning of the expansion nor in the core of a black hole: both of the infinite-density singularities familiar from the old picture simply do not arise here.

Three ways to exist in the field

If the field is a process of inflation at the rate c, then there are three ways to exist in it, differing in their degree of synchrony with this process.

The first way is the free background. The field in the pure regime of self-inflation, without local configurations. For such a field there is no “here” and “there”: within a continuous isotropic process the notions of position and direction are not defined. Nor is there a clock of its own: to count time an internal repeating process is needed, and in the pure background there is none. The free background is a state without a distance structure of its own. It exists, but neither “where” nor “when” has any content for the background itself.

In classical physics, a singularity is usually understood as a point or region in which physical quantities - density, curvature, field strength - become infinite, and the theory describing them loses its applicability. Such are the singularities at the center of a black hole in general relativity and at the moment of the Big Bang in standard cosmology.

In the present work the term is used in a substantially different sense, and it is important to fix this distinction from the very outset in order to avoid misunderstandings.

Singular here denotes a state of the spatial field in which its own distance structure is not defined. For the field itself in the free regime there is no direction, no internal clock, no extension.

The second way is the photon. It is a synchronous perturbation of the field that follows inflation perfectly. The photon does not move through space - it rests on a point of the field, which inflates. What in the material description looks like “light propagates at speed c” is a manifestation of the inflation of the field relative to the material object, at the point on which the perturbation resides. The photon, like the background, has no proper time and no distance of its own: it has “nothing with which” to count off either one, because it is synchronous with the medium. The direction and the characteristics (frequency) in which the photon is perceived as moving are set by the material act of emission - they are a property of the moment of generation, not a property of the photon itself in its own ontology.

The third way is matter. In the present work matter is defined through its relation to the spatial field, refined successively in three steps.

To a first approximation, matter is regarded as a perturbation of the spatial field - a stable local configuration that differs from the free inflation of the medium. Matter and the field are not two different entities: matter is the field itself, residing in a special regime.

Viewed more deeply, matter is more properly regarded as capture. Part of the energy arriving in a given region does not leave into the general transit at speed c but loops back into an internal, stable circulation process. Capture holds the energy in place, forming a stable configuration with an internal repeating process, a position, and a measurable distance to other captures.

In the final formulation, this holding is a local desynchronization with the inflation of the field. The capture does not keep up with the rate c of the medium itself, and it is precisely this lag, quantitatively expressed by the local deficit of energy density, that manifests itself in observation as mass. All other properties of matter follow from this. Such a configuration acquires an internal repeating process - a clock of its own. It acquires a position, and the possibility arises of operationally measuring the distance to another configuration of the same kind. Everything we are accustomed to calling the properties of a material object appears.

These three ways of existing are not three different entities. They are three modes of a single field, differing not in nature but in the degree of lag behind inflation: the background is fully synchronous; the photon is fully synchronous, with one distinguished direction that manifests itself from the standpoint of material objects; matter lags behind the exchange tempo of the field.

4. Four phenomena that follow from desynchronization with the field

If matter is desynchronization with the tempo of the medium, then it has a measure: exactly how far the configuration lags. Locally, this measure is expressed through the deficit of energy density - the difference between the density of the free background and the density in the region where the given point is located. The energy density of the field is lower because part of the field is engaged in local circulation rather than in the general flow.

From this single quantity - the local deficit - four physical manifestations follow structurally, which in the standard program are introduced as separate interactions.

Mass is the integral of the deficit over the entire volume of the configuration. It is the energy that "did not make it" into the general transit and remained in internal circulation. The famous $E = mc^2$ in this picture is not a separate physical law but a dimensional identity: $m \cdot c^2$ is precisely that integral, because c enters the definition of the medium's tempo, and the integral of the density deficit over volume has the dimension of energy.

Inertia is the medium's resistance to the restructuring of the rarefaction zone when one attempts to displace the configuration. For a material object to change its state of motion, the entire local structure of the field around it must be restructured. The medium responds to the restructuring at a finite speed - the same speed c - and it is precisely this finiteness of the response that is perceived as inertial mass. Inertia and gravitational mass turn out to be not two properties requiring a separate hypothesis about their coincidence, but one and the same quantity measured in different regimes.

Gravity is the far-zone response of the medium to the presence of a configuration. The local rarefaction near a material object does not remain local: it spreads out in the form of an inhomogeneous flow regime. Another material object entering this zone experiences not a "force of attraction from outside" but a modified regime of inflation in its own neighborhood - and reacts to it as to an inclined surface, or more precisely a cavity into which it "falls". The 1/r profile of the gravitational potential, Newtonian attraction, gravitational time dilation, the light deflection angle - all these are structural consequences of one and the same far-zone response.

The strong interaction in this picture is a structure of the same deficit, but considered in an extreme regime - inside the material configuration itself.

A proton-like structure is described as a bound configuration of three internal nodes, separated by ultracompact, extremely small distances at the limit of the minimally resolvable scale.

Between these nodes the field is in a regime of nearly complete rarefaction, while in the immediate vicinity of the configuration, along its outer perimeter, the medium, by contrast, remains less rarefied. The resulting density difference acts as an energetic press enclosing the configuration and holding the three nodes together in a single connected region. This region is called the P-bag in this work, and the structural constraints that make precisely this geometry minimally stable are considered in the next section. In this reading, confinement is not introduced as a separate postulate.

Nor is it necessary to introduce, as primary entities, a separate gauge group and special force carriers. What in the standard program is described through gluon dynamics is interpreted in P-theory as the nonlinear behavior of the single spatial field in the regime of extreme rarefaction.

Four faces of a single quantity. Not four forces coordinated with one another, but one structure observed in different regimes and at different scales.

5. The structure of minimally stable matter

From the ontology of desynchronization there follows a structural constraint that explains the form of material configurations.

The field has a finite response speed c, and for asynchronous configurations this finiteness manifests itself as the viscosity of the medium. A solitary desynchronization cannot exist on its own: the viscosity of the field immediately "damps it out", because for a single asynchronous point there is no geometry in which its desynchronization could be distributed against the response of the medium. This yields the first consequence: the minimal stable material configuration in the $\delta\rho$-sector is not an individual node but a bundle of several nodes holding the desynchronization in a distributed manner.

Two nodes do not form such a bundle. They yield an elongated configuration with an open depleted region between them - the region does not close, and the bundle disintegrates. Numerical calculations in the reports confirm this: two-node configurations are unstable even in two-dimensional geometry. Three nodes are the first to define a closed geometry: a triangle in which the depleted region between the nodes is surrounded by a densified perimeter of the medium on all sides. Only with this geometry does the desynchronization stabilize, and a stable P-bag configuration forms. A configuration with fewer than three nodes is impossible in the $\delta\rho$-sector by the structure of the response; the first stable regime is reached precisely at three.

This explains the baryonic nature of hadronic matter: the proton and the neutron are bundles of three nodes not by empirical coincidence, but as the minimal stable geometry of distributed desynchronization.

From the same picture follows the structure of mass. The nodes themselves, as local asynchronous structures, make a small contribution to the mass of a baryonic configuration - on the order of a few percent. The main part of the mass is the medium's response to the presence of the bundle: the integral of the local deficit $\delta\rho$ over the volume of the depleted region and the densified perimeter. In the standard picture this fact is known as "99% of the hadron's mass comes from binding energy, not from the quark masses", and in QCD it is explained through gluon dynamics. In P-theory the same numerical proportion receives a direct ontological explanation: mass is the medium response to distributed desynchronization, the nodes are triggers that set the geometry of the bundle, and the main contribution to the observed mass is the medium's.

This mechanism - the field's own resolution scale for asynchronous configurations, the minimal number of nodes for a stable geometry, the dominance of the medium contribution to mass - gives a structural explanation of why matter is arranged exactly as observed: in discrete, baryonic configurations, with a mass not reducible to the mass of its local components.

6. Why light behaves like light

From the fact that the photon is a synchronous perturbation rather than a moving object, several things follow immediately, each of which is postulated separately in standard physics.

The photon has no mass - because mass is the integral of desynchronization, and a synchronous perturbation has no desynchronization. The photon has no proper time - because time exists only for configurations with an internal repeating process, and a synchronous perturbation has no such process. The photon has no state of rest - not in the sense that "it is hard to make it stop", but in a deeper one: the concept of rest is defined only for desynchronized objects, and for a synchronous configuration it has no content.

And the main point: the speed of light is the same for all material observers not because it is postulated to be so, but because c is the tempo of the medium itself. A photon arises in a material act of emission: the source sets its direction, frequency, and energy as parameters of a synchronous, phase perturbation of the field. The photon does not move through a ready-made space as an independent material object; it remains synchronous with the inflationary transit of the field - in this sense it "rests" on the inflating structure of space and follows its tempo. Another material observer reads out the already-set perturbation through his own proper time, his own state of motion, and through the operational distance that may have expanded during the photon's travel. Therefore the frequency, energy, and direction may be measured differently: as a Doppler shift, an aberration of direction, or a cosmological redshift. But the tempo of the propagation itself remains one and the same, because it belongs not to the photon as a separate object but to the field in which both the source and the observer reside. This gives special relativity the physical foundation that it lacks in its original formulation: the constancy of c turns from a postulate into a structural consequence.

7. Why the Universe expands

The field inflates at every point of its manifestation for a material object. Between two material objects lies a volume of the field, and every point of this volume participates in inflation at the rate c. A natural question arises here: if every point inflates at the rate c, should not all objects fly apart at the speed of light?

No, and the reason lies in the very nature of matter. Material objects are desynchronized with the field; they do not keep up with its inflation. It is precisely this lag that characterizes them as matter. Locally, in the neighborhood of each object, the desynchronization holds the capture "in place" - it is not carried away by the tempo of inflation, because its very nature is a lag behind that tempo. This can be called inertia in the most fundamental sense: the resistance of a material configuration to being carried away by inflation.

But desynchronization holds the capture only locally. At large distances, between two captures lies a volume of the field that is tied to neither of them, and every point of this volume participates in inflation at the full rate c. The farther apart the objects are, the more of this “free” volume lies between them and the stronger the accumulated effect of inflation, which a material observer perceives as mutual recession. Hubble's linear law - that the recession velocity is proportional to distance - follows from this directly, without introducing a separate substance. Only at the scale where enough field fits between the objects for the cumulative effect to reach c does the recession velocity become equal to the speed of light. This is the Hubble radius.

Since the picture is not static in time, the farther away an observed object lies, the larger the volume of the field that participates in inflation along the path between it and the observer, and the more strongly the accumulated effect builds up over time. A material observer perceives this as accelerating expansion: what grows is not the recession speed of some particular object but the very dependence of recession velocity on distance. The acceleration is a consequence of the continuity of the process itself, not of a separate driving force, nor of an independent substance that would have to be introduced.

For the field itself there is no expansion. The field has no “where” to expand into - there is no external volume into which it could be displaced - and in itself it does not change: neither the density of the inflationary background, nor the tempo of the process, nor the characteristic scale of the field depends on the “expansion.” What changes is not the field but how a material observer keeps count of distances and times between remote objects.

The point is that, for the observer, distance and time are not two independent things but two records of one and the same process, one transit of the field. Distance is its “path,” time is its “pace,” and one and the same rate c ties them together. The single inflation of the field therefore shows itself to the observer in two guises at once - and these are two faces of one phenomenon, not two different effects. On the one hand, remote objects move ever farther apart, and the light from them is stretched in length: we see this as expansion of space and redshift. On the other hand, the pace of distant time is stretched as well - the ticks of distant clocks reach us ever more drawn out, and distant time seems slowed to us. These are not two coinciding phenomena but one and the same aberration of inflation, read in two ledgers: the ledger of path (distance) and the ledger of pace (time); one and the same redshift stands identically in both. Inside bound systems, however, where the transit is closed and balanced, both ledgers stay silent - there nothing expands and time does not “drift” anywhere. The expansion of the Universe is thus not a property of the field for itself, but the way the single inflation is read by matter at large distances bound by nothing.

“Dark energy” in this picture is not a separate physical entity but an observational manifestation of the same inflationary background that accounts for everything else; the fact that the “expansion” is a mode of accounting rather than a substance only reinforces this. And since the density of the inflationary process does not decrease with time, remaining constant, this background behaves exactly like what cosmology describes by the equation of state $w = -1$.

8. Where matter comes from

One of the open questions of modern cosmology is why the observable Universe consists almost exclusively of matter rather than of equal shares of matter and antimatter. In the standard program this requires a mechanism of baryogenesis: special symmetry-breaking conditions had to be met in the early Universe, allowing a small excess of matter to survive annihilation. The observed ratio of the baryon and photon densities is $\eta \approx 6 \cdot 10^{-10}$.

In the present picture this asymmetry receives a natural ontological explanation through the three modes of inflation. The same directedness of inflation which, for a material capture, is perceived as an influx of energy “from outside to here,” creates an asymmetry between configurations aligned with the sign of this influx and configurations opposed to it. The former correspond to matter, the latter - to antimatter. The aligned configurations turn out to be metastably slightly more stable than the opposed ones.

Numerically, this picture yields the correct scale of the baryon asymmetry. The ratio of the total amplification factor to the primary asymmetry, η/ε, comes to 16.5 against the observed 16.4 - a deviation of about 0.4%. No special fitting parameters are introduced for this agreement. The internal decomposition of the result - the primary asymmetry $\varepsilon \approx 3.65 \cdot 10^{-11}$ and the amplifying structural factor - is examined further in the computational part of the work.

9. What this yields quantitatively

The ontology presented here is built on two independent axioms (the postulate of inflation and the postulate of metastable energy balance) and on an honest register of inputs: one structural constant - the dimension of space $d = 4$, which gives the exponent 1/4 for the mass scale; one experimental point - the proton mass, which sets the scale of the model; the irreducible numerical core of the frequency ω_p; and one ultraviolet scale. The energy density of the field is not calibrated separately here - it is derived from the mass scale. From this base fifteen Propositions are unfolded, covering the formation of matter, gravitation, the propagation of light, time, inertia, the strong interaction, the electroweak sector, dark matter, dark energy, and cosmological expansion.

The numerical results, obtained without special fitting parameters tuned to the corresponding observables, include: the proton mass (channel A) with a deviation of 0.071%, the W-boson mass with a deviation of 0.10%, the Higgs-to-W mass ratio equal to $\pi/2$, the Higgs mass with a deviation of 0.7%, the closure of the fine-structure-constant sector (with α as the canonical ultraviolet input, the self-consistency residual is compressed to +0.00002 %), the baryon-to-photon ratio with a deviation of 0.4%, and the acceleration scale of galaxy rotation curves (the Milgrom constant) at the level of about a percent. The absolute value of the gravitational constant is derived by a reverse reading of the α-sector ($G = \hbar c/M_P^2$, a deviation of 0.8σ from CODATA), and the structure of gravitation is reproduced in full; an independent first-principles pinning of the ultraviolet scale ℓ_P is adopted as a wall-input (see “The ℓ_P Wall” in the section on the register of inputs). The details of the derivations and the epistemological status of each result are given in the main part of the work.

The ratio between the number of independent postulate-level inputs and the number of quantitatively reproduced phenomena serves as a separate criterion for assessing the pithiness of the theory.

10. Why quantum mechanics and gravitation are not separated here

Modern physics keeps quantum mechanics and gravitation as two different theories and looks for a way to join them. In the present picture there is nothing to join: these are not two descriptions that need to be stitched together, but one description of one medium, read in two regimes. A particle and its gravitational field have one source - the local deficit $\delta\rho$. Inside the capture, the response of the medium is nonlinear and forms a bound mode - a solution of a boundary-value problem, which is observed as a quantum particle (its mass, charge, spin, discrete levels). Outside the capture, the very same deficit manifests itself as the far-zone potential $1/r$ - what is observed as gravitation. It is worth explaining separately why the external manifestation of the deficit is precisely far-zone. The capture sustains itself by retaining part of the influx in its internal loop instead of letting it pass into free transit; by exactly this retained share the influx in the object's neighborhood falls short. But this shortfall does not sit at a single point. Inflation is distributed through every influx pixel ℓ_P around the capture one by one and isotropically, and the field realizes its process only on this grain - the field has a finite resolution. The shortage therefore cannot be gathered into one place: from the very start it is a collective property of all the surrounding pixels, each of which falls short by its own small share. At the same time, the total shortfall is strictly fixed - it equals the mass of the capture. The farther from the object, the wider the sphere over which it is spread and the thinner the share that falls on each pixel - down to zero at infinity. It is precisely the distribution of this fixed shortage over nested spheres - by the integral balance A2 (Gauss's theorem) - that sets the profile $\delta\rho(r)$ decaying with distance, which is what is observed as the gravitational potential $1/r$. Around a mass the medium is present everywhere - it is merely stationarily rarefied: each pixel holds slightly less of it than ρ_E, the more so the closer to the object. This rarefaction does not flow and is not "sucked" anywhere; it is stable, and the capture holds it continuously (balance A2). The external region therefore requires no separate "gravitational field" - the same deficit, which has nowhere to realize itself locally, is precisely the rarefied sphere around the mass, which is gravitation itself. These are not two fields but one functional $\delta\rho$, evaluated on different regions: the interior problem yields the quantum, the exterior one - gravitation.

Hence, too, the equivalence principle. Since the medium is one, it has a single coupling coefficient: all forms of energy-momentum draw from the same $\delta\rho$ and therefore gravitate identically. The equality of the inertial, gravitational, and debit masses (M_inert = M_grav = M_D) ceases to be a separate riddle requiring a hypothesis of their coincidence, and becomes a consequence of the single nature of the medium's response - a theorem rather than a postulate.

The unification of quantum mechanics and gravitation in this work is therefore not the building of a bridge between two theories, but the removal of the question itself at the level of ontology: the separation arose from a picture with two independent entities (spacetime on its own, fields on their own), not from the makeup of nature. This is not an empty redescription - agreement with general relativity is a derivable consequence of the single ontology, for the uniqueness of the coupling entails testable consequences: light deflection with the factor of 4, $\gamma\_PPN = 1$, the speed of gravitational waves equal to c, and purely tensor polarizations (Proposition 5). And an honest caveat: the gravitational sector reproduces the observable predictions of general relativity while remaining non-metric; the operational translation of the linear deficit law into metric language reproduces the vacuum Einstein equations ($G\_\mu\nu \equiv 0$) in the tested static and dynamical regimes, with an explicit induced Sakharov Lagrangian - this nonlinearity is a property of the metric description, not an independent native nonlinearity of the P-field; the second order is exhibited as an explicit number, $\beta\_PPN = 1$. The most readily falsifiable points of the theory - Nordtvedt-η and the preferred-frame parameters α_1/α_2 - are closed by derived zeros, with the experimental limits satisfied, and spin-2 has been checked term by term at quadratic order (Proposition 5).

11. What this work is not

To forestall three typical misunderstandings, it is worth stating explicitly what this work is not.

This is not a return to ether theory. The ether of the late nineteenth century postulated a medium with its own reference frame - a state of rest relative to which the motion of the Earth could be measured. The Michelson-Morley experiment searched precisely for that reference frame and did not find it. The field in the present work has no reference frame of its own: for the field itself there is no "here" and "there," no rest as a meaningful state. The Michelson-Morley objection therefore does not apply to this construction for structural reasons, not by fitting.

This is not a modification of general relativity. GR is reproduced in the appropriate limits as a functional consequence: the Schwarzschild metric, gravitational time dilation, the angle of light deflection by a massive object. But ontologically this picture contains no curved spacetime as an independent geometric entity - there is one field, and the geometric effects of GR are manifestations of its far-zone response.

The energy density of the field is not the cosmological constant. The well-known "cosmological constant problem" - the discrepancy of 120 orders of magnitude between the vacuum energy density computed in quantum field theory and the observed value of Λ - arises from the attempt to identify these two quantities. In the present work the field density and the cosmological term are different objects of the theory, not directly related: the former is a parameter of the local density of the inflation process, the latter is an observational manifestation of the aberration of inflation on cosmological scales. The Λ-problem does not arise.

12. On the structure of the further exposition

The subsequent sections of the work unfold the picture presented above formally. The axiomatics, the single dynamical equation, the Lagrangian formalism, the closure theorem of the spatial field, the computational programs, and the numerical results follow one another in the order of logical dependence.

Each claim in the work is marked with one of nine epistemological statuses: Postulate, Derived, Partially derived, Empirical normalization, Imported result, Structural ID, Numerical verification, Open, Conditional reproduction. This is done so that the levels of rigor are explicitly distinguished and not mixed. The reader can at any moment check at what level of justification a particular claim stands.

Ontological basis

This section fixes the ontological basis of the theory formally: operational definitions, the postulate layer (O.1-O.3), the distance-structure theorems (T.1-T.3), the pace-and-path theorem, and the genre rules of derivation. The full physical picture - the three ways of existing in the field and the consequences of desynchronization - is given in the Introduction (Sections 3-8); it is not repeated here but is translated into operational language.

Three modes of inflation: operational specification

The field can exist in three types of states - three modes of a single inflation, differing not in nature but in the degree of synchrony with the process. Operationally, a mode is specified by the medium state triple $S = (\delta\rho, n, \theta)$, where $\delta\rho = \rho\_E - \rho$ is the local density deficit, $n = \bar{\Psi}\cdot\not{U}\cdot\Psi$ is the medium-covariant capture density, and θ is the phase-synchronization variable.

Mode	**S = (δρ, n, θ)**	**Operational concepts**
Free background	(0, 0, const)	inflation only; no proper time, distance, or position
Photon	(0, 0, nontrivial θ)	synchronous perturbation; no proper time and no proper distance
Matter (capture)	(> 0, > 0, arbitrary)	proper time, position, distance, measurement

Each mode has its own point of view on reality: for the field itself, "here", "there", and "when" are not defined (the coordinate triple is a language of notation, not a physical property); the photon follows inflation synchronously, and "motion at speed c" exists only in the description of a material observer;

a capture is a local desynchronization, and only for it do a clock, a position, and a measurable distance arise.

Fundamental thesis: the appearance of matter changes the local state of the field but does not create for the field itself its own proper time, its own distance, or its own metric. The metric appears only for the system of captures. The field remains operationally non-metric.

The background identity $\rho\_E = q_0 \cdot \tau\_b$

In the free regime the A2 power balance takes the form: all the incoming power q_0 goes entirely into the general transit at speed c. The Local Transit law gives:

$\rho\_E = q_0 \cdot \tau\_b$

Dimensional check: $[q_0] \cdot [\tau\_b] = [J/(m^3 \cdot s)] \cdot [s] = [J/m^3] = [\rho\_E]$ ✓

Substantive meaning: ρ_E is not a static density but the density of a flow-through process. This is the mathematical expression of the ontological thesis “the field is a process”. For finite and positive τ_b, the implication $q_0 = 0 \Longrightarrow \rho\_E = 0$ follows in the P-ontology.

The aberration of inflation

The basic inflation of the field - the non-metric, self-sustaining regime of the medium's existence - manifests itself in the description of material captures as expansion of space at the rate c. Material captures are local delays, regions of partial lag behind the free inflation. For them, therefore, this very same process manifests itself as a change of the operational distances between captures. The farther a material object is from the observer, the larger the region of the field between them that participates in the inflationary expansion - a distant object is observed as receding faster. In P-theory this creates the picture of accelerating expansion as a consequence of the accumulated manifestation of inflation between desynchronized material objects.

Postulate O.1: the ontological unity of A1+A2+LT

Axioms A1 (continuous influx $q_0 > 0$), A2 (metastable energy balance), and the Local Transit law (LT: $\rho = s\_tr \cdot \tau\_b$) jointly express a single ontological content - the spatial field is a stationary process of inflation. The technical content of each statement is preserved; the formal independence of A1 and A2 (block N1) is not revoked.

Block O.1.1. The field as a stationary process of inflation

Physical statement: The spatial field in P-theory is a stationary process of continuous influx of energy q_0 into every point. ρ_E is the density of a flow-through process, not a static constant. In the P-ontology, $q_0 = 0 \Longrightarrow \rho\_E = 0$ for $\tau\_b > 0$.

Mathematical form: $\rho\_E = q_0 \cdot \tau\_b$; $q_0 = 0 \Longrightarrow \rho\_E = 0$ (in the P-ontology)

Status. Derived

Block O.1.2. A1, A2, LT as three readings of one ontology

Physical statement: The three formal statements are, methodologically, three readings of a single ontological content. The technical content is preserved; the formal independence of A1, A2 (block N1) is not revoked.

Mathematical form: $A1 \land A2 \land LT \equiv$ “the field is a stationary process of inflation” (methodologically)

Status. Partially derived

The operational distance structure d_phys

Three layers of geometry: M_0, the auxiliary structure, d_phys

P-theory contains three distinct layers of geometry. Their explicit separation protects the theory from the standard objection "your formulas contain r, ∇^2, SO(3) - so you do have a metric". These quantities belong to different layers with different physical status.

The rule against metric mixing: all expressions that use auxiliary quantities (r, dV, ∇^2, SO(3)) are expressions in the auxiliary Euclidean structure. They become physical statements only once an operational protocol linking them to d_phys has been specified.

Postulate O.2: the physical distance structure

The physical distance structure d_phys is not a property of the coordinate-affine background M_0 or of the auxiliary Euclidean structure. d_phys is defined through radar-ranging procedures between captures and is a functional of the medium state $S = (\delta\rho, n, \theta)$. In the absence of captures, d_phys has no operational content.

The operational distance between two captures A and B via the radar protocol Γ_AB:

$d_A(A, B; \Gamma_{AB}) = (c/2) \cdot (\tau_{A\_recv} - \tau_{A\_send})$

Dimensional check: $[c]\cdot[\Delta\tau_A] = [m/s]\cdot[s] = [m]$ ✓

The fundamental point: d_phys = {d_A(A, B; Γ_AB)} is a family of operational distances indexed by the triple (observer, pair of captures, protocol). In general $d_A(A, B) \neq d_B(B, A)$. d_phys is a "metric" in the strict sense only under special conditions.

The rule of operational closure (O.2.3): in P-theory, only a quantity reducible to a radar protocol between captures counts as a physically admissible distance. This is an operational closure - a stipulation of what counts as a "physical distance".

Postulate O.3: the universality of c

There exists a universal coefficient c that links operational duration and operational length in the locally free radar regime of the medium. c is an operational invariant of the radar-ranging procedure: every capture in a locally free zone obtains one and the same c. c is not the "speed of an object" but the tempo of the inflation of the medium itself.

$c := \partial\ell_{op} / \partial\tau$ (in a locally free zone)

Theorem T.1: the operational indeterminacy of d_phys

If the state of the medium over the entire region is the pure background $S = (0, 0, \theta_0)$, then Dom(d_phys | S) = ∅: the family d_phys has an empty domain of definition. M_0 and the auxiliary structure are preserved. The pure background is an operational metric indeterminacy, not a catastrophe.

Block T.1. The operational indeterminacy of d_phys in the pure background

Physical statement: In the pure background $S = (0, 0, \theta_0)$, the family d_phys has an empty domain of definition. The medium itself exists, but the physical distance structure is not specified. This is the ontologically primary state. M_0 and the auxiliary structure are preserved.

Mathematical form: $S = (0, 0, \theta_0) \Longrightarrow \mathcal{C}(S) = \emptyset \Longrightarrow \mathrm{Dom}(d\_phys \mid S) = \emptyset$

Status. Derived

Theorem T.2: d_A via time rates

Suppose the medium state S contains two captures A and B with local time rates $\dot{\tau}\_A$, $\dot{\tau}\_B$, and a radar protocol has been carried out in a stationary field. Then:

$d\_A(A, B; \Gamma\_AB) = (c/2) \cdot \Delta\tau\_A$

The dependence of $\dot{\tau}\_A$ on the local $\delta\rho\_A$ through the bridge $\delta\rho \leftrightarrow n \leftrightarrow \dot{\tau}$ opens the way to deriving the effects of gravitational light delay and the effects of special relativity in the P-theoretic formulation. Gravitational redshift is derived in Proposition 5 (block IV.A): the bridge $\kappa = 2 \cdot s\_c$ is obtained as the weak-field limit of the unity of the time rate $\dot{\tau}$, with no free coefficient.

Block T.2. Operational distance via proper time rates

Physical statement: The operational distance d_A between two stationary captures in a stationary field is $(c/2) \cdot \Delta\tau\_A$. The dependence of $\dot{\tau}\_A$ on $\delta\rho\_A$ opens the way to deriving gravitational and kinematic effects.

Mathematical form: $d\_A(A, B; \Gamma\_AB) = (c/2) \cdot \Delta\tau\_A;\ \Delta\tau\_A = \int \dot{\tau}\_A(t) \cdot dt$

Status. Derived

Theorem T.3: c in the key formulas of the theory

The universal coefficient c of Postulate O.3 appears in the key formulas of P-theory: $M\_D = D/c^2$, $G = \gamma \cdot \chi \cdot c^2/(4\pi)$, $\tau\_b = \ell\_b/c$, $d = c \cdot t$. This is a consequence of the uniqueness of c as the physical tempo of the theory - not “c appears in all formulas”, but “c appears in those formulas that require a link between operational characteristics of different dimensions”.

The theorem of pace and path: time and distance - two projections of a single transit

Let us begin with the question of where the world gets two quantities at all - time and distance. The field itself, so long as there is no matter in it, has neither: the physical distance structure is not defined (Theorem T.1), and proper time is a property of a capture, not of the medium. In the field's own being there exists only the flow-through - how much transit has passed. This is the world's only “currency”, and it does not have two independent measures.

Both familiar quantities appear together with matter - and they appear as a pair. A capture lags behind the tempo of the medium, and the laggard, for the first time, acquires a point of view: it has an “inside” - its own circulation - and an “outside” - everything it fails to keep up with. From that moment it is forced to keep account of one and the same flow-through in two ways. Inwardly, it counts the ticks of its circulation - this is what we call time; the entry in this account is phase, for the circulation of a capture is a phase rotation. Outwardly, it surveys its neighbors by the radar-ranging procedure (Postulate O.2): it sends out a disturbance and waits for it to come back - this is what we call distance; the entry in this account is transport. Two ledgers, one accounted process. Herein lies the essence of the theorem: time and distance are not two entities but the internal and external projections of a single transit.

From this the role of the constant c becomes clear. It is not the speed of some object in the world but the exchange rate between the two ledgers: “one second” and “299 792 458 meters” are one and the same amount of flow-through, recorded by two instruments. Postulate O.3 fixes the uniqueness of the rate; Theorem T.3, the fact that c appears precisely in those formulas where operational quantities of different dimensions meet. If time and distance were independent, there would be many bridges between them, and they would differ from place to place; there is one bridge, and it is the same everywhere - this is the empirical seal of the identity. On this reading the formula $E = m \cdot c^2$ loses its mystery: mass is lag, a store of undelivered flow-through, and c^2 is the square of the unit exchange rate for converting from the two-ledger record of matter into the one-ledger record of the medium; in the currency of the medium itself, $E = m$.

Why, then, is time not a fourth distance? The answer is structural. The three spatial channels are the directions along which transit runs; the temporal channel is the pace of the flowing itself. A river has three coordinates of its bed and one speed of its current, and the speed is not a fourth bed. The influx of axiom A1 is scalar - one number per point - and therefore the pace is one. Directions, on the other hand, must suffice for a node to be able to close: two phase slots do not close a current, and only three give the first closure (the minimal three-node bundle - see the section on the structure of minimally stable matter). The world formula $d = 4$ then reads: three paths for the node to tie, and one pace for the node to live. There is also a second asymmetry - the arrow: the path has no distinguished direction (the isotropy of E(3)), while the pace does, for the influx is positive; the past differs from the future not by geometry but by the fact that the flow-through runs.

Everything is now ready for stating the theorem in full. It has three parts, and they form a ladder. The first is the identity: there are two ledgers but one currency, and the exchange rate is one. The second is the budget: a single transit is shared between the internal entry (phase, the pace of the clock) and the external one (transport, path), and out of this sharing fall the interval, the “three plus one” signature, and the slowing of moving clocks - without the relativity postulate. The third is the aberration: it turns the identity onto the background itself and answers the question of what the expansion of the Universe is if space is a process. The answer will turn out to be this: the expansion is one single record of the background, which the observer is obliged to keep in both ledgers at once, and the “growing distances” and the “slowing distant clocks” are two columns of this record, not two different phenomena.

Part one, the identity. The operational time and distance of any capture are two ledgers accounting for one transit of the medium: an internal one (the ticks of circulation) and an external one (the radar survey). The conversion rate between them is single and universal - c. The ledgers are mutually definable and are therefore born in one act: a clock is a closed path, a ruler is a duration of flight, each definition contains the other - neither ledger exists before the other. Both ledgers are opened together with the first closure of a node: the minimal three-node bundle is the first instrument of space and time, the first clock and the first ruler in a single object, and its pair of scales ℓ_b and $\tau_b = \ell_b/c$ is the world's first meter and first second. For a synchronous disturbance - the photon - both of its own ledgers are empty: there is no lag, and hence neither a circulation of its own nor a survey of its own. The question “how long did the birth of time last” is ungrammatical: duration is a product of the act, and it cannot be used to measure the act itself.

Part two, the budget. For any capture transported at velocity v relative to the frame of the medium: (i) its proper pace is related to the coordinate time and the traversed path by the quadratic form

$$\tau^2 = t^2 - |\Delta x|^2/c^2$$

- an interval of signature (−,+,+,+); (ii) the rate of moving clocks relative to clocks at rest equals

$$\dot{\tau}/\dot{t} = \omega_0/\omega = \sqrt{1 - v^2/c^2}$$

- the slowing of moving clocks is an overspend of the pace budget on transport, not a postulate; (iii) a second temporal channel does not exist. The premises are only what has already been established in this work: the radar definition of distance (O.2), the uniqueness of the rate c (O.3), the scalarity of the influx (A1), the memorylessness of local transit, and the quadratic dispersion of the medium wave $\omega^2 = c^2 \cdot k^2 + \omega_0^2$, derived in the analysis of the de Broglie wave (Proposition 9; ω_0 is the internal clock of the capture).

Proof: a moving capture is represented by a mode of the medium on the dispersion curve, with wave number k and frequency $\omega(k) = \sqrt{c^2k^2 + \omega_0^2}$; its velocity is the group velocity, $v = c^2k/\omega$ (exactly the mechanics that gave the de Broglie wave). The full phase of the mode is $\varphi = \omega \cdot t - k \cdot x$, but the capture's internal clock counts the phase at the location of the capture itself, that is, along the trajectory $x = v \cdot t$. Substitution gives

$\varphi(\text{along the trajectory}) = (\omega - k \cdot v) \cdot t = (\omega_0^2/\omega) \cdot t$

The meaning of this line is transparent: transport eats the term $k \cdot v$ out of the full tempo, and the internal phase gets what remains. Dividing by ω_0, the tick of a clock at rest, and using the dispersion, we obtain $\tau/t = \omega_0/\omega = \sqrt{1 - v^2/c^2}$ - item (ii): the faster the transport, the less of the flow-through is left “for itself”. Squaring gives $\tau^2 = t^2 \cdot (1 - v^2/c^2) = t^2 - |\Delta x|^2/c^2$ - item (i). The minus sign in front of the spatial term is inherited from the fact that both entries are paid from one budget, while phase (rotation) and transport are orthogonal and therefore add in the Pythagorean way - the quadratic dispersion is precisely this bookkeeping identity, written out for modes. Plus signs stand between the directions of the path because the directions are independent and isotropic; there is a single time term because there is a single pace. A linear sharing of the budget ($\tau/t = 1 - v/c$) is ruled out twice over: it is incompatible with the derived dispersion and contradicts the observed slowing of clocks. Item (iii): two independent paces at a single point would require either a memory of the flow-through - which share has been given to which channel - contradicting the memorylessness from which the very exponential of the time rate is derived, or a second influx, that is, a second medium - against the uniqueness that gives one G and one c.

Machine check. Only the equation of the medium was put into the computational model - no relativity at all. A wave packet was accelerated to speeds of 0.3, 0.6, and 0.9 of c, and the tempo of the internal phase was measured while accompanying its center - literally the pace of a moving clock. The machine gave 0.954349, 0.800299, and 0.435883 against $\sqrt{1 - v^2/c^2}$ = 0.953986, 0.800111, and 0.435930 (the reference values were computed at the actually attained packet speeds, slightly different from the nominal 0.3/0.6/0.9) - agreement at the level of ten-thousandths, confirmed by a second integrator, independent in method. The medium itself knows the Lorentz kinematics; we merely asked it with the phase.

Part three, aberration. The inflation of the medium proceeds in the field's own being - where there are neither seconds nor meters: the background belongs to none of the observer's ledgers. The observer can record the background only through their operational quantities, of which there are exactly two, and by the first part of the theorem these are two projections of one and the same thing. Hence the record of the background must exist in two columns at once. Read in the spatial ledger, the aberration of inflation appears as a growth of radar distances between unbound captures - “space expands”. Read in the temporal ledger, the same aberration appears as a stretching of the arriving ticks of distant clocks - “distant time runs slower than mine”. Up to this point in this work, aberration has been formulated only in the first column; the theorem completes the symmetric half and asserts: both readings give one and the same factor,

$(1 + z)$ by path = $(1 + z)$ by pace

Proof: let a distant capture send two successive ticks. The medium is memoryless and homogeneous: a patch of the medium has nothing by which to distinguish two identical synchronous disturbances other than their position against the background - hence the comoving separation of the ticks in transit is unchanged. What changes is only the exchange rate at which that separation is converted into the receiver's units - the background count, which has grown during the flight time. The reception interval comes out equal to the emission interval multiplied by the ratio of the background counts, that is, by (1 + z). But the crests of a light wave are those same ticks of the source: the frequency of light falls by exactly the same factor. Redshift ("the path grew while the light was in flight") and the stretching of ticks ("distant clocks are slower") are one number by construction, not two mutually adjusted effects. The temporal column of this record has already been measured directly: the light curves of distant supernovae are stretched by exactly a factor of (1 + z) - distant explosions burn longer by precisely the redshift factor - and the same factor has been confirmed on quasar variability. In standard cosmology this is "an accompanying effect of expansion"; here it is inflation itself, read in the second ledger - an equal face of the phenomenon, not its consequence.

From here the Hubble constant itself is also clarified. H is the rate at which the stretching of ticks accrues per unit depth: the drift rate of the readout tempo. Its proper dimension is one over time; the familiar "kilometers per second per megaparsec" is the spatial notation of the same quantity, in which the kilometers and the megaparsecs cancel. The temporal ledger is visible directly in the units. And this column has a clean future measurement: redshift drift - a years-long observation of how the z of one and the same source changes. This is a direct measurement of temporal aberration in real time, with no rulers involved at all.

Next the theorem reaches the horizons. The readout tempo of another's clock equals its local tempo divided by the accumulated stretching factor:

$\dot{\tau}(\text{readout}) = \dot{\tau}(\text{local}) / (1 + z)$

At the surface of a black hole the denominator grows because of the medium's lag: the local tempo falls to zero in the depth of the rarefaction. At the cosmological horizon the source's local clock runs normally, but the aberration of the background accumulates an infinite stretching over the finite range c/H. In both cases the receiver sees one and the same thing: the other's clock freezes. Two surfaces that had been treated in this work as different storylines - the hole's horizon and the horizon of the far distance - turn out to be a single phenomenology of the freezing of the readout tempo; the difference lies only in the source of the denominator. One formula unites both horizons of the Universe.

The final item of part three is locality. In a bound system the transit between nodes is closed by the capture balance: background accrual has no place either in the clock loop or in the ruler's measurement. Both columns of the aberration record between bound nodes are identically zero: an atom does not grow in meters and does not stretch in seconds; a galaxy does not creep apart together with the background. Aberration is a property of the accounting of unbound captures through the background, and the symmetry here is complete: it is not "space expands, but rulers for some reason do not" - between bound nodes both ledgers are silent at once. The old schoolroom question "does the atom expand together with the Universe" dissolves: aberration between its nodes simply has nowhere to accumulate.

What the theorem explains. The agreement of the proper and coordinate clocks of cosmology is a special case of the identity of the two ledgers. The concerted distortion of times and lengths in a gravitational well is the reason why the equivalence principle is a theorem here: one medium cannot convert the two ledgers at different exchange rates (Proposition 5). The splitting of expansion-rate measurements into two stable camps acquires, by part three of the theorem, a precise meaning:

instruments that build their ruler from a census of matter read the path column, while instruments that read the pace along the ray itself read the pace column; the two camps are the two columns of a single aberration, and the gap between them is the price of the attempt to compress a two-column record into one number (Proposition 15; a testable prediction for standard sirens is in the section "Falsifiable Predictions"). The structural share $s\_c = 1/4$ acquires a physical reading: in the throughput budget the tempo is a full-fledged fourth channel, the medium's load steals equally from all channels, and the theft from the temporal channel is the slowing of clocks - gravity as stolen pace.

Dimensional check: $[\tau^2] = [t^2] - [x^2/c^2] = s^2 - m^2/(m/s)^2 = s^2$ ✓; $\dot{\tau}/\dot{t}$, ω_0/ω, and $(1 + z)$ are dimensionless ✓; $[H] = 1/s$ ✓; $[c/H] = (m/s)\cdot s = m$ ✓.

Known limitations. What has been proved is the kinematic layer of the emergent Lorentz structure: clocks, the interval, time dilation. The consistent transformation of the field equations themselves on passing to a moving observer is a separate, not yet closed node (the dynamics of the θ-sector, Proposition 9); the theorem lays no claim to it. The quadratic character of the dispersion is taken as a previously derived result, not as a new first principle: the theorem is a rigorous assembly of links already established, and therein lies its value. The unification of the horizons is a unification of the readout phenomenology: the sources of the freezing differ (the medium's lag at the hole, accumulated aberration at the far distance), and the theorem does not erase that difference. The stretching of light curves and redshift drift are external observational anchors, not the theory's own calculation.

Status of the result: parts one and two - Derived (an assembly of derived links) + Numerical verification (machine measurement of clock dilation, accuracy of order 10^{-4}, two independent integrators); the impossibility of a second temporal channel - Derived; part three - Derived (a consequence of the identity and of the derived cosmological background) with direct observational anchors (the $(1 + z)$ stretching in supernovae and quasars). The readings "an equal in the budget, singled out in pace" and "the first instrument of space and time" are systematizing statements.

On the genre of derivation: what the theory derives natively and where the pithiness boundary runs

This section fixes the epistemological status of the derivations of P-theory - what kind of statements the theory generates by itself, pithily, from its ontological basis, and what kind of quantities lie beyond the limits of pithy derivation. This distinction is fundamental for the correct posing of problems. The word Proposition is used here in the treatise sense - a structural claim developed with derivations, each carrying an explicit epistemological status - not in the mathematical sense of a proved statement.

A pithy and native theory generates first and foremost mechanisms, scales, signs, relations between quantities, and forced coincidences - that is, structural statements about WHY the physical picture is the way it is. These statements follow directly from the ontology. Examples: the characteristic size of the nucleon is ℓ_b; nuclear saturation gives $R \propto A^{(1/3)}$ with r_0 from ℓ_b, ρ_E, m_p; the deuteron comes out barely bound, while the diproton and the dineutron come out unbound (the exclusion of identical nucleons via the non-closure of coincident currents plus the θ-Coulomb); the ratio of magnetic moments $\mu\_p/\mu\_n = -3/2$ is parameter-free. Such results fall out of the theory on their own.

High-precision ABSOLUTE values of fine, finely tuned quantities do NOT fall out of the theory. The binding energy of the deuteron (≈2.224 MeV) is a small residual - of order 0.3 % of the nucleon mass - sensitive to a multitude of subleading details. Such a number is not derived elegantly in any fundamental theory: in standard nuclear physics it is obtained by fitting multi-parameter nucleon-nucleon potentials, or by a lattice calculation of large computational volume. In P-theory, too, this is a separate precision computational undertaking, not a native consequence. The theory PROVIDES the framework for such a number but does not YIELD it by an elegant derivation. This is a boundary of the genre, not a defect of the theory.

Hence the methodological principle. Since the theory is pithy and native, the correct questions to put to it are questions about mechanism, scale, sign, relations, and forced coincidences; it is precisely these that it answers directly. When some quantity does NOT fall out of the theory cleanly, this is, as a rule, a signal of one of two things: either the problem statement has stepped beyond the native level - a quantity has been requested of a kind (a fine absolute number) that the theory does not promise at this level; or an error has been made in interpreting the theory and a foreign apparatus has been imported into the formulation, so that the problem is posed incorrectly. In both cases the right response is to return to the native formulation and to ask the theory for what it derives elegantly, while keeping the exact values of fine quantities as a separate computational task.

This distinction is not a theoretical assumption but an observed regularity across the entire corpus of P-theory: structural derivations fall out easily and exactly, whereas the absolute values of individual quantities either remain a computational residual or are irreducible inputs of the theory. A list of the significant cases, by genre baskets.

Exact identities and ratios (the causal structure is fully visible): the dimension $d = 4$ from the incompatibility of A1+A2, and with it s_c, p, γ, u_W and the 5/6 bridge as exact identities (Axiomatics); the structural prefactors $8/3 = (4\pi)^2/(6\pi^2)$ and $m_H/m_W = \pi/2$ (Propositions 9 and 11); the ratio of magnetic moments $\mu_p/\mu_n = -3/2$ parameter-free (Proposition 2); the α-sector ↔ G identity at leading order, with round-trip closure (the there-and-back cycle) = 1 across six decades, equivalent to $\mu_{KG} = 3/4$ (Proposition 10); the de Broglie $\lambda = h/p$, derived from the dispersion of the medium (Proposition 9); the cascade screening-shift coefficient $K = d(d+1)/(d+2) = 10/3$ - a two-filter transfer consistent with the charge route only at $d = 4$ (Proposition 9); the $^3He - {}^3H$ splitting, equal to the θ-Coulomb of the added pair of protons to an accuracy of ~1% (Proposition 7).

Relation laws (the form of the dependence is derived exactly; the absolute coefficient is not): the nucleon size $R^* = \ell_b = (\hbar c/\rho_E)^{1/4}$, parameter-free (Propositions 2 and 7); nuclear saturation $R = r_0 \cdot A^{1/3}$ (Proposition 7); the pointwise size elasticity $1/p = 1 + 1/X$ with $p_b = 5/6$, $p_n = 4/5 = H$ at the realized point (Proposition 2, Step 8; the earlier branch notation $R \times \omega^{5/6} \approx \text{const}$ is its first-order plane); the ordering of light-nucleus binding by the number of contact edges, $^2H < {}^3H \approx {}^3He < {}^4He$ (Proposition 7); process dark energy $\rho_{DE} \propto H$ with $w = -1$ (Proposition 15; the literal form $\propto H$ is excluded by observations - Proposition 15); the electron exponent in $m_e = m_q \cdot \alpha^{5/4} \cdot (1 + \alpha \cdot k)$, where 5/4 is a consequence of the $d = 4$ cascade and k is the dressed screening of the current measure 25/9 (Proposition 9); the bridge correction $\omega_d/\omega_s = (5/6) \cdot (1 - s_c/E_B)$ - the price of the self-response slot under a finite budget (Proposition 2, Step 9).

Mechanisms, scales, signs, forced coincidences (the direction and the order of magnitude are derived exactly): the tested weak-field, post-Newtonian, and radiative structure of general relativity from the medium - $v_{GW} = c$, $\gamma_{PPN} = 1$, the factor of 4 in light deflection, quadrupole without dipole, tensor polarizations, the fixed coefficient $16\pi G/c^4$ (Proposition 5); the mechanism and scale of the neutrino mass $m_\nu \approx 0.03$ eV and its Majorana nature $\nu = \bar{\nu}$ as a structural prediction for neutrinoless double β-decay (Proposition 9); the Geiger-Nuttall slope and α-decay half-lives spanning 24 orders of magnitude from a single native r_0 (Proposition 7); the β-stability valley and the trend $N > Z$ (Proposition 7); the magic numbers 2, 8, 20 and the special stability of ^4He as geometric closures of the packing of captures (the tetrahedron), and the anthropic closure thresholds $N = 2$ / $N = 3$ (Proposition 7); the sign and scale of the nuclear spin-orbit coupling $\lambda \sim \ell_b^2$ (Proposition 7); the mass limit of compact collective lags $M_{max} \sim 2.7$-3.1 solar masses (Proposition 5).

The same analysis shows where an absolute number does NOT drop out, and two cases are distinguishable here. The first is the computational residual: the number is computable in principle but lies below the pithiness level. Here belonged the absolute binding energy of the deuteron and of the closed light nuclei - both now closed by the computational phase (the deuteron at −2.213 MeV as a loose bound state of the medium wave; the binding curve for A = 8…100 from α-aggregate assembly with an RMS of 0.348 MeV/nucleon and an ideal-crystal a_V of 25.2 ± 0.5 - Proposition 7); what remain are the absolute magnetic moment μ_p (~7 %) alongside the exact structural ratio −3/2, and the exact spectrum of the heavy nuclear magic numbers - with the sign and scale of the spin-orbit coupling $\lambda \sim \ell_b^2$ derived (Proposition 7). A number of quantities formerly of this genre have already been moved into the derived column: the electron mass has been brought by vertex dressing to +0.0027 % (Proposition 9), while the screening factors (K = 10/3) and the O(1) factor of the capture size have been obtained exactly. The residual of the fine-structure constant lies at the noise floor of the inputs (−0.007 % at leading order, down to +0.00002 % with full dressing of the vertex). The second case is the irreducible input: a quantity the theory accepts rather than generates. There are two such inputs, and it is important to distinguish their statuses honestly. The frequency ω_p: no closed first-principles formula for it has been found, and this has been established by systematic search - five independent paths have rejected the simple routes (statics yields no dimensionless selector; the inverse move - the size is ω-blind; the open balance does not close with naive forms; the charge is monotonic in frequency by Vakhitov-Kolokolov; the rational circle point 8/17, registered under a blind protocol with kill criteria fixed before the calculation, was rejected by the precision root). But this makes the irreducibility only plausible, not proven: a derivation is not ruled out, it has merely not been found. The anatomy of the number itself has nevertheless been laid open (Step 7, Proposition 2): the core of the mode is free, the zeroth order is closed ($1/\sqrt{2}$), and the irreducible remainder is localized in the phase of reflection off the saturation wall - a class of arctan and quadratures inaccessible to cascade fractions; the regularity of the failures of the rational hunts is thereby explained. Hence ω_p is an honest numerical input (computed exactly and reproducibly, on a par with the boundary-value-problem energies E_A, E_s, E_B), and the residual +2.7 % is a measure of the unclosedness of this point, not a separate law. The gravitational pixel ℓ_P and the constant G are a markedly stronger case: no independent M_P is generated within the local structure of the theory (a no-go argument over four mechanisms; the full formal theorem on the absence of channels is among the open problems), while the obstruction to the absolute coefficient $C_0 \propto H_0$ has been proven as an exact cosmic-coincidence theorem; with α chosen as the ultraviolet input, the value of G itself is derived ($G = \hbar c/M_P^2$, a 0.8σ deviation from CODATA), and only an independent first-principles pinning of the ℓ_P scale itself remains open. And here the failure of the absolute value to drop out is not a gap in the theory but the structure of its inputs: for ω_p it is open (a formula may yet be found); for the ℓ_P scale it comes with a proven obstruction to the pure coefficient.

Thus the corpus of the theory itself confirms the genre boundary. The causal structure shows through in identities, ratios, relation laws, mechanisms, and forced coincidences - where the inessential details cancel; the absolute values of certain complex or fine quantities either require a separate computational pass or are irreducible inputs of the theory. The ease of the former and the inevitability of the latter are not two different defects but a single signature of a theory that has grasped the cause rather than fitted the numbers.

Accordingly, the status of the native first version of the theory - the one intended for substantive discussion - is fixed. It is closed at the level of mechanism and structure within the declared corpus of the theory: every phenomenon considered - including the birth of matter and the baryon asymmetry (Propositions 12 and 15) - has been assigned a native causal account with an honest status, while the irreducible inputs and computational residuals are explicitly marked out and placed beyond the frame of pithy derivation. What remains - if desired, a rigorous theorem-level formulation of several already derived relations, and a separate subsequent computational phase for the absolute values of fine quantities - refines the causal picture but does not change it. In this sense the native version of the theory has integrity: it explains why the world is the way it is, and honestly shows where the boundary runs between what it derives and what it accepts as an input or hands over to computation.

Rule M.5. Prohibition of the static potential (dynamical carrier)

Rule: a static potential as a source of dynamics or of a spectrum is, in P-theory, a category error. P-matter is an open dynamical steady state of the power balance (A2), not an energy minimum; the gradient of the energy ledger is not a force. The legitimate carriers of calculation: (1) the ledgers of dynamical steady states of the medium solvers (prices are differences of settled ledgers with a full re-settling of the medium); (2) wave layers above measured field carriers (relative medium waves) - where the structure leaves available room; (3) the linear response of a frozen configuration - as a calibrated instrument with an explicit caveat.

Grounds: ontological - A2 asserts a power balance, not conservation, and a static energy minimum is not a stability criterion for an open flow-through medium; empirical - seven independent measurement refutations of statics sharing a single type of error: literal walls and a Hamiltonian frame for bags, a static spherical mean field on an aggregate source, the sum of pair wells as the single-particle well of a valence nucleon (a violation of packing occupancy), and centroid “shifts” that turned out to be an artifact of a reference-frame shift. Corollary: the spectrum of magic numbers has been recomputed dynamically; static measurements are admitted only under machine null controls (gates).

Status of the result: a methodological rule (class M.1); the empirical part - Numerical verification (seven measurements).

Rule M.6. The ontological filter (prohibition of foreign reading)

Rule: any new mechanism, channel of explanation, or bet begins with a formulation of the phenomenon in the native terms of the theory - process, lag, tempo, aberration, integrity, resonance. If a proposed mechanism requires a foreign reading (material-kinematic, metric, quantum-field-on-a-background, and the like), it is not fixed in the canon without an explicit ontological analysis; every fixed entry must carry an “ontological grounding” line, not numbers alone. Scanning through mechanisms - “what could yield the required number” - without an ontological formulation is forbidden: first the ontology is asked, then the number is computed.

Grounds (precedent): the kinematic branch “the Hubble discrepancy = outflow from a local underdensity” read a process phenomenon - expansion as the aberration of the inflation of the field at rate c - in foreign material-kinematic terms (motion of matter), with the observed number-count contrast as an input, and was fixed in the canon and in the register of bets. It has been withdrawn by the author in full (history - Appendix F); a sanity-check dynamical calculation confirmed that the physical contribution of the channel is a trifle (±0.3 % against the required 8.4 %). The rule closes off the very way in which such branches arise.

Status of the result: a methodological rule (class M.1).

Axiomatics and architecture of the theory

The ontology is fixed by two logically independent axioms and one kinematic law. Everything else is derived.

Two axioms

Axiom A1 (Inflation): At every point x of the three-dimensional manifold M_0, at every moment t, a local influx power $q(x,t) = q_0 > 0$ is present, constant. The law is invariant under the full group of Euclidean symmetries E(3). Localized perturbations propagate at a speed no greater than c.

Axiom A2 (Metastable balance): In the stationary sector, for any bounded region V the total energy does not change in time; stationarity is maintained by a power balance, not by accumulation.

$P\_influx(V,t) = P\_transit(\partial V,t) + P\_debit(V,t)$

A2 asserts balance, not conservation: nothing accumulates, everything passes through. At zero extraction $\kappa \equiv 0$ the medium is unperturbed ($\rho \equiv \rho\_E$); for $\kappa > 0$ part of the influx becomes stuck in a local cyclic process, forming a capture. Axioms A1 and A2 are logically independent (proven by two counterexamples): they cannot be reduced to a single one without loss of content.

The Local Transit law (LT)

The kinematic law relates the density of the medium to the power of free transit:

$\rho(x,t) = s\_tr(x,t) \cdot \tau\_b$

where $s\_tr = q_0 - \kappa$ is the local power of free transit, and $\tau\_b = \ell\_b/c$ is the characteristic time for which energy is held at a point before transit. This is the equation of state of the spatial field - the analogue of an equation of state for a medium. Both level-1 constitutive forms (the time rate $\dot{\tau} = \exp(-n/2s\_c)$ and the micro-law $\delta\rho = \tau\_b\cdot\varepsilon$) follow from a single premise, “a memoryless stationary flow-through with a single holding time”: memorylessness yields the exponential via the Cauchy equation, and stationarity yields the relation between stock and rate (Little's theorem).

The five-level architecture

The statements of the theory form a directed dependency graph without cycles - five levels, each resting only on those below: (1) the foundation - axioms A1 (inflation) and A2 (metastable balance); (2) kinematics - the Local Transit law $\rho = s\_tr\cdot\tau\_b$; (3) the field law - the far-zone lemmas and the 1/r uniqueness theorem with $G = \gamma\cdot\chi\cdot c^2/(4\pi)$; (4) closures - the single dynamical equation F2.3, the integral bridge (the principle of equivalence of masses), and postulates O.2 and O.3; (5) normalizations - the calibration point m_p (through it, m_q, ρ_E, ℓ_b, τ_b) and the structural share $s\_c = 1/4$.

The single dynamical equation (F2.3)

The internal phase dynamics of a capture is described by a single bispinor equation:

$i\gamma^\mu \cdot D\_\mu\Psi = \dot{\tau}(n) \cdot \not{U} \cdot \Psi$

where $\Psi \in \mathbb{C}^4$ is the bispinor of all channels of perturbation of the field, U_μ is the 4-velocity of the inflating medium, $n = \bar{\Psi}\not{U}\Psi$ is the medium-covariant density (not the usual $|\Psi|^2$), $\dot{\tau}(n) = \exp(-n/2s\_c)$ is the local rate of proper time, and D_μ is the covariant derivative with respect to the gauge field of the medium a_μ.

All sectors of interactions are different groups of bilinear forms of the bispinor:

u-sector: static rarefaction of the field - the gravitational potential and inertia.

θ-sector: oscillating polarity - electromagnetism and the electron mass.

ξ-sector: an internal two-component configuration - the weak interaction and chirality.

Note: $\dot{\tau}(n)$ is a self-consistent rate, not a constant mass. For $\dot{\tau}$ = const the right-hand side would reduce to a γ^0 shift of the energy above the massless cone ($v = c$) - the free, photonic limit. Mass, $v < c$, and the internal clock of the electron are emergent from the nonlinearity of $\dot{\tau}(n)$ (self-capture), not written in by a linear term.

The honest register of the theory's inputs

The theory has been reduced to a minimal set of inputs; an honest analysis revealed that the headline "d = 4 + one point" undercounts two load-bearing inputs. The full register:

Derived scales: $m_q = (\rho_E \cdot \hbar^3/c^5)^{(1/4)} \approx 231$ MeV; $\ell_b = \hbar/(m_q \cdot c) \approx 0.854$ fm; $\tau_b = \ell_b/c \approx 2.85 \cdot 10^{-24}$ s. The density $\rho_E = m_q^4 \cdot c^5/\hbar^3 \approx 5.94 \cdot 10^{34}$ J/m³ is not calibrated separately - it is derived from m_q. The numerical values of these scales are derived in Proposition 2.

The medium has two resolutions, and it is useful to distinguish them. The baryonic one, ℓ_b, is the grain of matter, below which a capture is not resolved as a stable configuration (hence the three nodes, hence the discreteness of matter); the absolute one, ℓ_P, is the limit of the flow-through itself, the transit pixel. Matter lives at the first resolution, while induced effects from the second yield the lightest objects (the neutrino, Proposition 9).

The ℓ_P wall: the status of the second input

Formulation. The medium has two intrinsic scales, irreducible to each other within the P structure: the matter pixel $\ell_b = \hbar/(m_q \cdot c) \approx 0.854$ fm (infrared; follows from m_p) and the transit pixel $\ell_P \approx 1.6163 \cdot 10^{-35}$ m (ultraviolet; it sets $M_P = \hbar/(\ell_P \cdot c)$ and $G = \hbar c/M_P^2$). The hierarchy $\ell_b/\ell_P = M_P/m_q \approx 5.3 \cdot 10^{19}$ is a property of the medium itself, of the same kind as c and ρ_E; the theory reads it off by measurement through the equivalent windows of a single input: $\alpha \Leftrightarrow M_P \Leftrightarrow \ell_P \Leftrightarrow m_\nu$ (all locked by the single quantity $L = \ln(M_P/m_q)$; the canonical input is α, as the most precise window - to eight digits).

Proven boundary. There is no native candidate for pinning ℓ_P inside the structure - this has been established, not assumed: (1) the no-go of four mechanisms - the dimensional set $\{\rho_E, \hbar, c\}$ yields only m_q and ℓ_b; saturating self-interaction stops at O(1); power-law running is nailed to ℓ_b; the logarithmic route is dimensional transmutation via the α-exponential; (2) the irreducibility theorem - all dimensionless outputs of the structure are O(1) or functions of α, the only mechanism for a hierarchy of twenty orders of magnitude is an exponential, and the only native exponential, the phase-slip $\exp(\mu_{KG}/\alpha)$, is already bound by α, so the counting route is circular; (3) a cosmological source of M_P has been tested with a negative result ($\{\ell_P, \ell_b, R_H\}$ do not form a geometric progression); (4) a complete enumeration of routes: dissipation leads to ℓ_b, the black-hole route is circular, the α-sector is an exact identity (the reverse reading derives G from α but does not fix the scale independently).

Decision. ℓ_P is adopted as the second structural input of the theory - status "Empirical normalization" (the value is read off from α), on a par with m_p; the "Open" line of the register is removed.

This is a statement about the limits of the structure, not about underivability in principle: the hierarchy problem is open throughout all of physics, and P has localized it exactly - a single quantity L,

locked by the $\alpha \Leftrightarrow m\_\nu$ lock (falsifiable: the one predicts the other). An honest statement of the boundary is itself the closure; no imitation of a derivation is put forward.

Status of the result: Input (empirical normalization); the no-go inside the structure - Derived. The question of an independent derivation of ℓ_P is closed by an honest statement of the boundary (2026).

Derivation of the dimension d = 4 and of the structural cascade

The dimension of spacetime is not postulated here but derived. Only the three-dimensionality of space is postulated ($M_0 = \mathbb{R}^3$); the number of transit channels turns out to be a consequence of the incompatibility of A1 and A2 in the free background. This is the most load-bearing node of the entire theory, which is why the derivation is given in full, with an explicit justification of every step - especially of the one that is usually skipped over in silence.

Step 1 - the influx must leave: In the unperturbed background the density is constant, $\rho = \rho\_E$, so $\partial\rho/\partial t = 0$. But A1 says that power $q_0 > 0$ is supplied to every point from outside. The continuity equation then requires that the entire influx be carried away by transit - by an outflow field J with everywhere positive divergence:

$$\partial\rho/\partial t + \nabla\cdot J = q_0 \quad \Longrightarrow \quad \nabla\cdot J = q_0 > 0 \quad \text{(at every point)}$$

The influx can neither be accumulated (the density is constant) nor ignored (it is real by A1) - it must drain off somewhere.

Step 2 - why the outflow is a vector, not a tensor: This is the decisive and usually omitted point. Before demanding symmetry of J, one must understand what kind of object it is - and here it is ontology that leads, not intuition. Three arguments converge on a single answer.

First, in the free background there is as yet no metric. By postulate O.2, physical distance is not a property of the auxiliary Euclidean background M_0; it is defined only between captures and only as a radar measurement - a “there and back” signal along the line connecting the pair. As long as there are no captures, the background has no spatial form whatsoever out of which a complex outflow object could be molded.

Second, in the pure background one single scalar quantity flows - the inflation energy density ρ_E. The internal sectors θ (charge) and ξ (spin) are the structure of captures and appear only together with matter; the background transit is not burdened with them. And the outflow of a scalar is, by its very nature, a current - a vector field, not a multi-component object.

Third, this immediately closes the “tensor loophole”. One might object: what if the influx is balanced not by a vector but by an isotropic tensor of the form $\delta_{ij}\cdot f$? No - and here it is important to state precisely what is forbidden. The Euclidean language of notation (coordinates, the symbol δ_{ij}, the rotations and translations of E(3)) is the theory's auxiliary language of notation: A1 itself is written in it, and it may be used anywhere. But from the fact that the word “distance” is in the dictionary it does not follow that the world already has a ruler: physical form in P-theory appears only together with captures (T.1), and before them the background has nothing out of which to manufacture its own distinguished outflow object - including a tensorial one molded from δ_{ij}. The objection “δ_{ij} is a metric, and there is no metric in the background” means a ban on passing the language off as a physical resource, not a ban on the symbol. And the main point: even if this loophole is temporarily allowed, it is closed by an independent physical argument from the medium's throughput capacity: if the background is allowed arbitrary configurations, be they tensorial or symmetry-breaking, they perish for purely physical reasons (Step 3′): the medium's throughput capacity is insufficient for them, and they make the background observably inhomogeneous.

The only form the outflow is capable of taking at all is the one induced by a measurement; and by O.2 a measurement is binary (distance is always for a pair of captures) and therefore one-dimensional (along a single “there-and-back” line). A one-dimensional directed slice of an isotropic outflow is exactly a vector. The vector nature of J is thus not an assumption tossed in, but the direct content of postulate O.2.

This same vector nature is easier to see than to prove. The outflow is isotropic - from a point equally in all directions; but every measurement is one-dimensional: the act of emitting a photon selects one direction out of the isotropic fan. The vector appears not in the field itself but in the act of measurement, which slices the isotropy along a single line.

Step 3 - isotropy kills the spatial channel: The free background is homogeneous and isotropic - invariant under the full Euclidean group E(3), and the outflow vector is obliged to share this symmetry. But the only E(3)-invariant vector field on $\mathbb{R}^3$ is identically zero:

any nonzero vector at a point singles out a direction and thereby breaks isotropy. Hence $J \equiv 0$, whence $\nabla\cdot J = 0 \neq q_0$. A uniform isotropic influx has not a single spatial channel into which it could leave - purely spatial transit is incompatible with A1+A2. The contradiction is genuine, not apparent.

Step 3′ - two locks against workaround solutions (Theorem 1′): Step 3 rests on symmetry: an invariant field must be zero. One objection remains - let the solution itself break the symmetry of the background. Formally, $\nabla\cdot J = q_0$ is solved by the linearly growing field $J(x) = (q_0/3)\cdot(x - x_0)$: it has a center x_0, and it is precisely this center that is usually hidden away in the “tensor loophole”. This loophole is closed twice over, and both locks are physical - with no appeal to a metric at all.

The first lock - the flux lock. For any solution with $\nabla\cdot J = q_0 > 0$, the flux through a sphere of radius R grows as the volume, $\Phi(R) = q_0\cdot(4\pi/3)\cdot R^3$, while the area grows only as R^2; the mean flux density inescapably grows linearly: $|J| \geq q_0\cdot R/3 \to \infty$. But transit has a native ceiling: by the Local Transit law, the energy of a state with $\rho \leq \rho\_E$ is carried at a rate no higher than c, so $|J| \leq \rho\cdot c \leq \rho\_E\cdot c$. At a radius $R > 3\cdot\rho\_E\cdot c/q_0$ the required flux exceeds the ceiling - no stationary purely spatial solution exists, neither symmetric nor symmetry-breaking. The background identity $\rho\_E = q_0\cdot\tau\_b$ makes the contradiction local: $R\_crit = 3\cdot\rho\_E\cdot c/q_0 = 3\cdot c\cdot\tau\_b = 3\cdot\ell\_b \approx 2.56$ fm - the ceiling is violated already at three transit cages (and the three here is d_sp from the divergence, $R\_crit = d\_sp\cdot\ell\_b$); the temporal channel is forced locally, not asymptotically.

Dimensional check: $[q_0\cdot R] = (W/m^3)\cdot m = W/m^2 = [\rho\_E\cdot c] = (J/m^3)\cdot(m/s)$ ✓

The second lock - the homogeneity lock. The center x_0 is an operationally distinguished point. A capture placed into such a background would, from the gradient of the outflow, discover an absolute reference point - the unique place of transit rest, physically distinguishable from all others. A free background with an absolute reference point contradicts the ontological homogeneity of A1 (no “here” and “there” are defined for the background - this is the content of the axiom, not an ornament). A spontaneously broken background would be observably inhomogeneous; the observed background is isotropic. (This is the direct lineage of the Seeliger-Neumann gravitational paradox of an infinite homogeneous background [31]: the Newtonian potential of an isotropic infinite medium is ill-defined for the same reason - a divergent flux; the Milne-McCrea Newtonian cosmology [32] circumvents it by passing to a local formulation, akin to the operational closure here.)

Status. Derived. Both locks use only A1 (homogeneity), A2 (balance), LT (the $\rho\_E\cdot c$ ceiling), and volume/area scaling; nowhere does the symbol δ_{ij} carry any physical load.

Step 4 - time as the only way out: this contradiction can be removed in exactly one way.

The influx is real (A1), it cannot accumulate (A2, the background is stationary), there is nowhere for it to go in space (isotropy) - what remains is the channel orthogonal to all three spatial ones: the medium's own inflation in time.

$d = 3$ (space, postulate) + 1 (time, forced) = 4

Time is not introduced here as a separate dimension and is not chosen - it is forced as the unique resolution of the background's contradiction. By postulate O.3 the rate c of this channel is unique, so there is exactly one temporal channel. This is the strongest node of the theory: "time is the pressure valve of inflation" is not a metaphor but a rigorous derivation by elimination. If this step is wrong, the entire edifice collapses; that is exactly why it is presented in full rather than referred off to the calculations.

Closing the three-dimensionality postulate: the only dimensional postulate that remained explicit - the three-dimensionality of space - is removed. It is derived from the theory's own spinor structure, introduced below (Proposition 9): the basic brick is not "the F2.3 equation of the chiral $\mathbb{C}^4$ bispinor" but the observed spin-½ of matter, borne by a two-component carrier $\xi \in \mathbb{C}^2$ with the rotation $2\pi \to -1$ (the double cover of the rotation group SO(3), SU(2) ≅ Spin(3)).
This is an observed, basic property of matter and the theory's own object, not a dimensional assumption.
The spinor derivation of d_sp = 3. The two-component nature of ξ sets the minimal spinor dimension $2^{\lfloor d\_sp/2 \rfloor} = 2$, which allows d_sp ∈ {2, 3}. The quantized nature of spin-½ (the discrete ½, the rotation $2\pi \to -1$) requires a non-abelian rotation group and rules out d_sp = 2: there SO(2) = U(1) is abelian, and "spin" is an arbitrary real number, with no discrete ½. For d_sp ≥ 4 the minimal spinor has at least four components, i.e., ξ is no longer two-component. The intersection of the two conditions yields the unique d_sp = 3 (explicit check: SO(2) - one generator, abelian; SO(3) - three generators of the algebra su(2), whose fundamental spinor is $\xi \in \mathbb{C}^2$ with spin-½, and $\exp(-i\cdot 2\pi\cdot S\_z) = -I$, $\exp(-i\cdot 4\pi\cdot S\_z) = +I$).

$\xi \in \mathbb{C}^2$ (spin-½, $2\pi \to -1$) $\implies$ d_sp = 3; $\Psi = \xi \otimes (\pm) \in \mathbb{C}^4$; $d = 3 + 1 = 4$

Assembly and the uniqueness of the tempo. The antiparticle doubling (± - the two signs of phase rotation, Proposition 12) yields the Dirac bispinor $\Psi = \xi \otimes (\pm) \in \mathbb{C}^4$, and the single temporal channel yields spacetime $d = 4 = 3 + 1$. Since $d = 4$ is even, there exists a chirality operator γ^5, realizing the ξ-chirality and the observed P-violation (an explicit construction of the Clifford algebra confirms it: a chiral four-component spinor exists uniquely at $d = 4$ - at $d = 3$ and $d = 5$ there is no chirality operator). Thereby the chiral $\mathbb{C}^4$ is assembled from $\xi \in \mathbb{C}^2$, not postulated. In parallel, the uniqueness of the rate c, previously accepted as postulate O.3, is derived: the rate of advance of the single A1 influx is scalar (one component), so there is exactly one temporal channel - O.3 becomes a consequence rather than a separate axiom.

Status of the result: Derived. The dimension $d = 4 = 3 + 1$ no longer contains free dimensional inputs: the three follows from spin-½ (an observed property of matter), the one - from the balance of the A1 influx. The load-bearing construction - both locks (the temporal one and the spinor F2.3 one) and the spinor assembly $\Theta \times \xi \times (\pm) = \mathbb{C}^4$ - is the author's own and already belongs to the theory; the strengthening formalizes the spinor lock, removes the three-dimensionality postulate, and turns O.3 into a consequence. Numerical cross-checks of the derivation are in Appendix D.

Structural cascade: one parameter - five independent confirmations: from $d = 4$ a rigid chain of numbers unfolds, and its overdetermination is the chief argument against the accusation of fitting. The basic scale of response saturation is $s_c = 1/d = 1/4$.

Screening is not an identity but a Dyson (RPA) resummation of repeated insertions of the response, a geometric series:

$p = s_c - s_c^2 + s_c^3 - \ldots = s_c/(1 + s_c) = (1/4)/(5/4) = 1/5$ (equivalently $1/p = 1/s_c + 1$)

The rest are exact identities at $d = 4$: $H = 1 - p = 4/5$ (the Hurst exponent); $\gamma = 1/H = 5/4 = 1 + s_c$ (the electron mass exponent = the inverse Hurst); $u_W = 2 \cdot s_c = 1/2$ (the horizon condition: $\dot{\tau} \to 0$ at $u = -1/2$); the bridge $\omega_d/\omega_s = (d+1)/(d+2) = 5/6$. And here is the key point: one and the same $s_c = 1/4$ shows up in five completely unrelated sectors - $\sin^2\theta_W = s_c$ (the angle at the channel ceiling $4\pi v$, -0.36 %; the earlier caveat "+8.1 %" is the standard running to M_Z, Proposition 11), the mass exponent $\gamma = 5/4$, the screening $p = 1/5$, the 5/6 bridge, the power $\alpha^{(5/2)}$ with $5/2 = (d+1)/2$ - and each of them separately fixes $d = 4$. This is not one parameter fitted to five numbers, but one number confirmed fivefold by independent measurements in different sectors: the direct opposite of fitting. Check of the bridge: $\omega_p/\omega_s = 0.47016/0.56471 = 0.8326$ against $5/6 = 0.8333$, a residual of -0.09 % - closed at the cost of the self-response slot at finite budget (Step 9 of Proposition 2). To the five anchors two more independent ones are added: the elasticity of matter $p_n = H$ (Step 8 of Proposition 2) and the agreement of the cascade and charge routes to the screening shift, possible only at $d = 4$ (Proposition 9).

Status of the result: Derived. $d = 4$ - from the incompatibility of A1+A2 (the vector character of the outflow is grounded via O.2, the tensor loophole is closed); the cascade - with the Dyson resummation shown; with the single postulate of three-dimensionality.

Nine epistemological statuses

Every statement of the theory is marked with one of nine statuses; the color coding is applied both to the text of the status word and to the cell fill in the summary tables.

Status	Content
Postulate	accepted without derivation; the basis of the model
Derived	a rigorous consequence of the postulates and previously derived statements
Partially derived	most of the chain is rigorous; one or several steps remain
Empirical normalization	the numerical value is set by calibration to an observed quantity
Imported result	a standard result from another field, accepted without re-derivation; always marked explicitly
Structural ID	a numerical coincidence at the ~1 % level or better, interpreted as a structural link; ranked below a derivation
Numerical verification	verified numerically (boundary-value problem, simulation), without a closed analytical derivation
Open	the statement is formulated, no justification is presented; the problem is named

Status	Content
Conditional reproduction	reproduces the standard value under normalization of the free bridge parameter

Fifteen Propositions

The core of the theory is unfolded in fifteen Propositions. Each is built to a single canon: postulate - ontological grounding - mathematical grounding with the derivation done on the spot - numerical cross-checks - an explicit epistemological status of the result. The Propositions rest on the ontological basis and the axiomatics of the preceding sections and on one another in numerical order; forward references are indicated explicitly.

Proposition 1. The basis of interaction

The cornerstone of the entire construction is the continuous inflation of the spatial field at rate c. Two axioms make this precise. A1: every point receives power q_0 from outside - always, isotropically, in every pixel (“the more space, the more space”). A2: this influx must go somewhere - either pass into transit (the free background) or be intercepted (capture). A massive object is precisely a region where part of the influx is intercepted and looped back to sustain its own configuration; the shortfall of what did not reach transit forms a localized deficit δρ_core, whose volume integral gives the debit mass (unfolded in Proposition 2).

Hence the main shift of the picture: interaction is not an exchange of carrier particles between ready-made objects, but the shared dependence of several captures on one and the same influx. A capture is a sink of the flow-through: it lowers the available inflation around itself. A second capture, finding itself in this depleted region, experiences an asymmetry of the influx and is carried toward the first - the overlap of deficits is attraction (quantitative gravity is in Proposition 5). Bodies “feel” each other because they draw from one and the same medium and change its regime for one another, not because they exchange signal quanta.

This removes the need to introduce a separate carrier for each force: the difference between the forces is a difference between regimes of a single medium response to the deficit, not different mediator particles. In what follows, each interaction is worked through as such a regime - gravity, the strong, the electromagnetic, the weak.

Status of the result: *Postulate.* Rests on axioms A1 and A2; the scale ρ_E is set by the m_p calibration (Proposition 2).

Proposition 2. The formation of matter

This Proposition answers the question “what is mass” and assembles the proton from the medium. In brief: a particle is not an object placed into space, but a self-sustaining vortex of the inflating medium itself; and mass is not the amount of substance inside, but a measure of this vortex's lag behind the pace of the surrounding space. Below this is unfolded in steps, each of which is verifiable.

Initial objects (in plain words). The medium carries a complex phase field; a free disturbance sweeps through it at rate c (transit), while a captured one rotates in place (circulation). A soliton (a simplified, starting picture) is a stable lump of the field that does not spread out; a Q-ball [7] is its special case: a lump held together by the internal rotation of the phase $\exp(-i\omega t)$, which carries a conserved charge Q (the letter Q gave it its name).

It is precisely such an object that we identify with a particle - but this is the crudest, starting picture: the real proton is not a static soliton, but an open dynamical steady state of the medium made of three nodes (Prop. 7).

Step 1. Why energy loops back

Once settled, it launches the loop of self-consistency - the heart of the mechanism: (1) circulation holds energy locally, so the local occupancy n grows; (2) occupancy lowers the local rate - $\dot{\tau}(n) = \exp(-n/(2s_c))$, where $\dot{\tau}$ is the rate of the capture relative to the tempo of the inflation itself, c (the free background keeps in step with the inflation, $\dot{\tau} = 1$; a capture lags behind, $\dot{\tau} < 1$), and $s_c = 1/d = 1/4$ is the structural screening constant from the architecture; (3) it is precisely this lag behind the inflation that gives birth to the capture's proper time - an internal repeating process, its clock, which the background marching in step with the inflation does not have; the deeper the capture, the more slowly this clock runs, and the region settles deeper still; (4) the deepening lowers $\dot{\tau}$ further - and the cycle closes. The stable fixed point of this loop is the particle: not embedded in the medium, but woven out of it.

Step 2. Mass is lag, not contents

Here an apparent contradiction is resolved: there is much energy inside the capture, yet the mass is small. Two densities are distinguished. The captured circulation is an excess of energy held locally: for the proton, about 63 GeV of local circulation energy. But because of the slowed local rate, the density of the inflation flow-through ρ falls below the background ρ_E. It is the shortage of flow-through, not the excess of internal circulation, that is seen from outside as mass. Introduce the deficit $\delta\rho = \rho_E - \rho \geq 0$; the mass is its integral over the capture region M:

$$\mathbf{M_D \cdot c^2 = \int_M (\rho_E - \rho(x)) \cdot dV \equiv D}$$

Dimensional check: $[J/m^3]\cdot[m^3] = [J] = [m\cdot c^2]$ ✓.

A convenient image is a funnel with flow-through. A material particle is a three-dimensional funnel in the field: slightly less energy comes out than goes in, because part has gone into sustaining the configuration itself. This difference is the measure of mass and inertia, while the far-zone response of the medium to the same deficit is gravity. The funnel carries flow-through and deficit in one. Inside the proton ~63 GeV circulates, yet only ~0.94 GeV comes out as mass - because gravity responds to the lag (the deficit δρ), not onto the internal circulation. This resolves the "proton paradox": the background energy within its volume is enormous, the circulation is ~63 GeV, and the mass is the third, smallest quantity - the pure deficit. Let us stress: this is a consequence of the picture, not an after-the-fact explanation. The ontology forces precisely the smallest of the three quantities to show up outside - the pure deficit (not the background energy and not the circulation) - and the dominance of the medium contribution, "99 % of a hadron's mass is not from the quark masses," is predicted as a direct consequence rather than fitted to what has already been measured in quantum chromodynamics: mass is a medium lag, not a sum of the masses of components.

Step 3. The capture equation (boundary-value problem)

To get numbers out of the mechanism, let us write out the capture itself. The stationary mode is taken with the ansatz $\psi(x,t) = e^{-i\omega t}\cdot\chi(x)$: the phase rotates at frequency ω, the profile χ is motionless. The profile χ obeys the Dirac equation of the medium (finite rate c, gated transit) in its own self-consistent field. In dimensionless form this is a boundary-value problem (BVP) with a single parameter ω and the conditions "regular at the center, decaying at infinity" ($\chi \to 0$).

Its solution for each ω yields a dimensionless energy E(ω) and a conserved charge Q(ω) - the Q-ball branch:

$$(-i\cdot\alpha\cdot\nabla + \beta\cdot V[\chi])\cdot\chi = \omega\cdot\chi\,,\quad E(\omega) = \int \varepsilon[\chi]\cdot dV\,,\quad Q(\omega) = \int \chi\dagger\chi\cdot dV$$

V[χ] is the self-consistent response of the medium (the very slowdown from Step 1), α, β are the Dirac matrices; this is not a free Dirac problem, but a capture in its own field. That the solution found is a genuine steady state and not a grid artifact is certified by the virial theorem: in a true bound state the kinetic and potential parts stand in a fixed ratio, and the residual of this identity in the computation is $\sim 10^{-13}$. Two independent programs converge to the same energies with agreement of ~1 ppm.

Step 4. Three working points and the meaning of the channels

Not all ω are needed, but three physical points; their distinction is what the "channels" are. The first is channel A, the proton channel: the Dirac capture is solved directly, the working frequency ω_p = 0.47016, the dimensionless energy E_A = 273.0054461. The second is channel s, the scalar channel: the scalar mode of the same medium, its working point selected by the Maslov condition (WKB), ω_s = 0.56471, E_s = 153.2376443. The third is channel B, the bridge channel: the same scalar point carried over to the Dirac branch by the structural 5/6 bridge, ω_d = (5/6)·ω_s = 0.47059167 (leading order; the finite-budget correction is Step 9), E_B = 272.2296504. All the energies are r_match → ∞ limits of the boundary-value problem (cross-check of the records - Appendix D.1).

Channel	What is solved	Frequency ω	Energy E
A - proton	direct Dirac capture	ω_p = 0.47016	E_A = 273.0054461
s - scalar	scalar mode (WKB)	ω_s = 0.56471	E_s = 153.2376443
B - bridge	the scalar point shifted by the 5/6 bridge	ω_d = (5/6)·ω_s = 0.47059167	E_B = 272.2296504

The bridge 5/6 = (d+1)/(d+2) at d = 4 is a structural coefficient from the cascade of the architecture; it carries the scalar working point over to the Dirac (proton) one. Thus two independent routes to the proton arise: the direct one (channel A) and the roundabout one - through the scalar plus the bridge (channel B). Their coincidence is checked in Step 6.

Step 5. Calibration, and why precisely the fourth root

The dimensionless energy E must be converted into a physical mass - and here the dimensionality of spacetime shows itself. The only mass scale is the grain of the medium, m_q. In four dimensions (d = 4 is derived in the architecture) the energy density has the dimension of $(\text{mass})^4$: the action is dimensionless, so [energy density] = mass^4 in natural units. The energy E of the boundary-value problem is built from the density, hence as a function of scale E ∝ $(\text{mass})^4$. Inverting this is the fourth root - literally the imprint of d = 4 in the mass formula:

$$\mathbf{m\_p = m\_q \cdot E\text{\^{}}(1/4)}$$

Calibration at a single point (the proton mass, channel B) and the derived scales of the medium:

$$m\_q\cdot c^2 = m\_p/E\_B\text{\^{}}(1/4) = 230.990855\ MeV$$

$$\rho\_E = m\_q^4\cdot c^5/\hbar^3 = 5.9365\cdot 10^{34}\ J/m^3\,;\quad \ell\_b = \hbar/(m\_q\cdot c) = 0.854263\ fm\,;\quad \tau\_b = \ell\_b/c = 2.8495\cdot 10^{-24}\ s$$

Let us stress: the fourth power here is not a fit made for convenience, but the same dimensionality $d = 4$ from the foundation - it ties the dimensionless capture energy to the mass scale, and through it to all the dimensional quantities of the medium (the density ρ_E, the length ℓ_b, the time τ_b).

Step 6. An independent cross-check: the proton mass is overdetermined

The two routes to the proton are bound to give one number. We cross-check them via a ratio in which the shared systematics of the solvers cancel:

$$(E\_A/E\_B)^{(1/4)} - 1 = +0.071\ \%$$

The direct Dirac proton (channel A) and the proton assembled from the scalar via the bridge (channel B) agree to within 0.071 %. This is not a prediction of the mass "from scratch" - one input, m_p, is still taken from experiment - but a strong internal cross-check: the proton mass is overdetermined by two independent routes. The error budget: the validity of the 5/6 bridge at leading order is ~0.1 % (the bridge residual has a mechanism and is closed at the cost of the self-response slot down to −0.0001 %, Step 9); the purely numerical part is better than 10^{-5}.

The same dimensionless apparatus also fixes the structural factors and the other masses. The angular prefactor of the capture normalization is the exact identity $8/3 = (4\pi)^2/(6\pi^2)$. The electron mass as a θ-mode and the electroweak ratio $m\_H/m\_W = \pi/2$ are derived by the same machinery in their own sectors (Propositions 9 and 11; in particular, dressing by the factor $(1 + \alpha/p)$ at $p = 1/5$ brings the raw electron-mass deviation of −3.6 % down to −0.07 %).

Step 7. Anatomy of the eigenfrequency: what sort of number ω is

The channel frequencies are the honestly acknowledged numerical core of the theory: they are computed precisely and reproducibly, but they are not derived by a closed formula. The right question is therefore not "what does ω equal" but "what sort of number is it". The key is given by the scaling theorem: all the parameters of the medium drop out of the dimensionless boundary-value problem - ρ_E, c, $\hbar$, and even s_c (absorbed by a renormalization of the fields). The frequency depends on not a single parameter of the medium; it belongs only to the form of the laws - the saturation exponential, the Dirac structure, the closedness of the balance. It is a number of form, like π for a circle: π does not depend on the radius. The dissection below lays this form open layer by layer; we work with the scalar mode (channel s) in the u-normalization $\sigma = \sqrt{s\_c}\cdot u$, where the equation takes the parameter-free form $u'' + (2/r)\cdot u' = (e^{(-u^2)} - \omega^2)\cdot u$, and the effective mass of the medium is $m^2(u) = e^{(-u^2)}$.

Five independent attempts to reduce the frequencies to a simple fraction have failed - including the last one, conducted under a blind protocol: the hypothesis $\omega\_d = 2d/(d^2+1) = 8/17$ (a rational point of the circle generated by the same $d = 4$ as the entire cascade; the Pythagorean triple (8, 15, 17)) was registered with rejection criteria set before the computation and was rejected by a precision test - the true root lies $3\cdot10^{-5}$ away from 8/17, with the numerical error two orders of magnitude smaller. These failures are systematic, not accidental - the reason is laid bare by the class of the number (below); the full history of the blind protocol is in Appendix F.

Layer one - the core of the mode is exactly free. Input data: at the working point the capture amplitude is $u_0 = 4.209$, so the mass of the medium at the center is $m^2(0) = e^{(-u_0^2)} = 2\cdot10^{-8}$ - suppression by a double exponential. Saturation does not "weaken" the medium's response in the depths of the capture - it silences it outright: inside the deep funnel the medium does not respond at all, and the mode there is a free spherical wave:

$$u(r) = u_0 \cdot j_0(\omega r) = u_0 \cdot \sin(\omega r)/(\omega r) \quad \text{(core; verified to } 2.3\cdot10^{-6}\text{)}$$

In numbers: over the entire core (out to the radius r_1, where m^2 grows only to 10^{-4}) the profile coincides with $u_0 \cdot j_0(\omega r)$ to a relative accuracy of $2.3 \cdot 10^{-6}$, and the core's contribution to the quantizing action equals $\omega \cdot r_1$ to an accuracy of $\sim 10^{-5}$. This is the signature of the exponential specifically: the memorylessness of the flow-through forces the form e^{-u^2}, and it zeroes the response at depth faster than any power; a power-law potential would have left a power-law mass tail in the core - it would have no free core. This has been verified by a direct discriminator: for the model power-law saturation $m^2 = 1/(1+u^2)$ at the same amplitude, the zone of silence ($m^2 \le 10^{-4}$) is empty - a free core does not exist as a region, and the deviation of the profile from j_0 on the same window is $2 \cdot 10^4$ times larger; the empty center of the capture is a structural signature of the memorylessness of the flow-through, not a numerical accident. Here one also recognizes the "empty center" of the canonical three-node model of the proton, but in the σ-language: a deep capture is empty for the medium from within.

Layer two - self-quantization. The scalar working point is defined by the Maslov condition $I(\omega) = \int \sqrt{\omega^2 - m^2(r)} \cdot dr = 3\pi/4$ (the hard wall at zero gives a phase of ½, the soft turning point - ¼). It is essential that the well $m^2(r)$ over which the integral is taken is not prescribed from outside - the mode itself dug it. The physical reading: the capture holds exactly its own mode - the wave digs out a well that holds it alone, without nodes (the principle of minimally sufficient effort). This is the "cause of capture" in static language: it is not an external well that traps the wave - the wave builds itself a trap to its own size. A precision solution of this condition (with the square-root singularity at the edge of the action removed by a change of variable) gives the Maslov root of the σ-theory, $\omega_{s\bigstar} = 0.564722903(4)$ (control variations of the quadrature and the integrator $< 10^{-9}$); this is a separate precision object alongside the five-digit convention $\omega_s = 0.56471$, their linkage and the cross-check of the records - Appendix D.1; the difference affects the derived quantities of channel B at $\sim 10^{-5}$ relative - far below the bridge budget (~0.1 %), and not a single number of the theory changes because of it.

Layer three - the zeroth order is closed: $\omega_0 = 1/\sqrt{2}$. Compress the saturation wall to a point: inside radius R the medium is silent ($m^2 = 0$), outside it responds with the full mass ($m^2 = 1$). Then inside $v = r \cdot u \propto \sin(\omega r)$, outside $v \propto e^{-\kappa r}$ with $\kappa = \sqrt{1 - \omega^2}$. Matching the logarithmic derivative at R gives $\omega \cdot \cot(\omega R) = -\kappa$, that is, $\omega R = \pi - \arctan(\omega/\kappa)$; self-quantization requires $I = \omega R = 3\pi/4$. Together:

$$\mathbf{arctg(\omega/\kappa) = \pi/4 \quad \Longrightarrow \quad \omega = \kappa \quad \Longrightarrow \quad \omega_0 = 1/\sqrt{2} = 0.7071}$$

The physical meaning of the zeroth order is transparent: the tempo of internal rotation (ω) equals the tempo of external decay (κ) - the self-quantized sharp capture sits exactly on the "hold/flow" symmetry, and its frequency squared is half the mass gap. The true root $\omega_{s\bigstar} = 0.5647 = 0.7986 \cdot (1/\sqrt{2})$: the soft wall lowers the frequency by 20.1 % - exactly the scale of the wall's relative width (0.46). **Dimensional check:** ω, κ, ωR are dimensionless in the auxiliary units of the problem ✓.

The wall and friction - the amplitude selector. All the irreducibility of the number sits in the transitional saturation wall (it accounts for 42.5 % of the quantizing action versus 57.5 % for the trivial free phase of the core; the wall width is 2.02 at a turning radius of 4.42 - the very same 0.46 of relative width): the irreducible remainder is the phase of reflection off this wall. At the same time, the wall is not a black box: without curvature (the $2u'/r$ term) the equation is planar and carries the exact invariant $H = \tfrac{1}{2} \cdot u'^2 + \tfrac{1}{2} \cdot \omega^2 \cdot u^2 + \tfrac{1}{2} \cdot e^{-u^2}$, while curvature drains it along the solution, $dH/dr = -(2/r) \cdot u'^2$, - playing the role of friction. It is this friction that answers the question of what selects the capture amplitude: on the tail separatrix (pure decay $e^{-\kappa r}$) the invariant equals ½, and the mode settles onto this unique outgoing trajectory only under an exact balance

$$H(0) - \tfrac{1}{2} = \int_0^\infty (2/r) \cdot u'^2 \cdot dr$$

The meaning of the balance: the initial excess of the invariant (growing with the amplitude, $H(0) \approx \frac{1}{2}\cdot\omega^2\cdot u_0^2$) is exactly equal to everything the curvature friction is able to drain away along the path. Without friction there is no root at all: for $H > \frac{1}{2}$ the limiting momentum $p^2(u\to 0) = 2H - 1$ is strictly positive - the mode oscillates and does not settle onto the decay. Numerically, the balance is satisfied on the eigensolution to $4\cdot 10^{-6}$. The "cause of capture," which the ontology describes in words (the balance of influx, transit, and debit), here receives an exact formulaic expression.

The ladder - ω without boundary shooting. The assembled layers combine into an explicit short system: the trigonometry of the core (j_0) + the smooth quadratures of the wall + the exponential of the tail + the Maslov condition (selection) - every term has a name and a physical meaning. The ladder reproduces ω without shooting to an accuracy of 0.001-0.004 % (the full breakdown of the scheme and its residual - Appendix D.1); convergence is monotone both in the drainage iterations and in the depth of the gluing. The results against the reference - the Maslov root $\omega\_s\bigstar = 0.564722903(4)$:

Ladder rung	ω	Deviation from the benchmark
Sharp wall (closed formula)	$1/\sqrt{2} = 0.70711$	+25.2 %
Nested quadratures, 4 drainage iterations	0.56912	+0.78 %
8 iterations / 24 iterations	0.56445 / 0.56464	−0.049 % / −0.015 %
Exact wall system (matching $m^2 = 10^{-4} / 10^{-5}$)	0.56470 / 0.56473	−0.004 % / +0.001 %

What this changes in the understanding of the number. Into ω there enter an arctan (the tail matching) and quadratures of the exponential (the phase of reflection off the saturation wall) - numbers of this class do not, in principle, live in the algebra of cascade rational fractions. That is why all five attempts to reduce the number to a simple rational form failed lawfully rather than by bad luck, and a general pattern of the theory shows through: in it, conditions and ratios are rational ($s\_c = 1/4$, $p = 1/5$, the 5/6 bridge, the Maslov index 3/4), while the values at the points of those conditions are transcendental - just as in quantum mechanics the quantization conditions are integer, but the levels themselves are not. The set of the theory's inputs does not change: ω remains the numerical core. What changes is its epistemological weight: instead of a "magic number from shooting" - the root of an explicit short system in which every layer is named (free core - saturation wall - tail - self-quantization), the zeroth order is closed ($1/\sqrt{2}$, the "hold/flow" symmetry), and the irreducible remainder is localized in the phase of reflection off a single wall.

Status of the result: *Derived for the structure; the value of ω itself - the irreducible numerical core.* The free-core lemma - the mechanism of the double exponential with a discriminator (contrast against the power-law class $2\cdot 10^4$; the empty center is the signature of memorylessness); the selector lemma - exact algebra (separatrix ½, the balance $H(0) - \frac{1}{2} = \int(2/r)\cdot u'^2\cdot dr$ to $4\cdot 10^{-6}$, without friction there is no tail); the ladder - an equivalent explicit system with a unique root, reproducing ω without shooting to 0.001-0.004 % (Appendix D.1); the class of the value (arctan and quadratures of the exponential - outside cascade rational fractions) is a consequence of the structure of the system. Numerical verification: the free core to $2.3\cdot 10^{-6}$; the Maslov root $\omega\_s\bigstar = 0.564722903(4)$. The zeroth order $\omega_0 = 1/\sqrt{2}$ - derived (exact algebra arctan = π/4); the blind hypothesis 8/17 - rejected (Appendix F).

Step 8. Elasticity of size and the pointwise theorem of the invariant R×ω^(5/6)

Besides a frequency, a capture has a size - and the connection between size and frequency has a structural law of its own. Let us define the elasticity of size: by how many percent the size of the capture will change if its internal clock is slowed by one percent. Formally, this is the logarithmic derivative along the family of solutions of the boundary-value problem of Step 3, taken for a chosen weight:

$$p\_X(\omega) = -\, d \ln R\_X / d \ln \omega\,, \quad R\_X^2 = \int w\_X(r)\cdot r^2 \cdot dV \,/ \int w\_X(r)\cdot dV$$

Here w_X is the weight of the sector: the capture density $n = |\chi|^2$ (matter) or the depletion $b = 1 - \dot{\tau}$ (the medium's response, the “bag” variable). The computation is direct: the boundary-value problem of Step 3 is solved at five points of a symmetric stencil around the working frequency (step 0.002, virial control to $5\cdot10^{-8}$), the root-mean-square radii are taken for each weight, and the local derivative is extracted by a quadratic fit in log-log axes. The procedure contains no parameters.

Why the question is posed at the point and not along the branch. There is no constant exponent along the entire branch of solutions: the local elasticity drifts smoothly (0.86 → 0.67 on the canonical branch from deep solutions to shallow ones), while a global fit of the form R_rms×ω^(5/6) ≈ const (exponent 0.8327 on nine points) lands on 5/6 because the drifting exponent crosses this value inside its window. From here the ontology takes over: the points of the branch at ω ≠ ω_p are configurations that nature does not realize (the medium neither gives birth to them nor holds them; they are the scaffolding of the computation, like the coordinate r of the auxiliary structure). The theory is answerable only for the realized point and its infinitesimal neighborhood - and the neighborhood is physical: transit proceeds with the grain ℓ_P, and the medium itself continuously probes the capture in steps of $\ell\_P/\ell\_b \approx 10^{-20}$ of its scale. The derivative at the point is the response to such probing; the global profile along the unrealized branch is not the subject of the theorem.

Theorem (elasticity = the Dyson fraction of the sector). At the realized point, the elasticity of size with respect to the weight of a sector with X channels is:

$$\mathbf{1/p = 1 + 1/X \quad \Leftrightarrow \quad p = X/(X+1)}$$

Step one - the bare elasticity equals unity. The core of the mode is exactly free (Step 7, layer one: saturation silences the mass of the medium with a double exponential; the profile of the core is $u_0\cdot j_0(\omega r)$ to an accuracy of $2.3\cdot10^{-6}$). A free wave has a single length scale - 1/ω: slow the clock by a percent - and the cavity grows by a percent. If the medium did not respond at all, that would be the end of the story: p = 1. This limit is not an abstraction - it is realized literally when the medium's response is saturated (see saturation below).

Step two - the lemma of the self-response slot. But outside this saturated limit the medium responds: a change of size redistributes the sector's logarithmic budget over its X channels. The medium's response to this redistribution - by the Local Transit law - is a flow-through of the same nature as the sector's per-channel flow-throughs: memoryless, with the same holding time τ_b. And by isotropy A1 it is in no way singled out among the channels - and therefore counts as one additional, equal slot of the distribution. The budget that without the response was divided into X parts is divided into X+1; the inverse elasticity (the number of slots per unit of geometric output) acquires the addition 1/X. An equivalent record - a series of re-reflections: the perturbation gives a share of 1/X to the self-response, which comes back against the perturbation (restoration A2), is re-reflected again, and the sum $p = 1 - 1/X + 1/X^2 - \ldots = X/(X+1)$ converges as a geometric series. This is exactly the same algebra by which the screening p_scr = s_c/(1+s_c) = 1/(d+1) is derived in the architecture: the lemma introduces no new assumptions.

Step three - the channel numbers of the sectors. Matter transits through the d isotropic channels of the architecture: X_n = d = 4. The medium response is an already dressed structure: the response contains its own self-response, the very "+1" that in screening gives $1/p_{scr} = d+1$; therefore $X_b = d + 1 = 5$. Hence two predictions and a limit:

$$\mathbf{p_n = d/(d+1) = 4/5 = H\ ;\quad p_b = (d+1)/(d+2) = 5/6\ ;\quad saturation \Longrightarrow p \to 1}$$

Saturation is the third, degenerate case: if the depletion has run into the ceiling ($b \approx 1$; the density floor $\delta\rho \le \rho_E$), the medium slot is unavailable, the dressing is switched off, and the elasticity returns to the bare unity. **Dimensional check:** p and X are dimensionless ✓.

A blind check on two faces of the medium. The prediction was registered before the computation: the scalar face (the σ-theory with the medium mass $m^2 = \tau^2$, working point $\omega_s = 0.56471$) and the Dirac face (channel A, $\omega_p = 0.47016$) must each carry their own fractions. The calculation by the procedure above gave:

Quantity	Face	Measured	Channel	Dev.
p_n (density)	scalar	0.79508	4/5 = 0.80000	−0.62 %
p_n (density)	Dirac	0.80604	4/5 = 0.80000	+0.76 %
p_b (depletion)	Dirac	0.83829	5/6 = 0.83333	+0.60 %
p_b (saturating)	scalar	0.99256	1 (cavity)	−0.74 %

All four numbers landed on their channels with sub-percent accuracy and mixed signs of the deviations. The saturation degeneracy is seen live: on the scalar face the capture is deep (amplitude $\sigma_0 = 2.105$, depletion at the center $b_0 = 1 - \exp(-\sigma_0^2/(2s_c)) = 0.9999$ - the ceiling), the bag variable turns into a rigid ball, and its elasticity returns to the cavity unity (0.9926); on the Dirac face the node is softer ($b_0 = 0.969$), the response is alive - and the depletion carries exactly 5/6. The intermediate trend is consistent as well: as the Dirac node deepens (b_0 0.969 → 0.981), the elasticity of the bag grows 0.838 → 0.879 toward unity. Cross-check of the apparatus: the same action integral with which the elasticity was computed reproduces, at the scalar root, the Maslov index $I/\pi = 0.750002$ (reference 3/4) - to two millionths.

What this gives the theory. First: the invariant $R\times\omega^{(5/6)}$ has been identified - it is a pointwise property of the bag weight at the realized point (the exponent is the Dyson fraction of the medium response), and its apparent "constancy" is the first-order flatness of the product $R\cdot\omega^{(5/6)}$ around the crossing point (numerically: a flat bottom with a spread of less than a percent). Second: the elasticity of matter coincided with the Hurst exponent $H = d/(d+1)$ - the very one whose inverse $\gamma = 1/H = 5/4$ sets the exponent of the electron mass; the elasticity sector and the α-sector are governed by one cascade number, and the overdetermination of $d = 4$ receives a sixth independent anchor. Third: the fixed point of elasticity (where $p_b(\omega) = \omega/\omega_s$) coincides with the bridge point of channel B to within +0.41 % - both conditions carry $(d+1)/(d+2)$ at leading order; the sub-percent residuals (+0.60 % in the exponent) lie in the $O(\alpha)$ band and belong to the same one-loop family as the bridge residual −0.092 %. Fourth: a dynamical check on the open canonical machine showed that charge is conserved and no drift-selection of frequency exists - the realized point is selected by birth (the charge quantization of the minimal closed bag, $B = 1$), while the neutrality of the budget $R^{(d+2)}\cdot\omega^{(d+1)}$ is a characterization of the realized point, of the same class as the Maslov condition for the scalar root.

Status of the result: *Derived (leading order) + Numerical verification.* The derivation is in the Dyson class of architecture: both premises of the lemma - equipartition as a reading of isotropy and the memoryless linearity of transit - are already adopted in the derivation of screening; there are no new assumptions. Verification: a two-face blind check ±0.8 %; saturation → 1; Maslov control $2\cdot10^{-6}$. The face residuals (±0.6-0.8 %) lie within the numerical budget of the test benches themselves and require no separate coefficient; the residual of the 5/6 bridge has a mechanism of its own and is closed by the price of the self-response slot (Step 9).

Step 9. The price of the self-response slot: the bridge correction at finite budget

The 5/6 bridge links the scalar and Dirac working points as a ratio of channel counts: the Dirac mode carries $d+1$ channel slots (three spatial, one inflation, one spin), while its integral norm runs over $d+2$ - to the mode's slots is added the medium's response to the presence of the mode itself, the self-response slot (the nonlocal noise of the medium; the same slot was at work in the elasticity lemma of Step 8). The precision boundary-value problem leaves a residual: $\omega_p/\omega_s = 0.47016/0.56471 = 0.832569$ against $5/6 = 0.833333$, a shortfall of -0.092 %. This is not a defect of the slot count: the leading-order ratio is exact in the limit where the slots cost nothing. The residual measures what the count leaves out - the price of the slot.

Mechanism. The physical bag is finite: its dimensionless energy budget on the Dirac branch of the bridge equals $E_B = 272.2296504$ (the same quantity as in the channel B calibration of Step 5; the benchmark is the limit $r_{match} \to \infty$, Appendix D.1). The self-response slot is not an abstract line in the count but a response of the medium, and it is financed out of the bag's self-interaction. The weight of the slot is fixed: by equipartition one channel carries the share $s_c = 1/4$, and the slot lives on the saturation wall, where the self-interaction ceiling is finite ($2\cdot s_c$) - so the weight of the slot is the absolute channel share s_c, which does not grow with the size of the bag (an equivalent reading: half the saturation ceiling, $\frac{1}{2}\cdot 2s_c = s_c$). The relative price of the slot in the bag's stock equals s_c/E_B. From here Little's theorem takes over (Proposition 4: stock = rate × holding time): in a memoryless flow-through with a single holding time τ_b, the share of stock equals the share of power. The frequency of a mode is the rate of its internal phase, that is, the power rate at which the medium processes the mode (axiom A2 asserts a balance of powers, not of stocks): withdrawing the power share s_c/E_B slows the rate by exactly that share.

$$\omega_d/\omega_s = (d+1)/(d+2)\cdot(1 - s_c/E_B)$$

The correction closes the bridge residual from -0.092 % to -0.0001 %.

Sign discriminator. The mechanism is tested by its sign. If the scalar side of the bridge carried its own slot of the same kind, the correction would be a difference: $-s_c/E_B + s_c/E_s = -9.18\cdot 10^{-4} + 16.31\cdot 10^{-4} = +7.13\cdot 10^{-4}$ - positive, and the measured bridge would lie above 5/6. It is observed below. The two-sided slot is rejected by observation; the one-sidedness is not postulated but forced: the self-response slot is exactly what distinguishes the Dirac norm in the bridge count ($d+2$ against $d+1$), whereas the absolute value of the scalar frequency is the numerical core of the theory, and all of its own corrections already sit inside the value of ω_s, never entering the ratio.

An honest caveat on normalization. The form of the correction s_c/E is derived, but discriminating between normalizations of the denominator (E_B against the full energy of the calibration channel E_A) lies beyond the current precision of the frequencies: at five significant figures of ω_p the budget of the coefficient is wider than the gap between the candidates, and the E_B normalization rests on the mechanism - the slot lives on the Dirac branch of the bridge, and the two-sided form is killed by the sign. The key to the resolution is the sixth digit of ω_p; the testable prediction $\omega_p = 0.470170(1)$ and the full bracket of readings are given in Appendix D.1.

Status of the result: *Derived at the mechanism level + Numerical verification.* Premises: equipartition, the bridge slot count, Little's theorem, finiteness of the budget; the slot weight s_c is the physical content of the step (the analogue of equipartition in the cascade and of the slot's equal standing in Step 8). Verification: closure of the residual to -0.0001 %; the sign discriminator is passed. The choice of normalization within the log-degenerate triple is a precision value at a point: by the theory's genre boundary it belongs to the computational phase, not to the mechanism (Appendix D.1).

The proton as a single object: the three-node threshold

In the strict language of the theory, the medium carries three phase slots $\{1, \omega, \omega^2\}$ (where $\omega = e^{(2\pi i/3)}$ is the cube root of unity, not the capture frequency) and the spinor ξ. The proton is a single coherent closed medium-current mode, and the number of its nodes is not introduced but derived from the requirement that the current be closed.

For a ring of N nodes with phases $2\pi k/N$, the total circular current $\propto \Sigma_k \exp(2\pi ik/N)$. At $N = 1$ there is nothing to circulate; at $N = 2$ the phases $\{0, \pi\}$ give a real field - the circuit does not close, the current vanishes; at $N = 3$ the phases $\{1, \omega, \omega^2\}$ for the first time give a circular current that cannot be nulled. Closure is precisely what stability means: the current loop sustains itself. Hence the minimal stable baryon has exactly three nodes - the theory predicts three constituents rather than postulating them.

Observables of the proton

From a single native assembly the entire set follows at once.

Spin ½ comes from the spinor ξ: a rotation by 2π gives a factor of -1 (the double cover of SU(2)). The medium responds to $|\text{amplitude}|^2$ and is therefore spin-blind - mass, frequency, and size are the same for all spin states (the bulk is intact). The three nodes sit in an s-wave, the mechanical angular momentum is zero, so the total angular momentum equals the spin, $J = ½$.

The empty center is not a funnel but a geometric quenching: at the center the three phases sum to zero, $1 + \omega + \omega^2 = 0$, giving a node of the charge density. This is testable - it corresponds to a dip in the charge density at the center of the proton, visible in the charge form factor.

The magnetic ratio μ_p/μ_n is exhibited by direct spin-charge combinatorics. In the symmetric spin-flavor assembly $\mu_p = (4\mu_u - \mu_d)/3$ and $\mu_n = (4\mu_d - \mu_u)/3$, and the node moments are proportional to the charges $\{+2/3, +2/3, -1/3\}$; the scale and the g-factor cancel in the ratio:

$$\mu_p/\mu_n = (4\cdot(+2/3) - (-1/3)) / (4\cdot(-1/3) - (+2/3)) = (9/3)/(-6/3) = -3/2$$

The inputs are native (the charges from the θ-sector, the spin from ξ), and the spin-flavor combinatorics is native as well: the ratio $-3/2$ is derived as the Clebsch-Gordan coefficients of the addition spin-1 ⊗ spin-½ → $J = ½$, without importing the group SU(6); $-3/2$ against the experimental -1.46, a deviation of +2.7 % at leading order.

Two levels of one field

Why the proton needs two sectors is seen from the numbers. A light charge winding (a topological curl carrying the charge and the baryon number), added to the smooth mass bag, shifts the frequency by only +0.1 %; an attempt to carry the mass itself with this winding breaks the frequency by +70 %. Hence the mass must live in the smooth bag, while the charge and the empty center live in the light winding: two levels of one field on a shared medium.

The size of the proton falls out without fitting, as an open (influx-sustained) dynamical steady state: the influx of energy, the outward transit, and the local debit balance at rate c, giving an equilibrium radius with a plateau, parameter-free, $R\bigstar \approx \ell_b \approx r_p$. The birth of matter and the thermal layer accompanying it are treated in Proposition 15.

Size metrics and the saturation bracket theorem

The "size" of a capture has several natural metrics, and they are bound to differ in a structurally predictable way. The root-mean-square radius can be measured by the matter energy ($T^{00} = \omega \cdot n$ on an eigenmode - the same radius as that of the capture density n), by the charge (the form factor), and by the medium depletion $\delta\rho = \rho\_E \cdot b$, where $b = 1 - \exp(-n/(2s\_c))$ is the saturable restorative response of the medium (healing-response; the same exponential as in the time rate $\dot{\tau}$). A naive pointwise proportionality between depletion and energy would give a single radius, yet their root-mean-square radii diverge by ~11-16 % - and this "bracket of normalizations" is not a free parameter blurring the size multiplier R★/ℓ_b, but a derivable structural quantity.

Mechanism and theorem. The response b is concave in n: in the core of the proton it runs into the ceiling (saturation depth $n(0)/2s\_c = 1.74074/0.5 = 3.48$, $b(0) = 0.969$), while in the tail it remains linear in n. The density ratio b/n therefore grows monotonically outward, and the weighted distribution $r^2 \cdot b$ lies strictly "to the right" of the distribution $r^2 \cdot n$: all moments are ordered. Hence the saturation bracket theorem: (1) $W \equiv \mathrm{rms}(\delta\rho)/\mathrm{rms}(T^{00}) \geq 1$ for any monotonically decreasing profile, with equality only in the absence of saturation ($n \ll 2s\_c$ everywhere); (2) W grows monotonically with saturation depth - for $s_1 < s_2$ the ratio of responses B_1/B_2 decreases in n, because the function $g(x) = x/(e^x-1)$ is decreasing, and the same ordering argument gives $W(s_1) \geq W(s_2)$; (3) at weak saturation $W - 1 \approx 0.0366/s\_c$ (the coefficient of the canonical profile), at deep saturation W grows linearly in $\ln(1/s\_c)$ with no ceiling (the saturated "cap" of depletion widens logarithmically: $r\_sat \approx (1/2\kappa) \cdot \ln(\mathrm{scale}/2s\_c)$, $\kappa = \sqrt{(1-\omega\_p^2)} = 0.88258$). Saturation cuts away the central weight of the depletion, and the weight of the root-mean-square radius moves outward: the medium depletion is "wider" than the matter energy. **Dimensional check:** W is a ratio of lengths; $x = n/2s\_c$, b, g(x) are dimensionless ✓.

$$\mathbf{W(s\_c = 1/4) = rms(\delta\rho)/rms(T^{00}) = 1.1111596(4)}$$

The calculation in full. The canonical point is structurally fixed ($s\_c = 1/4$ is the cascade constant), so the multiplier is not free. Quadrature over the canonical node profile at the limits of the boundary-value problem ($\omega\_p = 0.47016$, limiting amplitude $G_0 = 1.31937094$; the profile is monotonic - 0 violations; the tail $e^{(-2\kappa r)}/r^2$ handled analytically): rms(n) = 3.5794, rms(δρ) = 3.9774, W = 1.1111596(4) - convergence in the grid and in the matching radius to the seventh digit; an input budget of $\pm 4 \cdot 10^{-7}$ under honest transport along the branch of eigensolutions ($dW/d\omega = -0.076$ - forty-five times narrower than naive transport at fixed amplitude). A series in the depth of the response on a fixed profile: W = 1.17481 / 1.11116 / 1.06372 at s_c = 1/8, 1/4, 1/2, and a monotonic descent toward unity as the saturation weakens (1.034/1.018/1.009/1.005/1.002 at s_c = 1…16). In the open dynamical steady state the factor rises to W_dyn = 1.32(1): the gate transit additionally spreads the depletion beyond the local response - a premium of the open balance, not of the quadrature (the analysis and the cross-check are below).

The ladder of metrics and the charge radius. On one and the same canonical profile the rms of the matter energy, 3.5794, coincides with the charge rms radius of the form factor, 3.579, to 0.01 % - the charge metric sits on the matter (the charge is distributed over the nodes, and its radius is the radius of the matter, not of the depletion). The root-mean-square radius of the depletion is separated from them by the bracket: 3.9774 = 1.1112·3.5794. The self-consistent medium response (R_rms,b = 3.453, the model $\dot{\tau} = 1 - b$) is a fourth, independent metric, to which the bracket does not apply: the exact coincidence (0.01 %) is between the charge and the matter, while the closeness of the charge radius to R_rms,b (3.7 %) is only approximate. The blind fraction W = 10/9 is rejected by the precision computation at the limits of the boundary-value problem with a gap of about one hundred and twenty budgets (~120σ; the full history of the blind protocol is in Appendix F), and the theory's genre rule -

conditions and ratios are rational, values at points are transcendental - is confirmed on this number as well.

The limits of the bracket - by moment formulas. Both limits of the theorem are closed by exact formulas in the moments of the profile. Expanding the response $b = 1 - e^{(-n/2s)}$ in small depth gives the series $W(s) - 1 = C/s + D_2/s^2 + O(1/s^3)$ with coefficients

$$C = (a_2 - a_4)/8 = 0.036636\,, \quad a\_k = \int r^k \cdot n^2 \cdot dr \,/ \int r^k \cdot n \cdot dr$$

$$D_2 = (B_4 - B_2)/48 + a_2(a_2 - a_4)/32 - (a_2 - a_4)^2/128 = -0.002503\,, \quad B\_k = \int r^k \cdot n^3 \cdot dr \,/ \int r^k \cdot n \cdot dr$$

There are no free parameters: on the canonical profile $a_2 = 0.836791$, $a_4 = 0.543704$, the formula for C agrees with the extrapolation of the direct series of quadratures in all six digits (0.036636 against 0.036636), and D_2 with an independent fit of the series (−0.002503 against −0.002501). The positivity of C is forced by the monotonicity of the profile: the r^4 weight probes farther out, where n is smaller, so $a_4 < a_2$ always; the weak-saturation coefficient 0.0366 is a formula, not a measurement. The deep limit is described by the edge of the extreme tail (the asymptotic log-slope of the bracket's growth, 0.1226); the windowed value of the slope remains a quadrature number of the pre-asymptotic zone. **Dimensional check:** a_k and B_k carry the dimension of n, their combinations in C and D_2 are dimensionless together with $x = n/2s$ ✓.

The open steady state: the true dynamical bracket. In the open steady state the canonical medium (gated transit with healing) widens the depletion beyond the local response. A direct computation on the canonical dynamical model (unitary Dirac + gate transit; evolution to the steady state with drift control) resolves the factor into the product W_dyn = W_quad · T_transit · X, where W_quad is the quadrature bracket on the dynamical profile, T_transit = rms(b)/rms(b_src) is the transit premium, and X = rms(n)/rms(T^{00}) = 1.000 (modeness). The gate parameters are derived, not fitted: the transport coefficient k_D = c·ℓ_b, the holding time τ_b = ℓ_b/c, the viscosity η = ρ_E/c (Little's theorem + the cascade screening + the inertia-viscosity of Proposition 6), whence the product k_D·τ_b = ℓ_b² with a prefactor of 1. The back-reaction of matter is taken into account: the widened depletion slightly rebuilds the mass well, the capture profile compactifies (rms(n) 3.58 → 3.38), and the quadrature part rises to W_quad = 1.136. The transit premium obeys the law of screened dressing $T^2 - 1$ = β·k_D·τ_b/rms²(b_src) with β = 4.2-4.5 (linearity, coefficient of determination 0.997); on the derived gate parameters this gives T_transit = 1.16. The product fixes the multiplier: W_dyn = 1.136 · 1.16 · 1.000 = 1.32(1) (grid convergence 0.08 %; the charge is conserved to machine precision). In the limit of the transport switched off (k_D → 0) the static quadrature W = 1.1111596 is reproduced exactly. **Dimensional check:** k_D·τ_b is a length squared in units of ℓ_b²; T_transit, X, β are dimensionless ✓.

Status of the result: *Derived (theorem) + Numerical verification.* Theorem: the inequality and the monotonicity; the limits - via the exact moment formulas $C = (a_2 - a_4)/8$ and D_2; the asymptotic class of the extreme-tail edge. Verification: quadrature of the canonical point W = 1.1111596(4); the stationary dynamical factor W_dyn = 1.32(1) on the derived gate parameters with separation and the surcharge law. The charge/matter coincidence (0.01 %) is a Structural ID. The bracket of metrics is not a free uncertainty but a derived structural factor, set by the cascade constant s_c = 1/4 and the saturation depth of the core; the blind fraction 10/9 is rejected (Appendix F).

Baryon number: the discrete count, its carrier, and the conservation theorem

Why does matter not disappear? In the standard picture, conservation of baryon number is postulated. Here it is derived - but first one must say honestly what baryon number is natively. It is not a field charge (the charge Q is conserved on its own, by the unitarity of the dynamics) and not a topological winding (that route has been rejected: baryonicity is not winding-based, the phase in three dimensions is topologically trivial, and capture is an open process, not a conservative soliton). Baryon number is a discrete geometric count: matter exists only as closed bag units, and B is the number of such units.

B(V) = the number of connected components of the region {b > b_∗} carrying a closed medium current

The well-posedness of the definition is checked by a direct computation on the node profile: the depletion $b = 1 - \dot{\tau}$ falls monotonically from the central value 0.9692 to zero, and the number of connected components equals one for any threshold b_* up to the central value - the integer count does not depend on the choice of threshold at all. Only the position of the component boundary depends on b_* ($r = 5.21 \rightarrow 3.46$ in units of ℓ_b for $b_* = 0.2 \rightarrow 0.8$): the bag wall has a finite width of order ℓ_b, but that is geometry, not the count.

Discreteness: "half a bag" does not exist. The integrality of the count rests on the resolution of the medium: an asynchronous structure on a scale below ℓ_b is non-stationary - the screening length of the medium response equals exactly ℓ_b (it is derived from the transit law: $\sqrt{k_D \cdot \tau_b} = \ell_b$), and the viscosity $\propto \rho_E/c$ resorbs anything subthreshold within a time of order τ_b. This claim has been checked by a direct dynamical experiment on the same open machine that was used above for the size and the frequency (a unitary finite-speed Dirac with mass $m = 1 - b$, native viscosity, gated transit; the physics unchanged). Three node configurations were seeded. The full node (charge $Q = 378$) sits as a steady state: the density maximum $1.7407 \rightarrow 1.7428$ - a carrier. A seed weakened twofold in amplitude ($Q = 114$) does not die: the density sags to 0.53, and the configuration then condenses back to the bag (1.38 by $t = 6$, the radius contracting toward the nodal one) - weakening by itself does not kill the carrier. But a fragment three times smaller in size ($Q = 16$) resorbs monotonically: the density maximum falls by a factor of 24 over $t = 8$, the depletion heals (b_{max} $0.93 \rightarrow 0.15$), the charge flies apart into free transit - no localized carrier exists at such a charge. Bracketing gives the carrier threshold Q_{min} between 30 and 114 (a transition zone near $Q \sim 60$). The upshot is a dichotomy: a perturbed carrier either returns to the bag or - if it is subthreshold - disperses; the dynamics leaves no intermediate outcomes ("half a bag"). The count B takes only integer values, and the root of this discreteness is the finiteness of c ($\ell_b = \hbar/(m_q \cdot c) \propto 1/c$).

Four ways of changing the count, and their locks. Under continuous evolution the integer number of components can change only by four topological routes, and each is blocked by its own native mechanism. (1) Birth of a component: a new unit must grow out of scales smaller than ℓ_b, and such a structure is not self-sustaining - adiabatically it resorbs (the "fragment" case above); it can be pushed into carrier status only by an external concentration of energy - an event. (2) Death by shrinkage: the reverse route through ℓ_b; but the steady state is two-sided - a compressed cloud returns to the size ℓ_b at the rate c/ℓ_b (this was shown in the derivation of the size), and one can pass all the way through only by doing work against the restoration. (3) Merger of two carriers: forbidden by the incompressibility floor $\delta\rho \leq \rho_E$ - bag interiors are nearly saturated, and two saturated cores do not fit into one volume; numerically, carriers run into a wall at a distance $d \approx 1.7$ fm and remain distinguishable (which is why a nucleus is a cluster of separate nucleons rather than one big bag; see the assembly of nuclei). (4) Rupture of the closed current: at the moment of rupture the current would acquire a free end, and a free end is forbidden by the continuity of the balance in a steady state - it exists only as a non-stationary defect on a scale below the resolution. In the language of phase slots the same is seen exactly: a continuous path from the closed set $\{1, \omega, \omega^2\}$ to an unclosed one passes through a degeneration of the phases - a two-node-type configuration whose circulation is identically zero (the field is real); at the degeneration point the interior opens up, and the carrier passes through a subthreshold state. This is the native analogue of Kelvin's theorem: what is conserved is the closedness of the loop of the flow-through itself, protected by the resolution of the medium.

Barrier. The price of any of the events (1), (2), (4) is a local concentration of debit of the order of the medium price of the minimal bag: $D\_min \sim \rho\_E \cdot \ell\_b^3 = m\_q \cdot c^2 \cdot O(1)$. The barrier is two-sided: healing the interior is impeded by the b-retention from inside, rupturing the perimeter - by the ρ_E-viscosity from outside. **Dimensional check:** $[\rho\_E \cdot \ell\_b^3] = [J/m^3] \cdot [m^3] = [J]$ ✓.

$$\dot{\tau} > \omega\_p \;\wedge\; E\_loc < D\_min \sim \rho\_E \cdot \ell\_b^3 \quad \Longrightarrow \quad B = const$$

The theorem and its proof. In a region where the local time rate of the medium is everywhere above the dissolution threshold ($\dot{\tau} > \omega\_p$) and the local concentrations of free energy are below the barrier, open evolution conserves B exactly (the flux of carriers through the region's boundary is accounted for separately). The proof assembles from what has been said: a change of the count requires one of the four routes; merger is closed off by the floor unconditionally; birth, shrinkage and rupture require work ~ D_min against the two-sided barrier, unavailable below the barrier, while transient subthreshold fluctuations resorb back into transit without completing a change of the count. The condition on the rate guarantees the existence of the carriers themselves: below the dissolution threshold there is no bound mode and the count loses its force.

The channels for changing B - both already in the theory. First: above-barrier events - pair production in the hot phase; the production of matter proceeds at the peak $T \sim \rho\_E^{(1/4)}$, where the barrier is overcome thermally (Proposition 15). Second: the black hole - at $\dot{\tau} < \omega\_p$ the carriers dissolve, and B disappears while the lag $\int\delta\rho$ is conserved exactly (the mass remains, the baryonicity does not; see the black hole as a collective lag). The hole does not "violate" the theorem - in it the very condition $\dot{\tau} > \omega\_p$ is lifted: the barrier exists only in a live medium, and therefore gravitational dissolution is not obliged to pass through the ρ_E-barrier. A corollary of the theorem is the uniqueness of the stable proton: below the barrier the decay $B = 1 \rightarrow 0$ is forbidden, while within the sector $B = 1$ everything excited rolls down to the ground state of the minimal closed bag. An honest boundary: the theorem gives the structure of the prohibition, not a number of years; the quantitative rate of above-barrier fluctuations (the proton lifetime as a number) has not been computed - that is a computational remainder.

Status of the result: *Numerical verification (the Proposition as a whole); within it - derived structural blocks.* (a) Proton assembly: the mass is re-derived via two independent routes (channel A, +0.071 %); the threshold N = 3, the spin ½, the empty center and the size are native; μ_p/μ_n is a reproduction (+2.7 %); the boundary-value-problem energies - by two independent solvers (virial $\sim 10^{-13}$). (b) Frequency: the anatomy has been laid open (Step 7: the free core, self-quantization, $\omega_0 = 1/\sqrt{2}$, the ladder without shooting down to 0.001-0.004 %); ω remains an honest numerical core with localized irreducibility. (c) Baryon number: Derived (a conditional theorem under premises: continuity of the balance, the resolution ℓ_b, the closure threshold, the incompressibility floor, the two-sided barrier - each premise previously derived or numerically verified) + Numerical verification (the carrier trichotomy; the threshold $Q\_min \in (30; 114)$; return of the steady state; the incompressibility wall; dissolution); what remains open is the quantitative rate of above-barrier events.

Boundaries of the model

The boundary-value problem of Step 3 also has excited solutions: the first one-node root at ω_p (one-node amplitude $G_0 = 2.2132$) gives the dimensionless energy $E \approx 4047$ and a mass $m\_q \cdot E^{(1/4)} \approx 1.84$ GeV - +28 % above the first nucleon resonance (the Roper N(1440)). The discrepancy is native: in the two-level picture of the proton, the physical resonances are excitations of the mass bag and of the charge winding, not radial nodes of a single Q-ball, so the one-node radial branch does not map onto the observed spectrum and does not enter the theory's predictions. The full spectrum of excitations is a task for a separate theorem phase. **Status:** *Open.* A physical interpretation of the radial branch has not been presented; the spectral fork has been named.

Proposition 3. Propagation of photons

A photon is a synchronous perturbation of the θ-sector, the state $S = (\delta\rho = 0, n = 0, \theta \text{ nontrivial})$: it does not move through a ready-made space but rests on a point of the field, which inflates. From a single attribute - $\delta\rho = 0$ - several properties follow at once that in standard physics are postulated separately.

Masslessness. A direct consequence, not a separate postulate: mass is the integral of desynchronization (Propositions 2 and 4), while for a synchronous perturbation $\delta\rho = 0$ everywhere, so $\int\delta\rho = 0$ and the mass is zero. For the same reason a photon has no proper time (no internal repeating process) and no meaningful state of rest - rest is defined only for desynchronized objects (captures).

Universality of c. The speed c is the same for all material observers not by postulate, but because c is the tempo of the medium itself, in which both the source and the observer reside; the constancy of c turns from an axiom of special relativity into a structural consequence. Frequency, energy and direction are set by the material act of emission and are read out by another observer through their own proper time and motion - hence the Doppler shift, aberration and cosmological redshift are possible, while the propagation rate itself is unchanged.

Light deflection. Light is deflected by a gravitating body because it envelops the region rarefied near the mass: the photon - a synchronous perturbation of the medium at the rate c - follows the favorable (Fermat) trajectory in an inhomogeneous medium rather than being swept along by a flow. The deficit $\delta\rho$ sets the effective index of the medium $n(r) = 1 + 2GM/(c^2 \cdot r)$; the bending gives the angle $4 \cdot G \cdot M/(b\_imp \cdot c^2)$ - exactly the value of general relativity, twice the Newtonian one. This factor of 4 is composed of two equal contributions: the slowed tempo and the stretched radar length. The full derivation, together with the operational metric, is given in Proposition 5. Two-slit interference is the branching of a single perturbation of the field, not a riddle about "a particle in two places".

The de Broglie clock. The node spins its internal phase at the frequency $\omega_0 = m \cdot c^2/\hbar$; mass is the tempo of this internal clock (Proposition 4). For the electron, $\nu_0 \approx 1.235 \cdot 10^{20}$ Hz. It is important to distinguish two levels: ω_0 itself is a phase, and in any bilinear (observable) form it cancels - the bare tick at ω_0 is unobservable in principle; what is observable is only the beat of the internal ±-structure (the two signs of phase rotation, Proposition 12) at the doubled frequency $2\omega_0$. The only setup that has claimed sensitivity - electron channeling in a crystal - has not been independently reproduced, and its analysis points precisely to $2\omega_0$ and is consistent with standard Dirac dynamics. Therefore this item qualifies as consistency with the de Broglie clock, not an independent confirmation of P-theory; the testable frequency is $2\omega_0$, not ω_0.

Status of the result: *Derived (masslessness, absence of proper time, constancy of c).* All three properties are consequences of the single attribute $\delta\rho = 0$ and of the non-metric ontology, not separate postulates. Light deflection is a derivation in Proposition 5 (the native envelopment metric). The de Broglie clock is consistency with the mechanism (the observable frequency is $2\omega_0$; the bare ω_0 is an unobservable phase); channeling has not been independently reproduced and is explained by standard dynamics.

Proposition 4. Time and mass

Ontological position: one lag - three different consequences. This Proposition is the broadest node of the work: space, time and mass converge in it. All three have a single root. Capture is a local desynchronization with inflation: part of the influx closes into an internal loop and ceases to keep up with the rate c of the medium itself - a lag arises. The entire content of the section is to show that space, time and mass are three distinct consequences of this single lag, and to keep them apart rather than merge them into one entity.

Consequence one - space ("path"). For a distributed desynchronization to hold, it needs a closed geometry: two phase slots do not close the current, and only three give the first closure - the minimal three-node bundle (the section on minimally stable matter). Thus arise the three directions along which transit runs - operational three-dimensionality.

Consequence two - time ("pace"). A node, once tied, lives by an internal repeating process - the circulation of its own phase. This process is the clock; the count of its ticks is duration. Without it there is no duration at all: the free background and the photon have no internal process - and hence no proper time.

Consequence three - mass (the magnitude of the lag). How deeply the node lags behind the medium is shown by the local deficit $\delta\rho = \rho\_E - \rho$; its integral over volume, $D = \int\delta\rho\cdot dV$, is the mass.

The formula of the world and the two ledgers. The formula d = 4 now reads literally: three paths for the node to tie, and one pace for the node to live (the pace-and-path theorem). Space and time are two ledgers accounting for one and the same transit: the external one (a radar survey out to neighboring captures) and the internal one (the count of one's own ticks), linked by the single exchange rate c. Neither ledger is older than the other - both are opened together with the first closure of the node. Mass, however, is not a ledger: it is the magnitude of that very lag which makes both ledgers nontrivial at all. One root, three different consequences; in what follows - each one separately.

What proper time is. Proper time is the internal repeating process of a capture - not an external counter and not a "fourth distance." It is defined only for captures, configurations with internal circulation; the background and the photon have nothing to tick with. The full analysis of the "pace and path" pair is given in the ontological basis (the pace-and-path theorem); the present section adds two things to it: the rate at which the capture's clock runs, and the link between this rate and mass.

The law of the rate of the clock's pace. Let $\dot{\tau}$ denote the speed at which the local clock runs relative to the background. This is the rate of pace, not time itself: time is the count of ticks; $\dot{\tau}$ is how quickly the ticks accrue. The derivation of the law proceeds in three steps: form, sign, coefficient.

Step one - the form from memorylessness. The rate depends only on the current looped-in occupancy n and does not remember the past: transit is memoryless. Then independent increments of occupancy must multiply their slowdown factors f:

$$f(n_1 + n_2) = f(n_1)\cdot f(n_2)$$

This is the multiplicative Cauchy equation; its only continuous solution is the exponential $f(n) = \exp(\pm k\cdot n)$. The form is fixed, but the sign is not set by the equation - it is a separate piece of physical content, and the very existence of matter depends on it.

Step two - the sign from the capture mechanism. A capture loops the influx instead of passing it on in transit, so locally less reaches the flow-through: the density ρ drops below the background ρ_E. The clock rate tracks precisely the fraction of the flow-through that gets through: a region with full flow-through runs at the pace of the background ($\dot{\tau} = 1$); a lagging one runs slower, $\dot{\tau} = \rho/\rho\_E < 1$.

Hence growing occupancy n lowers ρ and slows the pace: the exponent is negative. This is not a detail of presentation but a condition for the existence of matter: the negative exponent gives positive feedback - slower pace → deeper lag → still slower pace - and the loop converges to a stable attractor particle. With the opposite sign, any germ of a capture would dissolve itself: there would be no matter.

Step three - the coefficient from normalization. The coefficient is fixed by the normalization of the dimensionless boundary-value problem: $k = 1/(2s\_c)$; at $s\_c = 1/d = 1/4$ this is $k = 2$. The result:

$$\dot{\tau}(n) = \exp(-n/2s\_c) = \exp(-2n)$$

Limit check: as $n \to 0$ the rate $\dot{\tau} \to 1$ (the pace of the background); as n grows the rate falls - the more densely the energy is looped in, the slower the pace of the clock. ✓

Consistency of the forms: three expressions of one rate. The expression $\dot{\tau} = \rho/\rho\_E$ and the expression $\dot{\tau} = \exp(-n/2s\_c)$ are one rate in different variables. The degree of depletion is $b = \delta\rho/\rho\_E = 1 - \exp(-n/2s\_c)$, whence

$$\dot{\tau} = 1 - b = \rho/\rho\_E = \exp(-n/2s\_c)$$

Only the algebra of the flow-through fraction is linear here ($\rho/\rho\_E = 1 - b$); the dependence on the occupancy n is exponential throughout, so the agreement is exact at any n. The same rate appears twice more: as the dissolution threshold of matter (a capture stays bound while $\dot{\tau} = \rho/\rho\_E$ is above ω_p - the black-hole sector) and as the far-zone $\sqrt{1 + 2u}$ (below). Three expressions - one quantity $\dot{\tau}$.

What mass is. Mass is the magnitude of the lag: the integral of the deficit over volume, $D = \int\delta\rho\cdot dV$ (Proposition 2). The link between the deficit and the rate of accrual is given by Little's theorem: the stationary stock equals the arrival rate multiplied by the holding time, $\delta\rho = \tau\_b\cdot\varepsilon$. Physically, D is the energy that "did not get through" to the common transit and stayed in the loop; it is precisely what gravity sees in the far zone, and it is what inertia resists (Propositions 5 and 6). The famous $E = m\cdot c^2$, on this reading, is not a separate law but a translation between the ledgers: c^2 is the square of the unit exchange rate linking the ledger of pace to the ledger of path; in the currency of the medium itself it is simply $E = m$.

How time and mass are related - and why they are not the same thing. Here it is important not to slip into identification. Mass and time are neighbors on the same lag, but different in kind: mass is a "how much" (the magnitude of the lag), time is a "count" (the ledger of pace). They are linked by the frequency of the internal clock: the circulation of a capture runs at the de Broglie frequency

$\omega_0 = m\cdot c^2/\hbar$

Dimensional check: $[1/s] = [kg]\cdot[m^2/s^2]/[J\cdot s] = [J]/[J\cdot s] = [1/s]$ ✓

Mass sets the frequency of the proper clock's pace: the deeper the lag, the higher the circulation frequency. The local depth of the lag, in turn, sets the rate of pace $\dot{\tau}$ relative to the background. In all, then, there are three quantities and one ledger, which must not be conflated: (1) mass - the magnitude of the lag ($D = \int\delta\rho$, it gravitates); (2) ω_0 - the clock frequency that this mass sets; (3) $\dot{\tau}$ - the rate of these clocks' pace relative to the background ($\exp(-2n)$); (4) time itself - not a quantity but the count of the accruing ticks. The correct formulation therefore reads not "time is mass" but this: mass sets the frequency of the very clock whose pace is time. Identifying mass with time is an oversimplification: the common root and the rigid link through ω_0 are there, but one of them is a quantity, the other a ledger.

The far zone: the slowing of pace in rarefaction. Around a mass the medium is rarefied: the deficit is spread over the neighborhood, the potential $u = -G\cdot M/(r\cdot c^2) < 0$. The pace of the local clock is slowed, and the link between rate and potential is quadratic, not linear: everything in the medium runs at the single rate c, so the potential enters the square of the rate, $\dot{\tau}^2\_grav = 1 + 2u$, whence

$$\dot{\tau}\_grav = \sqrt{(1 + 2u)} = \sqrt{(1 - 2 \cdot G \cdot M/(r \cdot c^2))}$$

This is exactly the time component of the Schwarzschild metric - but the quadratic form here is forced by c-transit, not taken from general relativity. The difference is testable: a linear link $\dot{\tau} = 1 + u$ would give $\beta\_PPN = ½$ and would fail the precession of Mercury; the quadratic one passes (Proposition 5). The horizon is the saturation surface of the medium: the density is locked in the corridor $\rho \in [0, \rho\_E]$, and where the deficit reaches the bottom ($\rho = 0$, $u = -½$), the pace stops: $\dot{\tau} = 0$, which gives $r = 2 \cdot G \cdot M/c^2$. Thus one lag sets both ends of the scale: the microscopic law $\exp(-2n)$ and the far-zone $\sqrt{(1 + 2u)}$.

The constitutive frequency of the pace. It remains to name the frequency at which a captured mode can live at all. It is taken from the radial WKB: the mode's c-circuit accumulates reflection phases - the hard inner wall gives ½, the soft outer turning point ¼, together the Maslov index $\delta = 3/4$. This is one condition in two notations: in the language of phase - the index $\delta = 3/4$; in the language of action - the self-quantization

$$I(\omega) = \int \sqrt{(\omega^2 - m^2(r))} \cdot dr = \delta \cdot \pi = 3\pi/4$$

The condition selects the same working point of the mode as Proposition 2; it sets the scalar frequency ω_s, and the $5/6 = (d+1)/(d+2)$ bridge translates it into the Dirac one.

ω_p - the irreducible numerical core (an honest negative result). The frequency of the proton mode, $\omega\_p \approx 0.470$, is a direct measure of the desynchronization: the ratio of the rate of the internal loop to the rate of the medium. No closed formula for it has been found, and this has been established along five independent paths: (1) static analysis yields no dimensionless selector; (2) the inverse move shows that the size is ω-blind; (3) the open power balance does not close with simple forms; (4) the Vakhitov-Kolokolov stability criterion does not single out ω_p; (5) a blind test of the rational hypothesis was rejected (analyzed in Proposition 2). Yet the value itself is not arbitrary: ω_p is the provably unique fixed point of the radial drainage flow (a monotone Lyapunov functional, uniqueness certified on the continuum), and this value is transcendental - in the theory, conditions and ratios are rational, values at their points are transcendental. Therefore ω_p is an honest numerical input on a par with $d = 4$, m_p, and the single UV input ($\alpha \Leftrightarrow M\_P$), not a gap: it is the boundary of the genre of pithy derivation.

Status of the result: Derived. The rate law $\exp(-2n)$ - from memorylessness (the Cauchy equation), the sign - from the capture mechanism; the mass-clock link $\omega_0 = m \cdot c^2/\hbar$ - from Proposition 2; $\sqrt{(1 + 2u)}$ and the horizon - from the rate of the rarefied medium (c-transit, the floor $\rho \geq 0$); the constitutive frequency - from WKB/Maslov ($\delta = 3/4 \Leftrightarrow I = 3\pi/4$); ω_p - the irreducible numerical core. Space, time, and mass have been presented as three distinct consequences of a single lag - without identifying them with one another.

Proposition 5. The nature of gravity

Gravity in P-theory is neither a force nor geometry, but the far-zone energy regime of the field around a mass. This Proposition derives the potential, shows that Newtonian attraction, time dilation, and light deflection are a single response, reproduces the predictions of general relativity from the medium, analyzes the black hole, and fixes the status of the constant G.

The exposition climbs a ladder: (a) the cavity mechanism and the 1/r law; (b) the operational metric of envelopment; (c) the post-Newtonian set; (d) gravitational waves; (e) the nonlinear level and the Sakharov action; (f) the black hole as collective lag; (g) the value of G.

(a) The cavity mechanism and the 1/r law

Derivation of the potential: the uniqueness of 1/r. The local rarefaction at a mass does not stay local. The medium is massless - it does not itself flow anywhere; the shortfall of inflation intercepted by the mass is merely distributed over ever larger spheres around it (a balance, Gaussian statement about the shortfall flux via the integral form A2). The surrounding field, inflated from distant pixels of neighboring sectors, envelops the rarefied patch - the same physics as the deflection of light in Proposition 3. The balance shortfall flux F outside the source is divergence-free, $\nabla\cdot F = 0$, and spherical symmetry in three-dimensional space leaves a unique solution:

$$F(r) \propto 1/r^2 \quad \Longrightarrow \quad u(r) = -G\cdot M\_D/(c^2\cdot r)\,, \quad G = \gamma\cdot\chi\cdot c^2/(4\pi)$$

This is the unique far-zone profile at $d = 4$: the field as $1/r^2$, the potential as $1/r$. Newtonian attraction, the time dilation $\sqrt{(1 + 2u)}$ (Proposition 4), and the light-deflection angle $4GM/(b\_imp\cdot c^2)$ (Proposition 3) are three manifestations of one far-zone response, not three independent facts.

The cavity mechanism. Mass is the measure of what is spent on maintaining the structure of the capture - energy is held in the internal loop instead of free transit, and the local deficit $\delta\rho$ is the consequence of this expenditure. This deficit is not localized at the point of the object: it is distributed over the influx pixels ℓ_P around the mass. The share of the deficit falling on a given pixel is greatest at the object and decreases with distance - by distribution over ever larger spheres (the balance shortfall flux via the integral form A2, Gauss's theorem), vanishing at infinity. It is precisely this shortage, distributed over the surrounding pixels, that is the rarefied sphere $\delta\rho(r)$, that is, the gravitational potential $u(r)$. The "shortfall flux" here is the balance (Gaussian) bookkeeping of the intercepted inflation: the surrounding inflated field envelops the rarefied sphere, just as light does in Proposition 3.

Attraction as mutual infall. The second capture experiences not a "force from outside" but an altered regime of inflation in its own neighborhood, and slides into the cavity of the first; the first symmetrically falls into the cavity of the second. The gravity of two bodies is mutual infall into each other's cavities.

(b) The operational metric: envelopment (cavity + two ledgers)

The leading order of GR: the metric and 1PN. This is the strongest and most readily falsifiable sector of the theory, so the levels of proof are separated strictly here. The operational metric of captures is assembled natively from two things already derived - the rate and the radar length. The time component is the rate of the rarefied medium, $g\_tt = -(1 + 2u)\cdot c^2$ ($\tau^2 = 1 + 2u$, the far zone of Proposition 4). The spatial component is the operational radar length: time and distance are two ledgers of one transit, and the radar length is stretched inversely to the rate, $g\_rr = 1/(1 + 2u)$. Together this is the diagonal form of the exterior Schwarzschild solution:

$$ds^2 = -(1 + 2u)\cdot c^2\cdot dt^2 + dr^2/(1 + 2u) + r^2\cdot d\Omega^2\,,\ u = -GM/(c^2\cdot r)$$

This is an exact identity, not an approximation. From it, with no additional assumptions, follow the time dilation $\sqrt{(1 + 2u)}$, the deflection of light with the factor of 4 (twice the Newtonian value), and the parameter $\gamma\_PPN = 1$ at the first post-Newtonian order; the whole classical set of tests (the perihelion advance, the Shapiro delay, and the gravitational redshift) is reproduced at this level, because the exterior metric itself is reproduced.

The bridge of rates $\kappa = 2 \cdot s_c$ - derived, with no free coefficient. The gravitational frequency shift does not rest on a separate postulate of the link $\kappa = 2 \cdot s_c$ - that postulate has been removed: the shift is the weak-field limit of the unity of one time rate. The material clock of a capture runs as $\dot{\tau} = \exp(-n/2s_c)$ (the single equation F2.3), while the gravitational rate of the rarefied medium is $\dot{\tau} = \sqrt{1 + 2u}$ (above); equating the two expressions of one rate gives $n = -s_c \cdot \ln(1 + 2u) \rightarrow 2 \cdot s_c \cdot |u|$ in the weak field, whence the redshift $z = 1 - \dot{\tau} = |u| = G \cdot M/(c^2 \cdot R)$ with no free factor (numerically $\kappa \rightarrow 0.50001$). At the horizon ($u = -½$) both expressions give $\dot{\tau} \rightarrow 0$ consistently. Thus gravitational time dilation is not pinned down by a separate constant but is forced by the fact that the clock of matter and the rate of the medium are one and the same.

Dimensional check: $[n] = [s_c \cdot \ln(1 + 2u)]$ = dimensionless; $[z] = [G \cdot M/(c^2 \cdot R)]$ = dimensionless ✓

Operational closure: from the auxiliary r to the measurable radar length. The coordinate r in the formulas above is auxiliary (a language of notation); physical distance in the theory is defined only operationally, as a radar measurement between captures (postulate O.2, theorem T.2: $d_A = (c/2) \cdot \Delta\tau_A$). The gravitational derivation closes in this operational layer: the auxiliary r is assembled into a measurable length explicitly. In the native metric, radial null rays ($ds^2 = 0$) yield the second ledger of transit - the radar length, stretched inversely to the rate:

$$\mathbf{c \cdot dt = \pm dr/(1 + 2u)}$$

Capture A at r_A sends a signal to capture B at r_B and receives the reflection. Integrating the radar-length element $dr/(1 + 2u)$ "out" and "back" and converting coordinate time into A's proper time by the factor $\sqrt{1 + 2u_A}$, we obtain the length that A actually measures by radar:

$$\mathbf{d_A = \sqrt{1 + 2u_A} \cdot \left[(r_B - r_A) + (2GM/c^2) \cdot \ln((r_B - r_s)/(r_A - r_s)) \right], \quad r_s = 2GM/c^2}$$

Dimensional check: $[\sqrt{\text{dimensionless}}] \cdot ([m] + [m]) = [m] = [d_A]$ ✓

This is precisely the closure: the measurable radar length d_A is not equal to the auxiliary coordinate difference $r_B - r_A$ - it differs by purely gravitational terms (the redshift prefactor $\sqrt{1 + 2u_A}$ and the logarithmic term of the metric), while r itself remains merely an integration variable. In the weak field the result coincides with the standard radar length and Shapiro delay of general relativity: the round-trip time excess equals $(4GM/c^3) \cdot \ln(r_B/r_A)$ (verified numerically), which independently confirms the native metric. The medium meanwhile remains non-metric - the operational metric belongs to the system of captures, not to the field itself. Thus the predictions of gravity live in the measurable layer d_{phys}, and not only in the auxiliary r.

Status of the result: *Derived.* The operational radar length d_A is obtained from the derived exterior metric (the native form of envelopment) and the rate $\sqrt{1 + 2u}$; it reproduces the radar length and Shapiro delay of general relativity. The closure holds at the same leading order at which the metric itself is established.

(c) The post-Newtonian set

Second order: $\beta_{PPN} = 1$ as an explicit number from the statics of the medium. The operational apparatus continues to the next order - this is the sharpest discriminating test of the gravitational sector. The parameter β measures the nonlinearity of the static field: in the isotropic gauge $-g_{00} = 1 - 2U + 2\beta \cdot U^2$, where $U = GM/(c^2 \cdot \bar{r})$; general relativity gives $\beta = 1$, and experiment constrains $|\beta - 1| < \sim 10^{-4}$ (Mercury's perihelion from MESSENGER data [38]; the Nordtvedt test of lunar laser ranging [37]). If a nonlinear term outside the Einstein series were sitting in the static sector of the medium, it would show up precisely here: β is the static twin of the question about the purity of the TT sector, and it must be extracted directly from the medium, without relying on Deser's theorem. The derivation is assembled from three already-derived ingredients: (1) the rate of a static capture $\dot\tau = \sqrt{1 + 2u}$ - the rate of the rarefied medium (Proposition 4); (2) the radar length $d\ell = dr/\sqrt{1 + 2u}$ - the second ledger of transit; (3) the deficit profile $u(r) = -GM/(c^2 \cdot r)$. Hence the operational metric of static captures, in static form:

$$-g_{tt} = 1/g_{rr} = 1 + 2u \;,\; g_{\theta\theta} = r^2$$

(cross-check: the diagonal form is identical to isotropic Schwarzschild up to $O(U^2)$ - symbolically). The only freedom of the static sector at second order is the deficit profile itself: any spherically symmetric static deformation at this order reduces to a single dimensionless parameter λ,

$$u = -(GM/(c^2 \cdot r)) \cdot (1 + \lambda \cdot GM/(c^2 \cdot r))$$

(deformations of the rate law are reabsorbed into the profile u(r) at this order; the √ form is pinned by the horizon and the redshift, luminality - by the observation of GW170817 [23] and Cassini [36]). The transformation to the isotropic gauge is performed symbolically and exactly; the isotropic substitution $r = \bar r \cdot (1 + a_1 \cdot U + a_2 \cdot U^2)$ gives $a_1 = 1$, $a_2 = 1/4 + \lambda/2$, and the coefficients of the post-Newtonian expansion are read off directly:

$$\gamma_{PPN}(\lambda) = 1 \;, \quad \beta_{PPN}(\lambda) = 1 - \lambda$$

At $\lambda = 0$ the expansion coincides with exact isotropic Schwarzschild up to and including third order (the difference is identically zero; $a_1 = 1$ and $a_2 = 1/4$ are the exact Schwarzschild values).

Dimensional check: β, γ, λ are dimensionless; $[GM/(c^2 \cdot r)]$ = dimensionless = [u] ✓

Why λ = 0 - three pillars. (1) The source is clean: the lag is conserved (the A2 steady state; in collapse $\int\delta\rho$ holds to machine precision) and screened (screening length $\sqrt{D \cdot \tau_b} = \ell_b$), so outside matter $\delta\rho = 0$ and the integral form of A2 gives $u = -GM/(c^2 \cdot r)$ exactly, with constant M. In P there is no “field energy” as a separate source: the gravitational field is a rarefied regime of free transit, and free transit does not lag. (2) The form of the rate is pinned by c-transit: everything in the medium proceeds at the single rate c, so the potential enters precisely the square of the rate, $\dot\tau^2 = 1 + 2u$, with no free term beyond u - that is, $\lambda = 0$; corrections for viscosity, pressure and F(n) vanish, because at $\delta\rho = 0$ their carrier (the lag) is absent ($\eta_{eff} = \tau_b \cdot \delta\rho = 0$, Lemma B, subchapter (e)). (3) The operational reading was pinned earlier: the √ form - by the horizon and the redshift, the speed of light relative to the medium - by postulate O.3 and by observations. The result:

$$\beta_{PPN} = 1 \text{ exactly} \;; \quad |\beta - 1|_{exp} < \sim 10^{-4} \;✓$$

The reverse reading is no less valuable: experiment pins down precisely this quadratic (relativistic) rate link $\dot\tau^2 = 1 + 2u$ at the relative level of $\sim 10^{-4}$, and thereby confirms by number the absence of a non-Einsteinian term in the static sector. Perihelion: the precession $\propto (2 + 2\gamma - \beta)/3 = 1$ at $\gamma = \beta = 1$ - the standard 43″ per century for Mercury. This also removes the “mystery of the coincidence with Schwarzschild”: the medium has no proper time of its own, the relativistic factors arise only in the operational reading by captures (the rate and the radar length), and therefore land exactly on the Schwarzschild coefficients. Known limitation: this is the one-body exterior β (the perihelion class of tests); the many-body aspect and the preferred-frame parameters are closed below - by derived zeros.

Many-body test: η = 0 from a single bookkeeping of the lag. The Nordtvedt test asks: does gravitational binding energy gravitate the same way it inerts? The answer is assembled from four already-established statements - with no new computation. Mass is the integral of the lag (the balance theorem); the inertial mass equals the debit mass (the bridge - the equivalence principle); the far-zone potential carries the same integral (uniqueness of 1/r via Gauss's theorem); the lag is screened and conserved - outside matter $\delta\rho = 0$, there is no “field energy” as a separate source (second-order statics above), so the lag integral of a composite system is additive over its carriers and already contains the shifts of the bodies' internal lags in each other's potential - what in the standard language is called gravitational binding energy. Hence:

$$\mathbf{M\_grav = M\_inert = \int \delta\rho\_tot \cdot dV \quad \Rightarrow \quad \eta\_N = 0\ exactly}$$

The gravitational and inertial masses of a composite system are one and the same integral by construction; the binding energy enters both identically, with no separate coefficient. In the standard form $\eta = 4\beta - \gamma - 3 = 0$ at the derived $\beta = \gamma = 1$ - consistency, not an argument: the derivation does not depend on the post-Newtonian expansion. Experiment: lunar laser ranging gives $|\eta| < 4.4\cdot10^{-4}$ - satisfied by an identical zero. The two-body aspect sits in the additivity of the lag integral - no separate two-capture statics is needed. Known limitation: statics and quasistatics - the level at which η is defined.

Dimensional check: $[\int\delta\rho\cdot dV] = [J] = [m\cdot c^2]$ ✓; η is dimensionless ✓

Preferred-frame: $\alpha_1 = \alpha_2 = 0$ from emergent luminality. The sharpest flank of any medium theory is the preferred-frame parameters (the bound $\alpha_2 < 10^{-7}$). Here they vanish structurally. All capture dynamics - matter, light, gravity, statics - lives on one medium with one rate c; the operational protocols (the clock rate $\dot{\tau} = \sqrt{(1 - v\_rel^2/c^2)}$ and the radar length) depend only on the relative velocity of the medium and the capture. The drift-compensation mechanism is exhibited by a symbolic identity: for a system moving with velocity w through the medium's frame, the round-trip time of a longitudinal radar is $T = d/(c-w) + d/(c+w)$, the proper time of the moving capture is $\tau = T\cdot\sqrt{(1-w^2/c^2)}$, and the equilibrium length of the ruler is dynamically contracted, $d = d_0\cdot\sqrt{(1-w^2/c^2)}$, - because the equilibria of captures are set by the same medium-luminal dynamics (the Lorentz-FitzGerald contraction is here a consequence, not a postulate). The exact result:

$$\mathbf{d\_A = (c/2)\cdot\tau = d_0\ \text{- the drift w drops out identically} \quad \Rightarrow \quad \alpha_1 = \alpha_2 = 0}$$

The velocity of a system through the medium's frame does not enter any operational protocol on its own - there are no preferred-frame terms in the operational metric. Moreover, envelopment is isotropic: the scalar deficit $\delta\rho$ has no distinguished drift direction, so there is no preferential vector from the very start - no “drift” needs compensating.
The medium has no proper time of its own; the relativistic factors arise only in the operational reading - and cancel. The bound $\alpha_2 < 10^{-7}$ is satisfied by an identical zero. The full translation of an arbitrary moving configuration into PPN notation (all components g_0i for arbitrary geometry) remains an external test of correspondence with the language of GR, not an internal unclosed problem of the theory: natively, gravity is described as the far-zone translation of the medium's deficit via flow-through with saturation $\delta\rho \leq \rho\_E$, and the lemma yields a structural zero and an exact one-dimensional identity of the mechanism.

Dimensional check: $[d\_A] = [c]\cdot[\tau] = m$ ✓

Summary of the post-Newtonian set - five observational checks:

Test	P-theory	Observational bound	Status
γ_PPN (factor of 4, Shapiro delay)	1 exactly (1PN, native envelopment metric)	Cassini [36] ✓	**Derived**

Test	P-theory	Observational bound	Status
β_PPN (nonlinearity of statics, 2PN)	1 exactly ($\lambda = 0$)	deviation from 1 less than $\sim 10^{-4}$ (MESSENGER [38]) ✓	**Derived**
Perihelion of Mercury	$(2 + 2\gamma - \beta)/3 = 1$: 43″ per century	classical test ✓	**Derived**
Nordtvedt η (binding energy)	0 identically	less than $4.4 \cdot 10^{-4}$ (lunar laser ranging [37]) ✓	**Derived**
Preferred-frame α_1, α_2	0 identically	α_2 less than 10^{-7} ✓	**Derived**

Status of the result: *Derived (at the mechanism level).* The dependences $\beta(\lambda) = 1 - \lambda$ and $\gamma = 1$ are exact symbolic consequences of the operational metric; the vanishing of λ rests on the mechanism level of Lemma B (viscosity lives on the lag, subchapter (e)) and on the medium response $\propto \delta\rho$; η_N and α_1, α_2 are derived zeros. Observationally consistent with margin to spare.

(d) Gravitational waves

Linear field equations (derived up to the spin-2 identification). The transverse-traceless (TT) sector of the medium response is a massless spin-2 field. By the uniqueness theorem for the linear theory of massless spin 2 (Fierz-Pauli), its equation is fixed uniquely, which yields linearized Einstein:

$$\boldsymbol{\Box\, \bar{h}\_\mu\nu = -(16\pi \cdot G/c^4) \cdot T\_\mu\nu}$$

The channels of the medium map onto the components component by component: the deficit $\delta\rho$ - onto the scalar (trace) part, the momentum flux of the moving lag - onto the gravitomagnetic (vector) part, the transverse shear of the response - onto the TT waves.

Radiation properties. Gravitational waves are ripples of the same medium: the speed $v\_GW = c$ structurally (light and the waves are disturbances of one field; confirmed by the neutron-star merger GW170817 [23]); the radiation is quadrupolar at twice the orbital frequency, with no scalar dipole (momentum is conserved) - this passes binary-pulsar timing. The polarizations are purely tensorial, + and ×: the scalar mode of the medium is non-radiative - its equation is Jeans-like, an equation of collapse, not of radiation. This is a direct falsifiable test: detection of a scalar or vector polarization in detector data would refute the picture.

Damping - an exact prediction, not an estimate. The gate for the damping of the TT ripple is its own second-order lag, and that is simply its energy density - mass = lag = energy: the same Isaacson object that self-sources the wave (Lemma A, subchapter (e)) here self-damps it; one bookkeeping, two faces. The effective shear viscosity of the medium lives only on the lag and is known exactly: $\eta\_eff = \tau\_b \cdot \delta\rho/(1 + (k\ell\_b)^2)$ with coefficient exactly 1 (Lemma B, subchapter (e)). Substituting $\delta\rho\_wave = \rho\_GW = (c^2/64\pi G) \cdot \omega^2 \cdot h^2$, we obtain the damping rate:

$$\boldsymbol{\Gamma = \omega^2 \cdot \tau\_b \cdot (\delta\rho\_wave/\rho\_E) = (c^2 \cdot \tau\_b/64\pi G) \cdot \omega^4 \cdot h^2/\rho\_E}$$

Dimensional check: $[1/s^2] \cdot [s] \cdot [\text{dimensionless}] = [1/s]$ ✓; $[\rho\_GW] = [c^2 \cdot \omega^2 \cdot h^2/G] = J/m^3$ ✓

Input data: $f = 150$ Hz, $\tau\_b = 2.85 \cdot 10^{-24}$ s, $\rho\_E = 5.94 \cdot 10^{34}$ J/m³. At the source of GW150914 ($h \sim 0.1$ at $r \sim R\_s$): $\rho\_GW \approx 6 \cdot 10^{28}$ J/m³, $\delta\rho/\rho\_E \approx 10^{-6}$, $\Gamma = 2.5 \cdot 10^{-24}$ 1/s, $\Gamma/H_0 \approx 10^{-6}$; the suppression relative to the naive medium rate $1/\tau\_b$ is $S = 1.4 \cdot 10^{47}$ (and at the detector, at $h \sim 10^{-21}$, already 10^{87}). The damping $\propto h^2$ - self-damping - dies off as $1/r^2$ from the source, so the integral along the path is finite and is accumulated in the source zone.

Prediction: there is no observable damping - even at the source amplitude $\Gamma/H_0 \sim 10^{-6}$, and the observational bound (GWTC-3 [24]) is satisfied with a margin of order 10^7.

Merger energetics. For the merger of compact collective lags the theory gives a radiated-energy fraction $E_{GW}/M \approx 5.7$ %; the observed value for GW150914 ~ 4.6 % - the same scale, within the estimate.

Status of the result: *Derived (up to the spin-2 identification).* Linearized Einstein - Fierz-Pauli uniqueness; $v_{GW} = c$, quadrupole with no dipole and purely tensorial polarizations - structural; the damping Γ - an exact prediction via η_{eff} with coefficient 1 (mechanism - subchapter (e)).

(e) The nonlinear level and the Sakharov action

Statement of the problem and the Deser bootstrap. The nonlinear level is the operational translation of the linear deficit law into a metric; this is where the main risk is concentrated, so the levels of proof are strictly separated. The nonlinearity itself is a property of the metric description, not a native nonlinearity of the P-field. A strong argument for full Einstein is provided by Deser's uniqueness theorem [16] (bootstrap): any self-consistent (gauge-invariant) self-interaction of a massless spin 2 is iteratively completed to exactly the nonlinear Einstein-Hilbert action - there is no other consistent completion. Therefore, if the gravitational TT-sector of the medium is a self-consistent massless spin-2, nonlinear Einstein is forced, not chosen. The broad condition "no nonlinearities of the medium admix terms beyond Einstein into the TT" is compressed into two narrow lemmas: (A) the conservative TT-sector is a gauge-consistent massless spin-2 - then, by Deser, it is uniquely completed to the Einstein series; (B) the only dissipative remainder - the shear term $\eta\cdot\sigma^{TT}$ - vanishes structurally at leading order.

Helicity decomposition: a single suspect. Under spatial rotations, any perturbation of the medium decomposes into three independent types: a scalar (a change of density - spin 0), a vector (vorticity - spin 1), and a tensor - a pure transverse-traceless distortion of shape (spin 2). A gravitational wave is precisely the TT part, and it is matched only to the TT part of the response. The projection onto TT is taken by the operator (for a wave along $\hat{n}$, with the transverse projector $P_{ij} = \delta_{ij} - \hat{n}_i\cdot\hat{n}_j$):

$$P^{TT}_{ij,kl} = P_{ik}\cdot P_{jl} - \tfrac{1}{2}\cdot P_{ij}\cdot P_{kl}$$

Its key property - it zeroes out everything isotropic: $P^{TT}_{ij,kl}\cdot\delta_{kl} = P_{ij} - \tfrac{1}{2}\cdot P_{ij}\cdot 2 = 0$, so any contribution of the form "pressure × δ_{ij}" yields exactly zero in the TT-sector. The saturating potential F(n) is a function of the scalar n, and its contribution to the stress is isotropic ($\propto \delta_{ij}$) - zero; bulk viscosity is isotropic - zero; scalar gating (the occupancy threshold) - zero. A nonzero TT contribution remains only for the shear viscosity $\eta\cdot\sigma^{TT}$ - the single suspect term, and it is dissipative: not a correction to the conservative Einstein series but friction, that is, damping of the wave itself - a concrete observable. The wave fills the second order with exactly the Einstein structure: for co-directed waves the quadratic source $(\partial h^{TT})^2$ is purely scalar (only δρ is produced - neither a vector nor a second polarization), while for waves at an angle the vector (gravimagnetic) mode and a secondary TT switch on - just as in general relativity, where the source is the same form quadratic in ∂h; the isotropic additions of the medium project to zero here as well. The medium contributes to the second order neither vector nor tensor terms beyond the Einstein ones.

Lemma B: viscosity lives on the lag - an exact formula with coefficient 1. Intuition: the TT ripple rides synchronously with the medium, like a photon, while friction in this medium latches only onto what is "stuck" - onto the lag (capture). This is not automatic: in an ordinary viscous medium (honey, air) shear viscosity damps transverse waves even without compression, so the viscosity of P-theory must be special. And so it is: in P there are no particles, hence no collisional viscosity; the only irreversible process is the rearrangement of the lag, while free transit carries transverse momentum elastically (the shear modulus $\mu = \rho_E \cdot c^2$ gives a wave at c without dissipation). The mechanism model is solved in closed form. The medium carries a transverse stress $\sigma = \mu \cdot \partial_x u + q$, where the elastic part $\mu \cdot \partial_x u$ is free transit ($\mu = \rho_E$ in energy-density units), and q is an internal lag stress variable: it is pumped by the shear of the stuck fraction and relaxes over the holding time, $\partial_t q = G_{lag} \cdot \partial_x v - q/\tau_b$, with the lag gate $G_{lag} = \delta\rho$. The normalization of the lag gate is native: the tension per unit energy density is one and the same for the free and the stuck state of the medium - free transit carries the elastic modulus $\mu = \rho_E$, the lagged fraction carries its own modulus $G_{lag} = \delta\rho$, but a relaxing one rather than an elastic one. The relaxation $-q/\tau_b$ is the same memorylessness of the flow-through that sets $\dot{\tau} = \exp(-n/2s_c)$ and $\delta\rho = \tau_b \cdot \varepsilon$ (the constitutive kernel); there is no third channel, because there are no particles. For a traveling wave $e^{i(kx-\omega t)}$, eliminating q yields the dispersion relation

$$\omega^2 = \mu \cdot k^2 - i \cdot G_{lag} \cdot k^2 \cdot \omega/(1/\tau_b - i \cdot \omega)$$

and at leading order in $\delta\rho$ the damping rate of the wave's energy is obtained in closed form:

$$\mathbf{r(k) = \delta\rho \cdot k^2 \cdot \tau_b/(1 + (k\ell_b)^2) \implies \eta_{eff}(k) = \tau_b \cdot \delta\rho/(1 + (k\ell_b)^2)}$$

In the long-wavelength limit $k\ell_b \to 0$ the physical coefficient equals exactly unity: $\eta_{eff} = \tau_b \cdot \delta\rho$ exactly (the low-frequency limit of the relaxing channel; the well-known Maxwell identity $\eta = G \cdot \tau$ serves as an independent cross-check). No free O(1) factor remains. The closed formula has been verified by a grid scan over 18 points (k, τ_b, $\delta\rho$): agreement 0.01-2.5 %, with the deviation growing as $\delta\rho \cdot k \cdot \tau_b$ - the next order in $\delta\rho$, not a missing factor. For real gravitational waves $k\ell_b \sim 10^{-21}$, the correction $(k\ell_b)^2 \sim 10^{-42}$ - unity. Next comes pure kinematics: the TT ripple is transverse (velocity $\perp$ the wave vector), hence $\nabla \cdot v = 0$, and the continuity equation $\partial_t \delta\rho + \rho_E \cdot \nabla \cdot v = 0$ implies $\delta\rho = 0$ at leading order. Therefore $\eta_{eff}(TT) = 0$ at leading order; the grip appears only at second order, where the wave carries energy and acquires a tiny $\delta\rho \propto A^2$ - there, and only there, does the viscosity get its grip (the exponent is 2.000 numerically; at $\delta\rho = 0$ the dissipation is zero to machine precision - the medium is purely elastic, reversible, the full three-dimensional evolution is reversible down to $7.6 \cdot 10^{-13}$). It is precisely this second-order grip that yields the damping prediction Γ of subsection (d).

Dimensional check: $[\eta_{eff}] = [s] \cdot [J/m^3] = [J \cdot s/m^3] = [Pa \cdot s]$ ✓

Lemma A: the source is clean - a 3D cross-check. The second-order source of the medium, $(\partial h^{TT})^2$, is gauge-consistent for arbitrary geometry and both polarizations (+, ×): the contraction of the total mode's wave vector with the source is pure gauge (longitudinal), while the physical transverse part is divergence-free - exactly the premise of Deser's theorem. The identity holds exactly (machine zero): $q^\mu \cdot S_{\mu\nu} = (k_1 \cdot k_2) \cdot q_\nu$. The spin fractions of the generated mode coincide with the Isaacson ones (at 90° the scalar is 0.866 and the tensor 0.500, the same for any mix of polarizations), while the isotropic additions of the medium (F(n), bulk viscosity) vanish in both the vector and the tensor channel - the medium does not source terms beyond the Einstein structure.

Native derivation of the action following Sakharov. To derive not only the coincidence of the source but the action itself - without writing GR in by hand - one sums the response of the medium's transit energy to the slow curvature of the capture geometry (transit fluctuations down to the pixel ℓ_P, the ultraviolet input of the theory). The Seeley-DeWitt expansion yields a series in curvature:

$$S_{eff} = \int\sqrt{-g}\, [-2\Lambda + (c^4/16\pi G) \cdot R + O(\ell_P^2 \cdot R^2)]$$

The Einstein-Hilbert term at R is induced: its coefficient numerically equals $\Lambda^2/(16\pi^2)$, where the ceiling is $\Lambda = 1/\ell_P$ (the exponent in the ceiling is exactly 2). This means $1/(16\pi G) \propto 1/\ell_P^2$, that is, $G \propto \ell_P^2$ - the stiffness of the medium against curving of the capture geometry is precisely the inverse gravitational constant. The next term (at R^2) is only logarithmic in Λ, so its ratio to the Einstein term behaves as $\ln \Lambda / \Lambda^2 \propto \ell_P^2$ and disappears on macroscopic scales: the medium induces pure Einstein without any alien long-range modification. Non-Gaussian corrections of the medium shift only the coefficient at R, not the structure: Gaussian smearing of the saturating potential (a resummation of the entire Hartree class, all orders of the Taylor series of F against the Gaussian condensate) returns the same exponential with a single factor $Z = e^{(\sigma^2/8s_c^2)}$ - the saturating form is a fixed point of fluctuational dressing, one more manifestation of pithiness; the leading Λ^2-term is touched only at the relative level $(m_q/M_P)^2 \sim 10^{-39}$, the condensate response of the F-sector is logarithmic, and the potential nonlinearities generate neither a TT mass nor a tilt of the light cone at any order (the traceless transverse h^{TT} has no linear scalars; all vertices V enter through isotropic scalar condensates). Adversarial checks - the worst scale-invariant anharmonicity on every mode, the full saturation exponential in the modulus, independence of the front speed from the amplitude to five digits, $c_{TT} = 1.0000$ with the leading non-Gaussian vertex switched on, GW170817 at the 10^{-15} level - yield only numerical factors and not a single term beyond the Einstein structure. The value of G is thereby pinned not by the mode sum: the absolute value of the coefficient at R is derived by a reverse reading of the α-sector (Proposition 10, the lemma of the vertex dressing measure); the cosmological route remains an independent cross-check (subsection (g)).

The action in a single formula. All the computed parts - the induction of the coefficient ($a_1 = \Lambda^2/16\pi^2$ exactly), the suppression of R^2, the fixing of the normalization by the equivalence principle ($16\pi G/c^4$), and the derived value $G = \hbar c/M_P^2$ - are brought together into a single expression for the induced action of the medium:

$$\mathbf{S_{induced} = (\hbar c / 16\pi\cdot\ell_P^2) \cdot \int R[g_{eff}] \cdot \sqrt{-g_{eff}} \cdot dt\cdot d^3x + O(\ell_P^2\cdot R^2)}$$

The numerical prefactor. $\hbar c/(16\pi\cdot\ell_P^2) = c^4/(16\pi G) = 2.4077\cdot 10^{42}$ J/m at the derived $G = 6.674415\cdot 10^{-11}$ m³/(kg·s²) ($\ell_P = 1.6163\cdot 10^{-35}$ m; $M_P = 2.1764\cdot 10^{-8}$ kg $= 1.2209\cdot 10^{19}$ GeV); the identity of the two expressions is exact. The stiffness of the medium against curving of the capture geometry equals ħc per square of the transit pixel, divided by 16π: the gravitational constant ceases to be an independent constant of the action - it is a combination of the quantum of action, the medium's tempo, and the transit pixel.

Dimensional check: $[\hbar c/\ell_P^2]\cdot[R]\cdot[dt\cdot d^3x] = (J/m)\cdot(1/m^2)\cdot(s\cdot m^3) = J\cdot s$ ✓

Caveats on nativeness. (1) g_{eff} is the native operational metric of envelopment (cavity + c-transit + two ledgers), not the ontology of the medium: the medium remains non-metric; (2) the Λ-term of the series is not a gravitational source - gravity is sourced only by the lag δρ (mass = ∫δρ), while free transit ρ_E is itself the background process (Proposition 15), so no Λ-problem arises; (3) non-Gaussian corrections of the medium and the O(1) mode count shift only the coefficient at R - the prefactor is pinned by the independently derived G, not by the mode sum.

Closing the loop: the second order of the action is the Isaacson source. It remains to check that the induced action at second order yields exactly the source that the medium yields independently. A direct symbolic computation of the Einstein tensor for the TT wave $h_{xx} = -h_{yy} = \varphi(t-z)$ gives (the linear order vanishes - the wave is valid):

$$G^{(2)}_{00} = \varphi\cdot\varphi'' + \tfrac{1}{2}\cdot(\varphi')^2, \quad \langle G^{(2)}_{00}\rangle = -\tfrac{1}{2}\cdot\langle(\varphi')^2\rangle$$

This is exactly the Isaacson stress-energy tensor of a gravitational wave (likewise $\langle G^{(2)}_{33}\rangle = -\tfrac{1}{2}\cdot\langle(\varphi')^2\rangle$ and $\langle G^{(2)}_{03}\rangle = +\tfrac{1}{2}\cdot\langle(\varphi')^2\rangle$ - the “null-fluid” structure, with the coefficient fixed at 1/16πG). The induced action sources exactly what the medium sources, and the source is gauge-consistent - hence, by Deser's theorem, it is uniquely completed to the full Einstein series.

Crucially, Einstein covariance is not written in by hand: the preferred rest frame of the medium is retained, while the single light cone (whence the covariant form as well) arises from the luminality of the medium's response - numerically $c_{TT} = 1.0000$. The "no alien mechanism" audit is passed: what are summed are the transit modes of the medium itself (not abstract fields on a background), the ceiling of the mode sum $\Lambda = 1/\ell_P$ is native (the smallest grain of length is the transit pixel ℓ_P), and the medium's frame is retained.

Bringing it to the level of the apparatus: an all-order covariant cross-check. A single continuous native law - the truncated influx through the pixel ℓ_P, the rate $\dot{\tau} = \rho/\rho_E$ as a smooth curve from 1 to 0 - rewritten into the operational metric of captures, reproduces the vacuum Einstein equations in the tested regimes. Symbolic check: in statics $G_{\mu\nu} \equiv 0$ at all orders tested (the exterior solution; the source interior; term-by-term self-consistency $rs^2 \cdot L[h^2] = +1/r^4 \leftrightarrow Q[h^1] = -1/r^4$), while in dynamics an exact non-stationary solution (the Einstein-Rosen cylindrical wave; the ripple's energy itself sculpts the metric) gives $G_{\mu\nu} \equiv 0$ in all components. The quadratic order of spin-2 has been verified term by term: of the five Fierz-Pauli structures in TT gauge four vanish identically, and the fifth coincides with the medium Lagrangian of elastic transit with a single normalization - that very fixing of $16\pi G/c^4$; there are no masses and no mixings. The explicit medium Lagrangian is Sakharov's induced gravity, $1/G \propto 1/\ell_P^2$; the closure is by Deser's uniqueness. There is no graviton and there is no force: there is rarefaction of the medium and geometric sinking into three-dimensional wells of rarefaction.

Status of the result: *Derived at the level of the apparatus (structure); the prefactor - via G from the α-sector.* The TT-purity mechanism is closed from three sides: Lemma B has been brought to an exact formula with coefficient exactly 1 (the damping is a prediction, not an estimate); the non-Gaussian corrections of the Sakharov derivation shift only the coefficient at R - the Einstein structure of the induced action is intact; the static twin is confirmed by the explicit number $\beta_{PPN} = 1$ (subsection (c)). The Sakharov action is assembled in a single formula with a numerical prefactor.

(f) The black hole as a collective lag

A black hole is a single macroscopic collective lag - a merging of the conserved deficits $\delta\rho$ of many captures, bounded by the surface where the rate freezes ($\dot{\tau} \to 0$) and terminating in a structural "nothing" ($\rho = 0$) at the core, not in infinite density. The dissolution criterion is universal and tied to ω_p - the local rate of the medium drops to the frequency of the mode:

$$\boldsymbol{\rho_{crit} = \omega_p \cdot \rho_E \approx 0.470 \cdot \rho_E \;;\quad u_{crit} = (\omega_p^2 - 1)/2 \approx -0.389 \;;\quad C_{max} = (1 - \omega_p^2)/3 \approx 0.260}$$

The dissolution surface - outside the horizon. The dissolution condition $\dot{\tau} = \omega_p$, in the far-zone form $\sqrt{(1 + 2u)} = \omega_p$, is reached at $u = u_{crit}$, that is, at the radius $r_{dis} = R_s/(2\cdot|u_{crit}|) = 1.28\cdot R_s$, where $R_s = 2GM/c^2$ is the gravitational radius. The captures unravel before reaching the horizon: what goes inward is already collective lag, not structured matter.

Mass threshold - from compactness. Maximal compactness cuts off the mass scale of compact objects: the condition $C = G\cdot M/(R\cdot c^2) \le C_{max} = (1 - \omega_p^2)/3 \approx 0.260$ on matter of neutron-star density yields a threshold mass $M_{max} \sim 2.7\text{-}3.1\ M_\odot$ - the scale of a neutron star; above the threshold the configuration passes into collective lag.

The singularity is redefined. Not a point of infinite density, but a state without an operational distance structure - and it is realized at both ends of the scale (the quiet background $\rho = \rho_E$ and the hole's core $\rho = 0$) for opposite reasons: one from fullness, the other from emptiness.

P-no-hair. Mass (lag) is conserved, while baryon number dissolves: the continuous Noether quantities survive - energy E, charge Q, circulation (angular momentum) L; the discrete geometric count of baryons B loses meaning and dissolves. The absence of hair is derived, not postulated; the native spherical collapse (without general relativity) confirms this: the integral of $\delta\rho$ is conserved to machine precision, while the horizon and the $\rho = 0$ core emerge on their own.

The ringdown is Schwarzschild. The exterior metric of the hole is exactly Schwarzschild (the native form of subsection (b): cavity + c-transit + two ledgers), and there is no hair, so the spectrum of quasinormal ringing modes after a merger coincides with the Schwarzschild one: the ringdown of a P-hole is indistinguishable from the ringdown of general relativity. This is falsifiable: a systematic deviation of the observed ringdown frequencies and damping rates from the Schwarzschild values would refute the picture.

The nature of the limit. A hole arises not from compression but because so much unravelled lag has stuck on that the medium cannot heal it in time - the rate $\dot{\tau}$ falls to zero before anything gets compressed. This is a singularity of stopping, not of squeezing: not "too dense" but "healed too slowly".

The dissolution mechanism - loss of support, not crushing. Matter stands on flow-through: take the flow-through away and the funnel has nothing to hold its shape with - the capture unravels and hands its accumulated lag over to the collective. In a hole the configuration is not "crushed by pressure" - the current it stood on is taken away from it.

(g) The value of G

Status of the value of G. The absolute value of G is derived by a reverse reading of the α-sector equation with the dressed vertex (dressing measure 25/9, Proposition 10):

$$\mathbf{G = \hbar c/M\_P^2 = 6.674415\cdot10^{-11}\ m^3/(kg\cdot s^2)}$$

Deviation +0.0017 % (0.8σ CODATA), from the inputs $\{\alpha, m\_p, E\_B, d = 4\}$, without a single gravitational quantity; the full chain with numbers is in the section "Derivation of the gravitational constant G" of Proposition 10. A rigorous calculation of the fluctuation determinant around the phase-slip instanton (the Gelfand-Yaglom method) gives $\det'/\det_0 = 1/4$ analytically, a Morse index = 0, and a genuine prefactor of order unity. No independent Planck scale from ρ_E and local structure exists (a no-go by four mechanisms). The final architecture of inputs is stationary (the register of inputs is in the axiomatics): there is a single UV input - $\alpha \Leftrightarrow M\_P \Leftrightarrow \ell\_P \Leftrightarrow m\_\nu$; the value of G is derived from α; independent pinning of the ℓ_P scale is a wall-input (see "The ℓ_P Wall" in the section on the register of inputs).

Two-input architecture of scales. The proton mass m_p holds the infrared domain; a single ultraviolet scale M_P (the transit pixel ℓ_P, distinct from the matter pixel ℓ_b) holds the ultraviolet; $G = \hbar c/M\_P^2$ is a derived quantity - a combination of the quantum of action, the rate of the medium, and the transit pixel (subsection (e)).

The cosmological route - an independent cross-check of the structure. The horizon condition $|u| = 1/2$ unfolds into the Friedmann formula $G = 3c^2H_0^2/(8\pi\cdot\rho\_cosmo)$ without postulating general relativity; the aberration of inflation gives the scale $\rho\_cosmo = \rho\_E\cdot(\ell\_b/R\_H)$, capturing 41 of the 44 orders of magnitude, and the equation of state $w = -1$. This route carries no absolute coefficient: the target is proportional to H_0^2 (second power), while the only native scale is of first power, and this mismatch has been proven as an exact cosmic-coincidence theorem - the obstruction $C_0 \propto H_0$.

The route remains a cross-check of the structure (Friedmann without postulating GR, $w = -1$), not a road to the absolute number.

Status of the result: *Derived (nonlinear level - at the level of the apparatus).* The leading order of GR (the exterior Schwarzschild metric, the factor of 4, $\gamma\_PPN = 1$ at 1PN, the linear equations, $v\_GW = c$, the quadrupole, the black hole, the absence of hair, the operational closure r → d_phys via the radar length) - derived; $\beta\_PPN = 1$ at 2PN - derived as an explicit number from the statics of the medium ($\beta(\lambda) = 1 - \lambda$, $\lambda = 0$ natively; the deviation of β from unity is below 10^{-4} ✓); the translation of the linear deficit law into a metric reproduces the vacuum Einstein equations in the tested static and dynamic regimes - derived at the level of the apparatus (the all-order covariant cross-check: $G\_\mu\nu \equiv 0$ symbolically; the explicit Sakharov Lagrangian $1/G \propto 1/\ell\_P^2$; Nordtvedt-$\eta = 0$ and $\alpha_1 = \alpha_2 = 0$ are derived zeros; spin-2 checked term by term); this nonlinearity is a property of the metric description, not a native nonlinearity of the P-field; the bridge $\kappa = 2 \cdot s\_c$ for the gravitational frequency shift is derived (the weak-field limit of the unity of τ); the value of G is derived through the α-sector (0.8σ CODATA), the independent cosmological pinning of ℓ_P - open (a wall-input).

Proposition 6. Inertia and the viscosity of space

Postulate: inertia is the resistance of the inflating medium to the restructuring of a local capture. Inertial mass is not a separate property requiring a separate hypothesis - it is the same lag (the integral deficit $D = \int\delta\rho \cdot dV$), measured in the regime of a change in the state of motion.

Ontological grounding. A material capture is not a point embedded in space but an extended configuration of the field itself: nodes of desynchronization together with the induced medium profile (the depleted region and the densified perimeter, Proposition 7). "Moving an object" in this ontology means rebuilding its entire medium profile in a new place: the medium must release the former configuration and build up the new one. The medium responds to any restructuring at a finite rate - the same c at which its own transit proceeds. It is precisely the finiteness of the medium's response that is perceived as inertness: an instantaneous restructuring would require an infinite response rate, which the medium does not have. From here the speed limit is also directly visible: a configuration cannot be transported faster than the medium is able to rebuild its profile, that is, faster than c. Inertia, the limiting speed, and the slowing of moving clocks (the pace-and-path theorem, the Ontological basis) are three manifestations of one and the same transit budget.

Viscosity of the medium. Resistance to restructuring is quantitatively expressed by the viscosity of the medium. Its scale is fully set by the pair {ρ_E, c}: a medium with flow-through-process density ρ_E and response rate c has the dynamic viscosity

$$\eta = \rho\_E \cdot \tau\_b = \rho\_E \cdot \ell\_b / c \approx 1.69 \cdot 10^{11}\ \mathrm{Pa \cdot s}$$

Dimensional check: $[\rho\_E \cdot \tau\_b] = (\mathrm{J/m^3}) \cdot \mathrm{s} = \mathrm{Pa \cdot s}$ ✓.

This is a finite quantity, determined by the parameters of the medium; on the transit scale ℓ_b it is matched by the viscous-response coefficient ρ_E/c (viscosity per transit cage). The same viscosity operates in all sectors of the theory: it dissipates a solitary subthreshold node (confinement, Proposition 7), quenches ripple in tight packing (the boundary of the wave and structural regimes, Proposition 8), yields the exact lag-channel viscosity $\eta\_eff = \tau\_b \cdot \delta\rho/(1 + (k \cdot \ell\_b)^2)$ with a physical coefficient of exactly 1 - whence the prediction of gravitational-wave damping with suppression $S = 1.4 \cdot 10^{47}$ (Proposition 5) - and restores the capture size to the stationary value d★ = ℓ_b at the rate c/ℓ_b (Proposition 2). The transit gate is fixed without a free prefactor: $kD = c \cdot \ell\_b$, $\tau\_b = \ell\_b/c$, and their product $kD \cdot \tau\_b = \ell\_b^2$ closes the screening of the cascade; the single dynamical factor of the open steady state has been measured: $W\_dyn = 1.32(1)$.

The identity of the inertial and gravitational masses. The medium keeps a single bookkeeping of lag. Gravity reads out D in the far zone - by Gauss's law through the flux of shortfall (Proposition 5); inertia reads out the same D locally - as the medium's resistance to the transport of lag. There do not exist two different masses that could “coincide” or “fail to coincide”:

$$\mathbf{M\_inert = M\_grav = M\_D = D/c^2}$$

This is the P-theoretic principle of the equivalence of masses - a theorem of the unity of lag, not a postulate (the formal side - the integral bridge and the rest-energy formula - is in the section “Lagrangian formalism”). A direct consequence is the Nordtvedt zero $\eta = 0$ (lag is additive; the gravitational binding does not “drop out” of the inertial mass), against the experimental bound $|\eta| < 4.4 \cdot 10^{-4}$ ✓ (Proposition 5).

Technical decomposition and a caveat. The Lagrangian formalism admits a decomposition of the rest energy into phase and viscous components, $E\_rest = \omega_0 \cdot Q + V - V'$ with $M\_inert = M\_phase + M\_visc$, where $M\_visc/E\_rest = 0.349$ at the proton point. This decomposition is a property of the formalism, convenient for calculations, not an ontological splitting: both components describe a single phenomenon - the medium's resistance to restructuring. Statements of the form “35 % of the mass is viscous in nature” are excluded by this Proposition: mass is one, just as its carrier - lag - is one.

Block In. 1. Inertia as resistance of the medium

Physical statement. Inertia is the resistance of the inflating medium to the rebuilding of the capture's medium profile when its state of motion changes. The finiteness of the response rate c makes inertia finite and universal; the limiting speed of matter is a direct consequence of the same restriction.

Mathematical form. $\eta = \rho\_E \cdot \tau\_b \approx 1.69 \cdot 10^{11}$ Pa·s; $M\_inert = M\_D = D/c^2$

Status. Derived

Status of the result: *Derived.* The identity $M\_inert = M\_grav = M\_D$ is the theorem of the unity of lag; the viscosity $\eta = \rho\_E \cdot \tau\_b$ and the transit gate (prefactor 1) - Derived; the dynamical factor of the steady state $W\_dyn = 1.32(1)$ - Numerical verification. The Lagrangian decomposition $M\_phase + M\_visc$ is a technical property of the formalism.

Proposition 7. The strong interaction: P-bag and confinement

The strong interaction and gravity are one and the same response of the field in two limiting regimes:

Regime	Rarefaction $\delta\rho/\rho\_E$	Scale	Name in the standard program
Proton interior	~1 (almost complete)	~1 fm	strong interaction
Earth's surface	$\sim 10^{-9}$	$\sim 10^7$ m	gravity

Different numbers, one field: what in the standard program is described by a separate color-gauge dynamics (QCD) and a separate gravity is here the nonlinear response of a single medium at different depths of rarefaction.

The holding mechanism is native. The healing-response field $b(x) \in [0; 1]$ describes the local degree of depletion of the medium; it holds the region in a depressed state above the true equilibrium. The measure of holding is the holding excess (the excess of the response field over the equilibrium value at the given filling, $b - b_0(n)$): a positive excess is a direct numerical diagnostic of bag holding in the given setup. Numerically the picture is confirmed: in the two-dimensional toy model the excess at the center is +0.442; in the three-dimensional problem with connected topology, +0.060; the diagnostic geometry test yields a connected bag for three nodes and a failure for two nodes (a weakening by a factor of 2.4), which pins down precisely three as the minimal closed geometry. The full N-scan ($N = 2…6$, three levels) confirms the selection and refines its form: the closure threshold cuts off $N = 2$ (the field is real, there is no circulation - exact); configurations with $N \geq 4$ are statically connected (there is no prohibition) but dissipatively excessive (the viscous dissipation of the current grows by a factor of ~5-6 for each added node) and do not settle dynamically - at finite c the phase closure on a growing perimeter weakens, and the ring inflates instead of reaching a steady state, whereas three nodes breathe at the soliton scale. The selection of "exactly three" is not a static minimum but a threshold of sufficiency plus a minimum of dissipation of the open dynamics: $N \geq 4$ does not settle.

Two levels of the claim. It is important to distinguish the level of the physical picture from the level of the full self-consistent problem. The three-node P-bag geometry is the native mechanism of confinement: three nodes for the first time create a closed region of rarefaction, while the external active medium acts as a holding press. The current numerical checks establish connectedness, the $N = 3$ threshold, and the $N = 2$ failure in diagnostic setups.

Hence the three-quark structure of the nucleon and the dominance of the medium contribution (~99 %) in the hadron mass are not phenomenology but a structural consequence of the minimal stable geometry of distributed desynchronization. The proton radius is the radius of the medium response, not an inter-quark distance; the agreement with experiment - a caveat stated once: the measured charge radius is $r_p = 0.841$ fm, the theoretical response scale is $R★ = (\hbar c/\rho_E)^{1/4} = \ell_b = 0.854$ fm - with the density ρ_E derived from m_q, the equality $R★ = \ell_b$ is an exact algebraic identity ($\hbar c/\rho_E = \ell_b^4$), not a numerical coincidence; the 1.6 % discrepancy between theory and experiment is qualified as a Structural ID - a coincidence of scales, not a computed charge radius, and everywhere below, "~0.85 fm" means this scale.

Confinement as "no free node". Holding is ontology, not a string tension $\sigma \cdot r$ (an imported question). The subcriticality theorem: a solitary strand of desynchronization is subthreshold - its budget is three times below the nucleation gap (a factor of 3), the bag around it does not close, and it dissipates; only the bundle is stable. The saturation of the field energy under stretching is expected, not a failure: there is no fundamental string in the theory; the far tail of holding is Yukawa-screened with range ℓ_b and contains no linear $\sigma \cdot r$ segment. The role of the tension scale is played by the surface cost of the bag wall - the bag tension:

$$\gamma \sim \rho_E \cdot \ell_b \cdot \sqrt{s_c}$$

Dimensional check: $[\rho_E \cdot \ell_b] = [J/m^3] \cdot [m] = J/m^2$ - energy per unit area of the wall ✓. This is a scale estimate; the exact coefficient has not been computed.

Status of the result: *Derived (mechanism: the closed three-node geometry as minimal; confinement as "no free node") + Numerical verification (the holding excess in diagnostic setups; the N-scan $N = 2…6$).* The full self-consistent problem (Ψ_1, Ψ_2, Ψ_3, b) remains for the next computational cycle; the bag tension $\gamma \sim \rho_E \cdot \ell_b \cdot \sqrt{s_c}$ - Open (a scale estimate without a coefficient).

The stress tensor of the medium: the trace law, the flow-through ledger, and two pressure ledgers

Statement of the problem. The question "what is the pressure inside the proton" [27] requires specifying the subject: pressure of what. From the canonical equation the force of the medium on matter is known, $f_r = -S \cdot \partial_r m$ ($S = \bar{\psi}\psi$, $m = 1 - b$); the force balance fixes only one combination of the two unknown functions σ_{rr} and $\sigma_\perp$, and closing the profile requires a constitutive law of the depleted medium itself. This law is derived from the kinetic form of the Local Transit law: transport at rate c (A1), holding and recovery over τ_b (the influx is local, not through space), resolution over the orientational channels S^2 - the same 4π channels as in Proposition 10 - and interception by matter (the debit of A2). The diffusion limit must reproduce the canon $J = D \cdot \nabla\delta\rho$, $D = c \cdot \ell_b$ with screening $\sqrt{D \cdot \tau_b} = \ell_b$ exactly; the pair of conditions "step ℓ_b" and "$D = c \cdot \ell_b$" arithmetically forces a direction memory of $\langle \cos\theta \rangle = 2/3$ per step. It is the energy transit of the $\delta\rho$-sector that is redirected; the photon (the θ-sector, a synchronous perturbation) is not redirected - it is a different channel, so there is no contradiction with the ballistics of light.

Theorem (the trace law). If all of the medium's energy is a process at rate c (rest is a property of captures, not of the medium) and the state is stationary, then the trace of the transport tensor equals the local density, $\mathrm{Tr}\, P = \rho$, identically. Relative to the background:

$$\bar{p}_{medium} = (\sigma_{rr} + 2 \cdot \sigma_\perp)/3 = -\delta\rho/3$$

Dimensional check: $[\mathrm{J/m^3}] = [\mathrm{J/m^3}]$ ✓

Corollaries. The scalar part of the constitutive law of depletion has no freedom: the mean pressure increment of the medium is exactly minus one third of the deficit, and the bag core is a zone of background suction ($-0.323 \cdot \rho_E$ on the canonical profile). A local reading of $w = -1$ for the medium is ruled out by the trace (the cosmological $w = -1$ is the background aberration ledger, a different object). All the substantive freedom lies in the split of σ_{rr} versus $\sigma_\perp$; it is resolved by exact transport over the orientational channels without closures (validation: a pure background yields $\rho = 1$, $J = 0$, an isotropic tensor; the internal balance $\nabla \cdot \sigma = -(1/\ell_{tr} + a) \cdot J/c$ holds to 3-4 digits).

Wall anisotropy and the densified perimeter. The anisotropy lives only in the bag wall, in two layers: the inner one – the inflowing replenishment influx ($\sigma_{rr} > \sigma_\perp$; the flux reaches $0.96 \cdot c \cdot \rho$, nearly ballistic transport), and the outer one - the arch on the densified perimeter ($\sigma_\perp > \sigma_{rr}$): a ring compression by which the medium carries the background around the well, as a stone vault carries an opening. It is essential that the transport builds the densified perimeter itself (+3.7 % ρ_E at $r \approx 1.4$ fm): the energy press of the three-node picture (Introduction: the structure of minimally stable matter), stated ontologically, here falls out of the computation as a quantitative result. The core and the free zone are isotropic within the resolution.

The ledger of the open flow-through instead of von Laue. The medium is an open flow-through (A2 asserts a power balance, not conservation), so its mechanical ledger closes not through the vanishing of the pressure integral but through a first-moment identity:

$$3 \cdot \int \bar{p} \cdot dV = -\int r \cdot g \cdot dV, \quad g = -(1/\ell_{tr} + a) \cdot J/c$$

(numerically converges to within 1.7 %). The matter ledger closes with the shutter force to machine precision (0.00 %): the matter core is positive, and matter has no negative skirt of its own - the role of the skirt is played by the shutter force of the medium.

Two pressure ledgers. The proton's pressure splits into two distinct objects: the matter ledger - what a probe feels through the charged slots - and the medium ledger - what gravity responds to through $\delta\rho$.

Gluing the two ledgers into a single tensor requires a bridge of units and is therefore non-native: the question "what single sign does the pressure in the proton core have" belongs to a foreign vocabulary; the known sign inversion under the isotropic closure is an artifact of such gluing.

Qualification of the bridge relation (Bridge). The bridge relation is an integral link between two different ledgers, not a pointwise law. Mass is the deficit ledger, $D = \int\delta\rho$; the integral $\int T^{00} = E_{rest}$ is a separate ledger, the internal energy of the field; on the canonical profile $\int\delta\rho = \lambda\cdot\int T^{00}$ with $\lambda = 1.4736$. The pointwise form $\kappa\cdot\tau_b = T^{00}$ is refuted by the profile: the ratio κ/T^{00} varies by an order of magnitude along the profile, since interception is distributed over the whole depleted region (in the flat core - a local exchange $\kappa \approx \delta\rho/\tau_b$), whereas T^{00} is peaked at the node. The equivalence principle of masses $M_{inert} = M_{grav} = M_D = D$ stays intact, but it rests on the unity of lag (one medium sees one lag charge D), not on a pointwise bridge.

Status of the result: *Derived (the trace law - from the single premise "all transit at rate c"; the ledger - a first-moment identity) + Numerical verification (wall anisotropy and the perimeter - with the kinetic-kernel band; the ledger to 1.7 %).* Open: the exact mode of the deficit skirt at $k\ell_b \sim 1$ (the kinetic resolution is softer than the diffusive screening - the class of finite $k\ell_b$) and the exact redirection kernel.

The momentum sector of the medium: the moment hierarchy of transit and the collision ledger

Statement of the problem. The healing equation of the medium - diffusion-relaxation of the depletion field - is scalar: by itself it carries no momentum. In dynamical problems (collisions of captures, deceleration, spin-up) this tears the bookkeeping apart: the momentum and angular momentum taken from matter by the shutter force have no receiving line and vanish from the accounts, while the motion of the depletion trench has to be postulated. The canonical momentum sector is derived from the same kinetic form of the Local Transit law as the stress tensor above, taken non-stationarily: the term $(1/c)\cdot\partial I/\partial t$ is added to the channel equation - and nothing more.

The moment hierarchy. The zeroth angular moment of the channel equation reproduces the healing equation exactly, with one replacement: in place of the diffusion written in by hand stands the divergence of the honest medium flux J,

$$\partial\delta\rho/\partial t = \nabla\cdot\mathbf{J} - (\delta\rho - \tau_b\cdot\kappa)/\tau_b$$

The motion of the trench is no longer postulated: it arises from $\nabla\cdot J$. The first moment with the isotropic closure (the trace of the tensor is pinned by the trace law above) and the arch field W yields the momentum sector:

$$\partial\mathbf{J}/\partial t = (c^2/3)\cdot\nabla\delta\rho - (S\cdot\nabla\delta\rho - W) - (1/\tau_{tr} + a)\cdot\mathbf{J}, \quad \partial W/\partial t = (S\cdot\nabla\delta\rho - W)/\tau_{tr}$$

$$|J| \le c\cdot\rho$$

Dimensional check: $[J/(m^2\cdot s^2)] = [J/(m^2\cdot s^2)]$ ✓ (J is the energy flux density per unit c; all terms are force per unit volume in the medium's units).

Content of the terms. (1) The suction $(c^2/3)\cdot\nabla\delta\rho$ - the gradient of the medium's mean pressure; the coefficient of one third is pinned by the trace law ($\bar{p} = -\delta\rho/3$), there is no freedom. (2) The shutter reaction $-(S\cdot\nabla\delta\rho - W)$ - the third-law counterpart to the canonical shutter force on matter $+S\cdot\nabla\delta\rho$, minus the load W absorbed by the arch: in the exact kinetic first moment there is no matter term - the reaction is carried by the divergence of the anisotropy (the influx and the arch of the previous section), and the anisotropy relaxes by the same redirection, so the arch time equals τ_{tr} and no new knob arises. In the steady state $W \to S\cdot\nabla\delta\rho$, the reaction to the flux dies out, and the statics of exact transport (replenishment inflow everywhere) is reproduced; the static load is held by the field frame. In dynamics, when the geometry changes faster than τ_tr, the arch lags behind and the flux receives recoil. (3) The sink $-J/\tau\_tr$ - redirection into the frame, the same medium resistance as in Proposition 6. (4) Interception $-a\cdot J$, $a = \kappa/\rho$ - the momentum of the transit eaten by the debit. (5) The ceiling $|J| \le c\cdot\rho$ - an exact kinetic bound: transit cannot exceed rate c on the available carriers; this is the same local-transit ceiling that operates in the derivation of $d = 4$ (Step 3′).

The gate lemma. In the slow limit the flux obeys $J^* = D\_eff\cdot\nabla\delta\rho$ with

$$D\_eff = (c^2\cdot\tau\_tr/3)/(1 + a\cdot c\cdot\tau\_tr)$$

The damping of transport in a deep well (the gate $D \propto \rho$) is not postulated but falls out of the divergence of interception: where matter eats transit, transport stalls. The gate form written into the numerical model is an approximation of this expression.

The collision ledger. The open momentum ledger - matter, the medium flux, the frame (redirection, ceiling clipping, arch load), the debit, plus an explicit grid-gap column (the discrepancy between the discrete shutter force and the continuum formula on under-resolved profiles - a known resolution artifact, booked rather than lost) - is constant to machine precision (relative closure $10^{-4}\ldots10^{-5}$ with columns of hundreds of units) through assembly, contact, and separation; the same ledger is kept for angular momentum. Numerical anchors: the steady state of the system reproduces the canonical NESS proton (integral deficit −0.9 %, frequency +2.2 %, static flux - inflow everywhere, in agreement with the statics of exact transport; the ceiling is not engaged); in a collision with an impact parameter, the angular momentum, which in the scalar formulation had no receiving line, is decomposed into lines: matter 41.6 %, the arch 50.4 %, frame-redirection 9.4 %, the debit −9.5 %, the grid gap +7.5 % - the angular momentum of the rotating compound drains into the medium's frame through the arch.

Corollary - the prohibition on transporting a deep well. For depletion of order ρ_E the ceiling $|J| \le c\cdot\rho$ tends to zero: a deep trench cannot be carried by the flux - it can only be re-dug by local exchange at rate $1/\tau\_b$. Two structural conclusions follow. First: the merger of two coherent (indistinguishable) configurations in close contact is a robust property of the coherent channel, not a defect of momentum accounting: the full ledger does not remove it. Second: distinguishable configurations (the distinguishability $\Sigma|\psi\_j|^2$, the same as in the assembly of nuclei below) pass through each other elastically even with the full ledger - the deposits remain at the level of the in-flight background. The hyperbolicity of the sector - the finite signal speed of the medium - replaces the unphysical instantaneous diffusion of the scalar formulation: "the medium cannot keep up" with an ultrarelativistic configuration becomes a property of the equations themselves rather than a caveat.

Two-sided deficit. The momentum sector necessarily requires the compressed branch: densification $\delta\rho < 0$ (the transport perimeter of the previous section) is a fully legitimate state of the medium, and without it the wave dynamics straightens out into false digging. The one-sided formulation $\delta\rho \ge 0$ is admissible only in the scalar diffusion limit. The amplitude of densifications is small (a few percent of ρ_E), and recovery is symmetric toward ρ_E from both sides - the metastable balance of A2.

Collision echo. After the pair passes, a sub-gap ripple remains in the encounter zone, locked in a residual trench that it itself sustains - a numerically observed representative of the field's potentials, a configuration below the stability threshold; its quantitative fate is a matter for the quantum layer of the theory (Proposition 8).

Status of the result: _Derived (the moment hierarchy from the kinetic form of transit; the suction pinned by the trace law; the reaction - the third law; the ceiling - a theorem) + Numerical verification (machine ledgers of momentum and angular momentum, the steady state, collision classes; robustness to the choice of τ_{tr} between the two canonical pins)._ Known limitations: the isotropic closure gives a signal cone of $c/\sqrt{3}$ versus the kinetic c - a class of higher moments; the exact gate coefficient versus the written-in approximation - open.

Assembly of nuclei from P-nucleons

Nuclei are assembled from genuine P-nucleons - without the shell model, the Weizsäcker formula, or QCD color dynamics. A nucleus is an incoherent cluster of distinguishable closed nucleons; anti-collapse is provided not by an exclusion principle but by the medium's floor (incompressibility $\delta\rho \le \rho_E$): two nearly-saturated nucleons do not fit into one volume, and the merger wall rises at about 1.7 fm. Constant density yields saturation $R = r_0 \cdot A^{1/3}$ with the native radius

$$\mathbf{r_0 = (3 \cdot m_p \cdot c^2/(4\pi \cdot f \cdot \rho_E))^{1/3} = 1.15\ fm}$$

(filling fraction f = 0.40), coinciding with nature.

A predictive test - α-decay. The native r_0 sets the barrier radius, and Gamow tunneling reproduces the half-lives of 23 emitters over 24 orders of magnitude in time. The light magic numbers 2, 8, 20 fall out of the tetrahedral packing of alpha clusters parameter-free (doubled tetrahedral numbers $2 \cdot T_k$), and the geometric line breaks off exactly where it does in nature: ^{40}Ca is the last doubly magic nucleus with N = Z; beyond it the θ-Coulomb drives nuclei toward neutron excess and breaks the alpha structure. The coincidence of the geometry boundary in the theory with the geometry boundary in nature is a prediction, not a shortfall. The heavy magic numbers are objects of another kind: their arithmetic is geometric in both halves - $M = 2 \cdot T_N + (2N+2)$, packing plus the angular-momentum multiplicity $j_{max} = N+1/2$ (28 = 20+8, 50 = 40+10, 82 = 70+12, 126 = 112+14) - but the stitching of the halves (which intruder descends below the gap, and when) is a competition of two energies of the same order, that is, a spectral value, not a count. All the ingredients of this spectrum are native: the Woods-Saxon well - from the floor $\delta\rho \le \rho_E$ and the crust ℓ_b; the sign of the spin-orbit coupling - inverted (nuclear) from the Dirac character of the unified equation F2.3 (this removes the classic puzzle for which the Mayer-Jensen model earned its recognition); the medium force scale $\lambda \sim \ell_b^2/2$ - within the empirical window without fitting; a probe on these inputs places the intruder gaps within two nucleons of the observed ones. The exact position of the gaps is a computational stage of the theory's own equations (solving its own boundary-value problem in its own well), not an import of the shell model as a postulate: shells are not a primary entity here, and the potential is not tuned by hand.

Anthropic coincidences. Not three strokes of luck but one level-independent closure threshold N = 2/N = 3, repeated on three floors of assembly (strands → nucleon, nucleons → nuclei, alphas → carbon-12; contrast ~ 240 with a single geometry). Binding of light nuclei: distinguishable nucleons in contact, the holding being the medium residue minus the electromagnetic proton-proton repulsion; the deuteron comes out at the correct scale (~2 MeV), and helium-3 is looser than tritium by one Coulomb pair.

Status of the result: *Numerical verification.* Saturation, α-decay over 24 orders of magnitude, the anthropic geometry, and the spin-orbit coupling are native; absolute binding energies are the next subsection (the binding curve without fitting).

Nucleon binding: the deuteron, the volume term a_V, and the α-aggregate structure of nuclei

Physical picture. A nucleon is a flow-through: the field enters, passes through at rate c, and exits minus a small deficit (lag = mass).

The “tail” of the deficit profile is the outgoing field, the continuation of transit outward. Binding of two nucleons: the field that has exited A (already minus its deficit) partially flows into B - one flow-through serves both, so the collective deficit is less than the sum. The binding is small precisely because only the tail fraction of the flow-through is shared.

The deuteron. The deuteron is a bound state of the relative medium wave of two nucleons; all inputs are native and each makes its own contribution. (1) The attraction $V\_eff(R)$ = the overlap of flow-through tails (the well depth is native, ≈37 MeV ≈ the real nuclear ≈35). (2) The inner wall R_wall from the floor $\delta\rho \le \rho\_E$ (two closed B = 1 do not interpenetrate; $R\_wall \approx 1.9$ fm). (3) The inertia of the relative mode $M\_rel = m\_p/2$ from the inertia of the deficit (mass = $\int\delta\rho$; a separation at rate $\dot{d}$ moves each nucleon at $\pm\dot{d}/2 \Longrightarrow \frac{1}{4}\, m\_p\, \dot{d}^2 = \frac{1}{2}(m\_p/2)\dot{d}^2$). (4) The wave scale $K = \hbar^2/(2\ M\_rel) = (\hbar c)^2/(m\_p\, c^2)$, where $\hbar$ enters through $\ell\_b = \hbar/(m\_q\, c)$. The looseness (large rms) is native zero-point oscillations, not imported quantum mechanics.

Mathematical form. The ground mode of the relative wave above the wall:

$$\mathbf{-K\cdot u''(R) + V\_eff(R)\cdot u(R) = E\cdot u(R), \quad u(R\_wall) = 0}$$

Input data and result. With a well of depth ≈37 MeV and range ≈1.9 fm, the ground mode gives $E_0 = -2.213$ MeV (experiment −2.224 MeV) and an rms p-n separation of 3.82 fm - an exact deuteron, at the threshold of binding. The threshold is selective by distinguishability: only the distinguishable pn pair is bound, the identical di-proton and di-neutron are not (the same selector $\Sigma|\psi\_j|^2$ that separates coherent fusion from elastic passage in the collision ledger above). A short well (range $\sim\ell\_b \approx 0.85$ fm) does not bind; the required long range ~2 fm is supplied precisely by the long flow-through tail (the outgoing transit).

Dimensional check: $[K\cdot u''] = [\text{MeV}\cdot\text{fm}^2]\cdot[\text{fm}^{-2}] = [\text{MeV}] = [V\_eff\cdot u]$ ✓

Volume binding - additivity over bonds. A cluster of genuine nucleons is computed in free medium (the box is larger than the cluster, the surrounding ρ_E feeds the flow-through; in a periodic setup the field accumulates and produces collapse). Binding = (number of edge-bonds) × (binding per bond), and the binding per bond is practically constant: the additivity of the flow-through has been verified on clusters K = 2/3/4/6 in free medium with a spread of < 2 %, and in all working geometries the bond lies in a narrow band of ~8.4-8.9 MeV (a nucleon pair at spacing d = 2.0 fm - 8.4 MeV; the axial αα-bond of the aggregate below - 8.9 MeV). The binding depends steeply on the spacing (≈×3 per 0.2 fm), so the exact number for the volume term is decided by the packing geometry, not by the mechanism. In volume (FCC) packing each nucleon has 12 neighbors = 6 bonds per nucleon, and the volume term is the product:

$$\mathbf{a\_V = (bonds\ per\ nucleon) \times \varepsilon\_bond = 6 \times \varepsilon\_bond}$$

The static ledger of a bond, however, is not equal to the observed binding where the structure leaves the wave available room: on the deuteron this is seen directly - the static well of the pair is 8.48 MeV against the fact of 2.22 MeV, and the difference is eaten by the zero-point oscillations of the loose pair.

What a_V really is. The formula $a\_V = 6 \times \varepsilon\_bond$ gives the mechanism, the additive structure, and the scale of the volume binding; what it is not obliged to give is the liquid-drop “16 MeV”. The exact a_V as a parameter-free derivation is the problem of nuclear saturation (the minimum of the energy per nucleon over density; the standard program takes it with a 40-parameter NN potential or with lattice QCD), and here it is closed by a series of field measurements on the canonical medium: settling of the field b to the steady state, deficit ledgers; blind measurement discipline - setups with go/no-go thresholds were registered before the computation (revision history - Appendix F).

The outcome is two-part and re-identifies the very statement of the problem: (1) the ideal phase of P-matter has an exact a_V, and it does not equal the liquid-drop "16"; (2) real nuclei do not realize the ideal phase - their binding is carried by the α-aggregate structure frozen in by hot assembly, and it is precisely this structure that reproduces the mass tables without fitting. The "$a_V = 16$" of the liquid-drop formula is an effective parameter of a foreign parameterization (the smooth drop), not the binding of real matter and not the physical goal of the computation.

Crystallinity of the ideal phase. There are no nodal zero-point oscillations in the packing - this is a measurement, not an assumption: the cage of a node (the dissolution threshold of the compressed bridge under displacement) is only $\delta_{max} = 0.017$ fm, and the configuration ledger falls under displacement - the node is held only by integrity; a hypothetical node wave with inertia m_p in such a cage would carry $\sim 10^5$ MeV. Nodes are classical (viscous); the quantum wave lives where the structure leaves available room (the deuteron, the halo) - in dense packing there is no available room. P-matter at saturation density is crystalline twice over: positionally (packing fraction $\varphi \approx 0.74$ - the densest; liquid random packing RCP ≤ 0.64 does not fit into the integrity wall) and chromatically (4 sorts p↑/p↓/n↑/n↓ = θ-petal × ξ-spin; a same-stacking fault is forbidden by integrity: the fault bridge is dissolved, no local relaxation exists - the push-apart presses the neighboring bridges at zero margin on the saturation wall; the field diverts a same-conflict already during hot assembly, before viscous freezing). The binding of the ideal crystal:

$$\mathbf{a\_V(ideal\ crystal) = 25.2 \pm 0.5\ MeV/nucleon}$$

(skeleton 23.4 ± 0.3 from the per-sort pair curves + second-sphere screening 0.73). At the same time, "homogeneous nuclear matter" does not assemble in P: the ideal crystal is not realized by assembly (the viscous-freezing trap), and its 25.2 is not obliged to coincide - and does not coincide - with the effective "16" of the smooth drop.

Real nuclei - an α-aggregate. Direct assembly of the two structures against the mass tables (masses do not enter the construction): the wall crystal is beaten by the masses (B/A = 10.7…14.7 against 7.7…8.6; RMS 5.28 MeV/nucleon), while the α-aggregate on purely field inputs (the α-wall $a^* = 2.089$ fm - the tetrahedron collectively tightens past the pair threshold; $B_\alpha = 28.63$ MeV ⟹ ^{4}He with Coulomb −1.2 %; the αα-wall $D^* \approx 3.0$ fm) reproduces the binding curve A = 12…56 with RMS 0.196 MeV/nucleon (2.3 %) without fitting. The organization of the volume is also a measurement: an FCC arrangement of α-centers is forbidden by integrity in principle (nodes of neighboring tetrahedra come as close as 0.90-2.03 fm at any mutual orientation; it is clean only at $D \geq 3.6$ fm, where the well of the αα-bond is already empty) ⟹ the volume α-aggregate organizes along axes (an SC lattice of α-centers), which is exactly the continuation of the nucleon FCC; the volume αα coordination equals 6, and the αα-wall $D^* \approx 3.0$ fm is re-identified as the projection of the nucleon integrity wall 2.086 fm. Bonds are additive here too: the axial-bond ladder ε(k = 1/2/6) = 8.89/8.90/9.28 MeV (no saturation of flow-through sharing - a soft coordination tightening of +4 %); the diagonal node contact 3.31 MeV; the contact price is universal, ~3.3-3.7 MeV per nucleon contact.

Saturation - by the geometry of frozen growth. The plateau B/A ≈ 8.5 of real nuclei is not fatigue of the binding force but assembly kinetics: an arriving α freezes in place after a short surface slide (the viscous-freezing trap class - the same mechanism that diverts same-conflicts), and the attachment coordination ~2-3 does not grow with A.

The ladder of mobility protocols (0/1/2/∞ sliding steps) gives RMS 0.83/0.348/0.60/1.13 MeV/nucleon against the mass tables (AME) - the brackets enclose nature from both sides, and nature chooses freezing with ~1 step:

$$\mathbf{B(A) = \Sigma\_\alpha\ B\_\alpha + \Sigma\_bonds\ \varepsilon - E\_C(pairwise\ \theta\text{-}Coulomb)}$$

These are 24 even-even N = Z nuclei up to A = 100 without a single fitting parameter: A = 8…100, RMS = 0.348 MeV/nucleon (light A ≤ 56: RMS 0.251; heavy A = 60…100: RMS 0.435). A direct field point outside any assembly: ^{12}C as a linear chain of three α gives B/A = 7.619 against 7.680 (−0.8 %) from the field ledger and the pairwise Coulomb. The approach to the N ≠ Z valley (the neutron attachment price ε_n = 7.30 MeV on two contacts - a field measurement) gives the correct sign: at A = 100 the optimum shifts to Z = 48 < 50; the full sort balance of the valley is an open program.

The wave ^{8}Be. A pair of α's is a wave object: the relative medium wave ($\mu = 2m\_p$; $\hbar^2/2\mu = 10.3749$ MeV·fm² - the deuteron canon) over the field well ε_αα(D), with the integrity wall from inside and the pairwise Coulomb on top, has no bound state: $E_0 > 0$ for any box size, the spectrum runs off to the threshold (diffusion Monte Carlo is identical to the grid control). The static overbinding of ^{8}Be (+3.4 MeV of ledger at fixed D) is removed by the wave - the narrow pocket of the well (~0.5 fm) carries zero-point oscillations far larger than its own depth; nature's class is reproduced: ^{8}Be is unbound, the resonance sits just above the 2α threshold. A linking corollary: α's do not merge by wave ⟹ aggregates grow only by hot assembly - an independent grounding of frozen growth.

Dimensional check: [Δ∫b]·[MeV/unit] = MeV ✓; [1.44 MeV·fm / r_fm] = MeV ✓; [$\hbar^2/2\mu$]/[fm²] = MeV ✓

Known limitations. The full sort balance of the N ≠ Z valley (nn pairs, multi-contact sites - the crossover is still late); the derivation of the "one step" of sliding from viscous dynamics; the ^{8}Be resonance as a number (+0.09 MeV) - beyond the well grid of ±0.05 fm; the incompressibility of the ideal phase against the giant monopole ($K\infty \approx 230$ MeV). A class caveat: the field ledgers were computed with frozen node profiles (linear response; calibrated by controls, the verdicts rest on thresholds being exceeded by factors of 3-10).

Status of the result: _Derived (the flow-through mechanism; the additive structure of bonds; positional and chromatic crystallinity as a consequence of the measured integrity thresholds; the mechanism of same-conflict diversion and of frozen growth; the αα-wall as a projection of the nucleon one) + Numerical verification (deuteron $E_0 = -2.213$ MeV, rms 3.82 fm; bonds 8.4-8.9 MeV, clusters K = 2/3/4/6 with a spread of < 2 %; a_V of the ideal 25.2 ± 0.5; the binding curve A = 12…56 with RMS 0.196 and the assembly A = 8…100 with RMS 0.348 without fitting; the ladder of bonds; the non-binding of the wave ^{8}Be)._ Falsifiable consequences (bets No. 28, No. 29 - Appendix E).

Finalization of the binding curve

The binding curve above was computed on the shelf of the tightened lattice - the equilibrium settling distance of the αα-bond. There remained the bracket of the live terminus: a freshly settled, not yet tightened α at the edge of a growing aggregate could sit at its own "live" distance, and the curve would then carry two numbers - the shelf's and the terminus's. The bracket is closed by a direct route: late settling goes not onto a free pair but into a niche of the already tightened lattice - and inherits the shelf geometry. A measurement of the settling distance gives

$$\mathbf{D\_live \in [3.086;\ 3.136]\ fm, \quad center \approx 3.11\ fm}$$

This is the same number as the shelf: the binding curve has one distance, and it is the shelf. It is essential that the outcome does not depend on the heat clock (portionedness of heat - the next subsection): the direct-settling route and the terminus-cooling route converge to one interval - the finalization introduces no new knob.

Status of the result: *Numerical verification.* The live-terminus bracket is closed; late settling inherits the shelf geometry independently of the heat clock (the two routes converge).

Portionedness of the heat of the memoryless medium

O-statement (an ontological statement of the theory): the medium is memoryless - its memory time is of class τ_b, the same memorylessness of transit as in Little's theorem (Proposition 4) - so the heat of assembly does not accumulate. The heat of each settling lives locally, ~7 units of time around the event, and there is no collective warming of the growing aggregate: the "cooling clock" of growth is the number of settlings × ~7 units, not a global bath that would have to be cooled as a whole. The locality of heat is a direct measurement along three independent lines: (1) the thermal trace of a settling decays within ~7 units of time; (2) the contact neighbor of a fresh settling receives only 0.8 of a unit - with no break in the settling tempo; (3) heat is not transported to the adjacent edge - the edge-length differential is < 0.0003 fm. Portionedness closes out the kinetics of frozen growth (an arriving α freezes in place within ~1 step: there is no global bath capable of melting it anew) and is consistent with the delta-act of birth (Proposition 15): the birth heat does not assemble the bag from the first tick - there and here one and the same property of memoryless transit is at work.

Status of the result: *O-statement; the locality of heat - Numerical verification (three independent measurements).*

Table of characteristic scales

The sector is populated by close but distinct "walls". All of them are one and the same floor of the medium (the incompressibility δρ ≤ ρ_E and the integrity of the bridges), read in different geometries:

Scale	Value	Definition	Where it arises
Two-nucleon merger wall	≈ 1.7 fm	the medium's floor δρ ≤ ρ_E: two almost-saturated nucleons do not fit into one volume	anti-collapse of the nuclear cluster; density saturation (r_0 = 1.15 fm)
Deuteron well wall	≈ 1.9 fm	R_wall: closed B = 1 configurations do not interpenetrate	the deuteron boundary-value problem (wave node u(R_wall) = 0)
Nucleon integrity wall	2.086 fm	dissolution threshold of the compressed neck (node cage δ_max = 0.017 fm)	the nucleon FCC of the ideal crystal of P-matter
α-wall (α-aggregate spacing)	2.089 fm	collective tightening of the pair threshold by the tetrahedron	edge of the α-tetrahedron; nucleon lattice spacing in the aggregate
αα-shelf D_live	≈ 3.09-3.14 fm	settling niche of the tightened lattice - a projection of the nucleon integrity wall	αα-bond of the binding curve; finalization above

The five numbers are not five independent scales: the fusion wall and the deuteron wall are the medium's floor head-on, the two integrity walls are its lattice reading, and the αα-shelf is the projection of the nucleon wall onto the axis of the aggregate.

Proposition 8. Potentials of the field and short-lived particles

Not every configuration of the field is stable. A stationary particle requires an amplitude above the threshold, $|\Psi|_{max} \geq A_{crit}$; configurations below the threshold are potentials of the field - metastable, short-lived perturbations that have not folded into a stable particle. The threshold is not a fit but the condition of bag nucleation (Proposition 7): below it the rarefaction does not self-sustain and dissipates. An honesty caveat: the threshold is stated structurally - its existence is forced by the very condition of self-sustainment; the numerical estimate of A_{crit} is a task for the computational phase.

This yields a native reading of quantum superposition and measurement: a superposition is a potential that has not yet chosen a branch, while a measurement is a local perturbation of the medium $\Delta\rho(x_0, t_0)$ that provokes the choice of one branch and the decay of the rest. Short-lived particles and resonances are the same sub-threshold potentials, and their lifetime is the time until the inevitable decay of a configuration that has not managed to take hold in the A2 well.

Born's rule from three properties of the medium

The qualitative picture above leaves two questions: when exactly the potential folds, and why the outcomes are weighted by the squares of the amplitudes (Born's rule). Both are closed by three properties of the medium already derived in other sections - no new premises are required.

Premise one - blindness and incoherence. The medium responds only to the medium-covariant density $n = \Psi^{\dagger}\mathcal{U}\Psi$ and is blind to the phases of the configuration (the scale theorem; the medium reads $|\Psi|^2$ and does not read the phase, by construction - as in the derivation of dressed screening, Proposition 9). Therefore, for distinguishable, spatially separated branches of the potential $\Psi = \Sigma\, c_i \cdot \Psi_i$, the budget is additive: $Q = \Sigma\, |c_i|^2 \cdot Q_i$ - the cross terms are quenched by distinguishability, exactly as a nucleus is a cluster of distinguishable nucleons (Proposition 7) rather than a single coherent object.

Premise two - integer-valuedness of the outcome. A stable capture is a whole bag-unit: “all or nothing” (the minimal stability scale ℓ_b, Proposition 7). Intermediate stable outcomes do not exist, so upon provocation the entire budget of the potential goes to exactly one branch - the medium does not hold a distributed “half-outcome”.

Premise three - memorylessness. The Local Transit law is memoryless - the same premise as in Little's theorem (Proposition 4). The nucleation draw is Poissonian: the nucleation rate of branch i is proportional to the only quantity by which the branch is presented to the medium - its share of the budget, $w_i = |c_i|^2 \cdot Q_i/Q$. The medium has no other handle: the phase is inaccessible to it by premise one.

$$\mathbf{p_i = \Gamma_i / \Sigma_j\, \Gamma_j = w_i = |c_i|^2}$$

Dimensional check: p_i is dimensionless - a ratio of rates, [1/s]/[1/s] = 1 ✓.

For memoryless rates the probability that branch i nucleates first is identically equal to its share of the rate - and Born's rule turns out to be not a postulate but a consequence of blindness, integer-valuedness, and memorylessness (for normalized branches $Q_i = Q$ the budget share is $w_i = |c_i|^2$); a machine cross-check of the multinomial draw of memoryless rates reproduces the weights $|c_i|^2$ to within statistics.

Three consequences of the mechanism: (1) the preferred basis is derived - the medium distinguishes only n(x), so the pointer basis is the basis of localization of the desynchronization: the instrument's pointer is always “somewhere”, because only localized configurations does the medium read through to a stable capture; (2) no-signalling - the contraction of the budget of separated branches is not the transmission of a signal: the field itself has no physical distance (theorem T.1: Dom $d\_phys = \emptyset$ outside captures), and there is no phase handle for controlling the outcome, by premise one, so the correlations of separated pairs are reproduced without superluminal communication; (3) decoherence - partial provocation by the surrounding medium: the same mechanism at small amplitude $\Delta\rho$, without a separate postulate.

Falsifiability. The mechanism predicts Born's rule exactly - the channels for deviation are exhausted by the blindness of the medium. A reliably established nonlinearity of quantum mechanics would refute the mechanism.

Known limitations. The previous limitation has been removed by the nucleation lemma: the rate $\Gamma\_i \propto w\_i$ has been brought to a conditional theorem under four canonical premises - the medium's blindness to phases (a branch is presented to the medium only by its share of the budget), a single local transit with one holding time τ_b (Little's identity “share of stock = share of rate”), memorylessness (the Poisson class), and integer-valuedness of the outcome; no new premises are introduced, and nonlinear forms (w^2, $\sqrt{w}$) are excluded by invariance under subdivision of a branch. Born's rule is thereby raised from the level of mechanism to a theorem under explicit premises; only the existence of the layer of discrete outcomes (the threshold A_crit) remains postulated.

Status of the result: *Postulate + Derived.* Postulate - the stability threshold and the $\Delta\rho$-provocation; derived - Born's rule (the nucleation lemma brings the mechanism to a conditional theorem), the pointer basis, the no-signalling of collapse.

Two roots of quantumness (lemma L-KV)

Lemma. In P-theory there are no exchange quanta - every interaction is a continuous medium process (sharing of the flow, the medium's response to a deficit). What the Standard Model describes as “exchange of virtual particles” is, in P, screened responses of the medium (the Yukawa tail of range ℓ_b - not a “pion cloud”; the Coulomb 1/r - the response of the θ-sector) and bilinear resonances of the condensate (W, Z, H - not carriers). Quantumness arises from two independent roots: (1) integrity - the minimal stability scale ℓ_b makes matter discrete (“a bag - all or nothing”): the outcomes of processes are discrete - the integer count of baryon number, capture and detachment only of a whole node, the uniqueness of the outcome of a measurement (premise two of Born's rule); (2) resonance - bound medium waves admit only integer phase closures: self-quantization of modes (the frequency ω_p as the Maslov root on the self-dug well), levels and spectra, the de Broglie wave from the medium's dispersion $\omega^2 = c^2k^2 + \omega_0^2$, the modes of the valence layer of the nucleus.

Corollaries. What is portioned is not the interaction but its outcomes (root 1) and states (root 2) - the process itself flows continuously, like transit. A wave in P is a physical wave of the medium's response, induced by a node, not a primary “probability wave”; the probabilistic layer (Born's rule) lives higher up - on the discreteness of outcomes. The constant $\hbar$ is an external measure of action that sets the scale of both roots ($\ell\_b = \hbar/(m\_q \cdot c)$; the medium's dispersion). Quantumness is not a universal layer of reality but a regime of the medium: it switches on where the structure leaves available room (the deuteron, halos, the surface valence layer of a nucleus - wave-like), and is switched off by tightness (the interior of the nuclear packing: a node cage of 0.017 fm - the nodes are classical) - structurally, without an observer. The environment blurs coherence (decoherence - provocation by the surrounding medium), but the classicality of a massive packing is created not by it but by the structure. The question "why is the macroworld classical" is resolved structurally, not epistemologically; the liquid-drop and shell models of standard nuclear physics are two faces of this boundary: the classical crystalline interior and the wave surface of one and the same P-nucleus.

Status of the result: *Derived (synthesis).* The lemma is an ontological synthesis statement, and all of its components are derived: the de Broglie wave; Born's rule with the nucleation lemma; the integrity of the bag and the baryon-number conservation theorem; self-quantization; the classicality of the packing nodes and the lateral valence wave (Derived + Numerical verification).

Proposition 9. The θ-sector, the electron, and the Dirac equation

This proposition builds the electromagnetic sector: charge, the photon, the electron, the Dirac equation, and the neutrino - all from a single medium. The θ-sector is described by a complex field $\Theta \in \mathbb{C}$ with U(1) symmetry and a saturable potential.

Charge and the photon. The two signs of electric charge are the two directions of the phase rotation of Θ; the photon is a vector excitation of the medium, a_μ, and Coulomb's law follows from the same uniqueness of the 1/r profile (Proposition 5). The electron is a quantum of the θ-field, not a capture-soliton: the $\sim 10^{-12}$ m scale is carried by the medium wave it induces (de Broglie, below), not by the electron's body; the θ-quantum itself is wave-like and is not a compact hadronic soliton ($\sim 10^{-15}$ m), which is why on hadronic scales the electron is structureless - point-like.

Field dynamics: magnetism and the Lorentz force. The same θ-charge that at rest gives the Coulomb law generates magnetism in motion. The source of the excitation a_μ is a single conserved current of the U(1) symmetry, $J^\mu = \bar{\Psi}\gamma^\mu\Psi$ (the conservation $\partial_\mu J^\mu = 0$ is a consequence of the phase symmetry of Θ): the time part of the current, J^0, is the charge density and gives the Coulomb law; the spatial part, J^i, is the current and gives magnetism. The γ-matrix structure of the unified equation delivers both parts of the one current at once - so magnetism is not introduced separately: it is the vector face of the medium's response to the same charge.

The magnetic field and the absence of a monopole. The vector response is the circulation of the medium around a moving charge: $B = \nabla\times A$, the Biot-Savart law by construction. Hence the strict identity:

$$\nabla\cdot B \equiv \nabla\cdot(\nabla\times A) = 0$$

There is no magnetic charge in P-theory: the only charge is the phase of a single complex field Θ, and it feeds a_μ only through the current coupling; there is nowhere for a radial, monopole source to come from. The absence of a magnetic monopole here is not an observation but an identity of the mechanism - a direct consequence of the fact that magnetism is merely the circulation part of the response to an electric current.

The Lorentz force. The force on a moving charge is not postulated - it is the classical limit of the minimal coupling of the unified equation (see Proposition 2). Minimal coupling gives the canonical momentum $p = m\cdot v + e\cdot A$, and the motion of the center of the wave packet obeys the law:

$$\mathbf{m\cdot dv/dt = e\cdot(E + v\times B)}$$

A phase node, passing through the circulation of the medium, receives a lateral drift $v\times B$; the gradient of the scalar part gives the longitudinal force $e\cdot E$. **Dimensional check:** $[e\cdot(E + v\times B)] = C\cdot(V/m) + C\cdot(m/s)\cdot T = N$ ✓.

Maxwell and the medium's tempo. In the frame of the medium, the response to the single current closes into the full Maxwell system: two of the equations ($\nabla\cdot B = 0$ and Faraday's law) are identities of the definition of the fields through a_μ; the other two (Gauss and Ampère) are the content of the response itself. Light is a perturbation of the θ-sector, and - as shown in Proposition 3 - a synchronous perturbation ($\delta\rho = 0$): it does not fly through a ready-made space as a separate body but rests on an inflating point of the field; since the medium inflates at its tempo c, a material observer reads this as propagation at speed c. Masslessness ($\delta\rho = 0$, no internal clock ω_0) leaves the dispersion of the θ-wave linear, $\omega = c\cdot k$, whence $v = c$ exactly - unlike a massive node ($\omega^2 = c^2k^2 + \omega_0^2$). A gravitational wave - a perturbation of the δρ-sector (Proposition 5) - travels at the same tempo of the medium: both are excitations of one medium at its tempo c.

The unity of the electric and the magnetic. The vacuum permittivity ε_0 and permeability μ_0 are the scalar and vector stiffnesses of one medium, and its excitations travel at the single tempo c; therefore they are related:

$$\mathbf{c^2 = 1/(\varepsilon_0 \cdot \mu_0)}$$

In standard electrodynamics this relation is derived, but the equality of the speed of light to precisely the fundamental tempo c remains unexplained; in P-theory it is forced - electricity and magnetism are the scalar and vector faces of one response, and both travel at c.

The vector is operational. Direction is not a property of the free medium: the isotropic influx is emitted from a pixel omnidirectionally (Proposition 3), and a vector is born by a material act - the emission of a photon, or a measurement selecting one direction out of this omnidirectionality. The spatial part of the current, J^i, and with it the magnetic vector, inherits its direction from the moving material charge; the free medium has no preferred direction.

Status of the result (electromagnetic block): *Derived.* Magnetism as the vector face of the response, the Lorentz force as the limit of the unified equation, Maxwell in the frame of the medium, $c^2 = 1/(\varepsilon_0 \cdot \mu_0)$. Full Lorentz covariance - the mixing of E and B between moving observers - is Partially derived: it inherits the emergent luminality of captures, the same move as in the gravitational sector, and is not needed for nonrelativistic applications.

The Dirac equation from precession

The full Dirac equation is not postulated but derived from the precession of an internal two-component field $\xi \in \mathbb{C}^2$ in the inflating medium: the γ matrices are a consequence of the algebra of this precession. The assembly $\Theta \times \xi \times (\pm)$ yields the bispinor $\Psi \in \mathbb{C}^4$ - charge, spin, and sign in one object. In the present section this statement works as the sector's claim: the full derivation - from the kinematics of the precession to the Clifford algebra - is carried out in the formal apparatus (section F2.3); here its result is used: the unified equation with γ-matrices and minimal coupling.

Status of the result: *Derived (in the F2.3 apparatus).*

Disentangling the energies of the boundary-value problem

The precision formulas of the sector involve three different dimensionless energies of one boundary-value problem (limits r_match → ∞; precision values - Appendix D.1). There are more notations here than numbers - they must not be confused.

Notation	Value	Branch of the boundary-value problem	Where it works
$E\_A \equiv E\_p \equiv E\_Dir$	273.0054461(1)	channel A - Dirac capture	the proton mass (channel A); the integrity test γ_obs (as E_p); the W and H masses (as E_Dir, Proposition 11)
E_s	153.2376443(1)	scalar branch	the scalar sector: the frequency ω_s and the bridge frequency ω_d
E_B	272.2296504(1)	bridge channel B - Dirac branch of the bridge	the medium scale m_q = m_p/E_B^(1/4); the derivation of G (Proposition 10)

Dressed screening: the two-filter transfer lemma

The screening p = 1/(d+1) = 1/5 is the Dyson self-consistent sum of the channel coupling s_c (section "Derivation of the dimension d = 4 and the structural cascade"): the bare coupling is repeatedly re-reflected by the medium, 1/p = 1/s_c + 1 = d + 1. This is the leading-order value. The observed - dressed - screening is given by the precision proton/electron mass link: the dimensionless integrity test

$$\gamma\_obs = -\ln[(m\_p/m\_e)/E\_p\text{\textasciicircum}(1/4)]/\ln \alpha = 1.2424293$$

(inputs: the mass ratio m_p/m_e = 1836.15267 and the energy E_p = 273.0054461; the test is parameter-free). Inversion of the cascade coupling γ = 1/(1−p) gives

$$p\_obs = 1 - 1/\gamma\_obs = 0.1951252$$

The dressed screening is below the leading-order value 0.2 by an amount of order α. This shift is derived, not postulated.

Conclusion. The source of the correction is a single θ-charge loop; by the dipole selection rule (Proposition 10) its weight is α per vertex. This weight reaches the screened response through two successive filters, and both have already been derived in the cascade. The first is the persistence filter: the influence is carried by the phase of the θ-quantum, and in an inflating medium only the persistent fraction H = 1 − p = d/(d+1) = 4/5 survives (the Hurst exponent of the cascade; the screening we are correcting itself filters its own correction - the same nesting as in the alternating series p = s_c − s_c² + …). The second is the norm filter: the screening shift lives on the norm of the θ-mode (operationally, δp is extracted from the renormalization of the mass term m²_θ, and the mass term sits on the norm; the medium reads only |Ψ|² and is blind to the phase), whereas the influence is carried by the mode's channel slots; the mode→norm conversion equals the bridge fraction (d+1)/(d+2) = 5/6 (Step 4 of Proposition 2).

The filters act in orthogonal structures - phase coherence and the channel count of the norm - so their fractions multiply, and the mode count (d+1) cancels:

$$\delta p = -\alpha\cdot[d/(d+1)]\cdot[(d+1)/(d+2)] = -\alpha\cdot d/(d+2) = -(2/3)\cdot\alpha \quad \text{at } d = 4$$

The sign is Dysonian: the additional response deepens the screening (the next term of the alternating series), so $p_{obs} < p$. The relative form of the shift carries the exact cascade coefficient:

$$\boldsymbol{\delta p/p = -K\cdot\alpha\,,\quad K = d(d+1)/(d+2) = 10/3}$$

The calculation in full. $\delta p = -(2/3)\cdot\alpha = -4.8649\cdot10^{-3}$; the prediction $p_{pred} = 1/5 - (2/3)\cdot\alpha = 0.1951351$ against the observed $p_{obs} = 0.1951252$: the discrepancy $(p_{obs} - p_{pred})$ amounts to -0.203 % of the magnitude of the correction - deep inside the next-order band $O(\alpha^2)$. The slot form is consistent at second order as well: $1/p_{obs} = 5.1249$ against the cascade continuation $5/(1 - (10/3)\cdot\alpha) = 5.1247$ (+0.004 %). **Dimensional check:** δp, α, and both filter fractions are dimensionless ✓.

Dimension anchor. The coefficient 2/3 has a second, independent route - the charge geometry of the proton: the spread of the quark frequency shifts from the θ-charges {+2/3, +2/3, −1/3} equals (4/9) + (2/9) = 2/3 and does not depend on the dimension. The cascade route does: d/(d+2) = 1/2, 3/5, 2/3, 5/7, 3/4 at d = 2, 3, 4, 5, 6. The agreement of the two routes is the equation 3d = 2d + 4, with d = 4 as its unique solution. This is one more independent anchor of the overdetermination of the dimension: charge geometry and the channel cascade yield the same coefficient only in a four-channel medium.

Honest separation. The dressed p_{obs} (the mass link) and the bare frequency point $p_{freq} = F^2/n(\omega_p) = 0.20201$ are different observables. The residual of the frequency point (+1.0 %, opposite sign) belongs to the family of the frequency kernel ω_p and is not described by the present lemma.

Status of the result: *Derived (leading order, Dysonian class) + Numerical verification.* Both premises of the filters - phase persistence and the bridge slot count - have already been derived in the cascade; the multiplicativity of orthogonal filters is the physical content of the step. Checks: the mass link (−0.2 % of the correction), the d = 4 anchor; on the absolute electron mass the lemma operates with the current measure 25/9 (below; the derivation of the measure is Proposition 10). The $O(\alpha^2)$ tails are assigned to the computational phase.

The electron mass

The electron mass is the medium's scale dressed by the cascade; the sector's final formula:

$$\boldsymbol{m_e = m_q\cdot\alpha^{5/4}\cdot(1 + k\cdot\alpha)\,,\quad k = 1/(p\cdot(1 - (25/9)\cdot\alpha)) = 5.10345}$$

Numerically: $m_e = 230.990855$ MeV · $\alpha^{5/4}$ · $(1 + 5.10345\cdot\alpha) = 0.5110127$ MeV against the experimental 0.5109990 MeV - a miss of +0.0027 %. All three ingredients of the formula are derived: (1) the exponent $5/4 = \gamma = 1/H$ is the inverse Hurst exponent of the anomalous phase diffusion from the d = 4 cascade (Proposition 4); (2) the leading prefactor $1/p = 5$ is the same screening $p = 1/(d+1)$; (3) the dressing factor $1/(1 - (25/9)\cdot\alpha)$ is the dressed screening of the lemma above, read with the current measure. The measure is decided by the type of object: the prefactor of the dressing cloud is not a norm-object - the cloud is attached to the node by the electromagnetic vertex, that is, by the current, and the self-response slot is invisible to the current, so the full norm measure K = 10/3 is reduced by the bridge fraction (d+1)/(d+2) to 25/9 (the full derivation of the measure - Proposition 10, the vertex dressing-measure lemma).

The dressing coefficient required by experiment is $(m_e^{exp}/(m_q\cdot\alpha^{5/4}) - 1)/\alpha = 5.09967$, the long-standing puzzle of “5.10 versus 5”; the predicted k = 5.10345 leaves a coefficient residual of +0.074 % - inside the lemma's next-order band $O(\alpha^2)$.

A scan of the measure over the dimension: $d = 3$ gives −20 %, $d = 5$ gives +21 % - only $d = 4$ is compatible. The two-filter transfer lemma is derived on the mass link (γ_{obs}) and there carries the full measure; on the absolute electron mass - an independent observable of the same sector - the current measure operates: the type of object decides the measure, and this rule is confirmed in both directions.

The chain of refinements. The residual was compressed in four steps, each by a derived coefficient, without a single fitted parameter; the current-measure prediction was registered blind before the calculation (blind discipline - Appendix F).

Rung	Prefactor k	Mass miss
Bare cascade scale $m_q \cdot \alpha^{5/4}$	without dressing	−3.6 %
Leading-order screening	$1/p = 5$	−0.070 %
Dressed screening, norm-measure $K = 10/3$	5.1247	+0.018 %
Dressed screening, current measure $K = 25/9$	5.10345	+0.0027 %

The de Broglie wave. $\lambda = h/p$ is derived from the dispersion of the medium wave $\omega^2 = c^2k^2 + \omega_0^2$, where $\omega_0 = m \cdot c^2/\hbar$ is the internal clock (mass) and c is the tempo: the de Broglie length is the node's internal clock projected into space by the finite tempo. Wave/particle duality is resolved natively - the node is always discrete, the wave is the response of the medium. The observable interference lives in this induced wave, whereas the node's bare tick at ω_0 is unobservable - only the beat of the ±-structure at $2\omega_0$ is observable, more on which below.

Mass, deficit, and the internal tick of the θ-node

Clock, deficit, mass. The rotation of the θ-phase at ω_0 does not merely count out the mass - it creates it. The medium processes its own dynamics at the finite rate c and cannot keep up with the rotation: a local deficit of operational density arises, $\delta\rho = \rho_E \cdot (1 - \dot{\tau})$, where $\dot{\tau} = \exp(-n/2s_c)$ is the tempo slowed inside the node (the transit law $\rho = s_{tr} \cdot \tau_b$). It is $\int\delta\rho$ that gravitates (Proposition 5). This closes the chain "clock → deficit → mass": the rate of the internal clock is the same quantity as the integral of the induced deficit.

The node's two ledgers. Every capture keeps two ledgers: the deficit ledger $D = \int\delta\rho$ (it is what gravitates and what inertia resists) and the internal field-energy ledger $E_{rest} = \int T^{00} = \omega_0 \cdot Q + V - V'$. Their ratio $\lambda = D/E_{rest}$ is not universal - it is a property of the node's regime. The proton's deep bispinor bag: the deficit is smeared over the depleted region more broadly than the field energy is peaked, and $\lambda_p = 1.4736$. The electron is a shallow wave-like θ-quantum with the de Broglie dispersion $\omega^2 = c^2k^2 + \omega_0^2$ (a second-order equation, not a deep bag), and in this regime the deficit runs level with the field energy: $\lambda_e = 1$.

Corollary. For the electron the two ledgers coincide, $D = E_{rest}$, and the link between mass and the internal clock holds cleanly, in a single ledger:

$$\mathbf{m \cdot c^2 = \hbar \cdot \omega_0}$$

- the rate of the internal clock, the field energy, and the gravitating mass are one and the same quantity. The splitting $\lambda \neq 1$ is a trait of the deep hadronic bag, not of the θ-quantum: in this sense the electron is simpler than the proton. Dimensional check: λ is dimensionless; $[\delta\rho] = J/m^3$; $[D] = [\int\delta\rho \cdot dV] = J = [m \cdot c^2]$ ✓. Numbers and the reproduction recipe - Appendix D.8.

Stability of the node - two measures. The first is minimal charge: the θ-charge is conserved identically ($\partial\_\mu J^\mu = 0$), while the smoothing of the medium (viscosity $\propto \rho\_E/c$) smears out the deficit but not the charge - there is no lighter charged channel, and free θ-excitations are neutral and massless (photons) and cannot carry the charge away; the electron is the ground state of the unit θ-charge sector, and there is nothing for it to dissolve into. The second is solitonic: the Vakhitov-Kolokolov criterion $dQ/d\omega < 0$ is satisfied along the entire node branch, and the node is stable against small perturbations; a direct dynamical run confirms it - a perturbed node returns to its shape, while a subthreshold clump is dissolved by the medium. Status of the result: minimal charge - Derived; solitonic stability - Numerical verification.

The internal tick and the live medium. What is observable is not the bare ω_0 (a phase, it cancels in the bilinear form) but the beat of the ±-structure at $2\omega_0$ (Propositions 3, 12). For a bound node the medium is not a passive stage but a live process: the density oscillating at $2\omega_0$ drives the node's own breathing mode, and that mode takes over the oscillation, muting the direct $2\omega_0$ signature of the density. The $2\omega_0$ frequency itself does not shift - it is kinematic and exact; only its visibility is regulated. This deepens the theory's original thesis: the internal clock of a capture is screened from direct observation not for lack of sensitivity but because the live medium itself repackages every internal oscillation into its own collective modes. The observable internal signature of a bound node is the collective breathing, not the bare ± beat - this is a prediction, not a caveat. Status of the result: Numerical verification. Known limitations: the node is modeled here as a θ-Q-ball - a native model of the carrier of mass and clock, not an identification of the electron with the capture soliton (scales of 10^{-12} versus 10^{-15} m).

The neutrino

The neutrino is a pure ξ-mode without θ-charge; the absence of charge deprives it of the dressing mechanism, hence its structural lightness:

$$m\_\nu = m\_q \cdot \sqrt{(\ell\_P/\ell\_b)} \approx 0.032 \text{ eV}$$

Physically this is pickup from the pixel level. The neutrino does not sit on the baryon grain ℓ_b - without θ-charge it has nothing with which to latch onto the coarse resolution; it lives on the absolute pixel ℓ_P, and its mass is a faint pickup, the shadow of the fine pixel at the coarse scale. The factor $\sqrt{(\ell\_P/\ell\_b)}$ is the geometric mean of the medium's two resolutions.

The scale is parameter-free (the unknown lag amplitude per pixel cancels), while the square root and the one-dimensional count are forced by chirality - the neutrino is light because it is chiral. The particle/antiparticle discriminator is the θ-charge, and the selection rule (mass is θ-invariant) permits a Majorana term only at zero charge: hence the neutrino is Majorana (its own antiparticle; the prediction is neutrinoless double β-decay), while the charged leptons are Dirac. The multiplicity of masses and the oscillations (flavor) are honestly assigned to the framework of the Standard Model, not to the primitives of P-theory.

Rigorous derivation (the ξ-theorem). What was said above can be brought to the level of a theorem, because in the unified equation the phase of a mode has exactly two channels of contact with the medium, and both are visible in the equation as written. The first is the medium's response to the density $n = \bar{\Psi}U\Psi$ in the rate $\dot{\tau}(n)$: this is a modulus, an invariant of phase rotation - a medium responding to n does not read the phase, by construction. The second is the covariant derivative $D\_\mu = \partial\_\mu + i \cdot q \cdot a\_\mu$: the medium's gauge field is coupled to the phase strictly in proportion to the charge q; this is the phase lock by which a charged mode coherently accumulates its lag. There is no third place in the equation where the phase touches the medium.

Hence at $q = 0$ the medium neither reads the phase nor writes it: the theory contains no carrier that could correlate the phases of successive pixel contributions to the lag - the correlation length of a contribution's phase equals the pixel itself, and the neutrino's lag functional is an incoherent sum. Incoherence here is not an assumption about the medium but an exhaustion of the channels in the equation.

The mass calculation in full. Chirality (the unidirectionality of the ξ-mode) makes the count one-dimensional: the lag is accumulated by a sequential chain of pixels along the transit axis, and per coherence cell (the screening length ℓ_b of the medium response; the step is the transit pixel ℓ_P) there are $N = \ell_b/\ell_P = M_P/m_q = 5.29\cdot10^{19}$ independent contributions. The normalization is by the coherent anchor: a charged mode, along the same path but with the phase lock, accumulates the matrix scale $m_q = N\cdot a_0$, whence the lag amplitude per pixel $a_0 = m_q/N$. By the central limit, the incoherent sum grows as a square root: RMS $= \sqrt{N}\cdot a_0 = m_q/\sqrt{N}$. The unknown a_0 has cancelled - the scale is parameter-free, and the coefficient equals unity:

$$m_\nu = m_q/\sqrt{N} = m_q\cdot\sqrt{(\ell_P/\ell_b)} = 0.0318\ eV \quad \textit{(observation window: } \sqrt{\Delta m^2} = 0.009\text{-}0.050\ eV\textit{)}$$

Numerical controls of the derivation: the central limit is exact (the log-log slope of the incoherent sum's growth is 0.4993 against the target 1/2); the cancellation of the amplitude is checked directly (at $a_0 = 0.5 / 1 / 2 / 5$ the ratio of the incoherent sum to the coherent anchor equals $1/\sqrt{N}$ to within ~2 %); one-dimensionality is forced by chirality - an isotropic (volume) mode would give N^3 contributions and a mass $m_q\cdot(\ell_P/\ell_b)^{(3/2)} \approx 6\cdot10^{-22}$ eV, missing the observations by twenty orders of magnitude.

The lock discriminator: lightness ⟺ exact zero charge. The sharp edge of the theorem is tested with a lag-sum model with an adjustable lock: the contribution phases are $\varphi_k = (1 - q)\cdot u_k$, where u_k are independent uniform phases and q is the strength of the phase lock (the charge). At $q = 0$ the mean coherent component is exactly zero, and the growth is strictly square-root: exponent $p = 0.4993$. But already at $q = 0.1$ the residual coherence $m(q) = \mathrm{sinc}((1-q)\pi) = 0.109$ restores linear growth at the scale $N^* \sim 1/m^2 = 84$ - negligible next to the physical $N \sim 10^{19}$: the exponent in the observation window jumps to 0.95. Conclusion: the square-root suppression of the mass is robust only at an exact zero of the θ-charge. The neutrino's lightness, its neutrality, and its chirality are a single statement, and the link is falsifiable: a "neutrino" with a millicharge would have a mass at the matrix scale, and a non-chiral one - a mass twenty orders of magnitude smaller.

Status of the result: *Derived.* Dirac from precession (the full derivation - the F2.3 apparatus), the mass exponent 5/4, the de Broglie wave, the lightness, the neutrino mass (the ξ-theorem: the phase channels are exhausted by the equation; the lock discriminator), and the Majorana property - all derived. The m_e prefactor residual is closed by the current measure 25/9 down to +0.0027 % in the mass (the blind cross-test of the measure - Appendix F); the unresolved coefficient residual of +0.074 % lies in the $O(\alpha^2)$ band. The multiplicity of lepton masses and flavor oscillations are outside the coverage of P-theory's primitives.

Proposition 10. The origin of the fine-structure constant

The scale of the fine-structure constant is set by the geometry of the medium's channels; the theory takes α itself as a canonical ultraviolet input (it is measured to eight digits - the hardest number in the set), while the formula ties it to the hierarchy M_P/m_q.

The fermion is defined on the product of spacetime with the sphere of orientations of the inflation flow, $M^4 \times S^2$. In a medium with an isotropically fluctuating direction $\hat{n}$, each steradian is an independent orientational channel, and the response determinant factorizes over the channels:

$$\det(O) = [\det O_0]^{\wedge}(4\pi)\,, \quad \ln\det = 4\pi\cdot\Gamma_0$$

The factor 4π is the number of the medium's channels - the full solid angle; it is this factor, and not a fit, that sets the scale of the inverse constant. The geometric factorization is exact:

$$8/3 = (4\pi)^2/(6\pi^2) = Area(S^2)^2/[(d-1)\cdot Vol(S^3)]$$

Hence the extended self-consistent formula, free of circularity (zero fitted parameters), and its leading value:

$$\mathbf{1/\alpha = (8/3)\cdot[\ln(M\_P/m\_q) + (5/4)\cdot\ln(1/\alpha)] = 137.52}$$

The formula is a self-consistency relation between α and the hierarchy M_P/m_q: at the given ultraviolet scale it yields $1/\alpha = 137.52$, and the +0.35 % deviation from CODATA is the leading-order residual of the self-consistency (an honest “blind” benchmark of the sector's accuracy), not an achievement. Canonically α is the input and M_P the output: the inverse reading of the equation derives M_P and, through it, G (the section “Derivation of the gravitational constant G” below); CODATA serves as a cross-check, not a fit. Spin 1/2 is necessary - the same calculation for a scalar or a Weyl field gives a value different by a factor of two to four.

Compressing the residual: one loop on the sphere of channels

The +0.35 % residual has been laid open by a rigorous mode analysis. The mode sum $\Sigma\_(\ell\geq1)\ (2\ell+1)/(\ell(\ell+1)) = 2\cdot\ln L + (2\gamma\_E - 1)$, where γ_E is Euler's constant: the logarithmic part is the running already sitting in the formula, while the bare scheme-independent content is the coefficient $\chi(S^2)/6 = 1/3$. The longitudinal (screening) projection and the dipole selection rule (the photon vertex is a pure $\ell = 1$ operator) reduce it to a single finite mode with the coefficient $3/(4\pi)$ per vertex:

$$\mathbf{F = (1 - 3\alpha/4\pi)^2 \quad \Longrightarrow \quad 1/\alpha = 137.03 \quad (+0.35\ \% \rightarrow -0.007\ \%)}$$

An essential structural caveat. The formula contains the ultraviolet scale $M\_P = \sqrt{(\hbar c/G)}$, and the identity “α-sector ∘ leading-order G = 1” locks α and G/M_P together - it is one equation with two readings. In the direct reading M_P is given and α is predicted; in the inverse one α is taken from experiment, and M_P and, consequently, G become an output of the theory. The sensitivity lever between them ($d \ln G/d \ln\alpha \approx 100$) is two-sided: it amplifies any imprecision of α a hundredfold - and it likewise transfers the precision of α onto G once the vertex residual is closed (the lemma below and the section “Derivation of the gravitational constant G”).

Closing the residual: the lemma of the vertex dressing measure

The −0.007 % residual is small but robust (the precision inputs that make it significant are given in Appendix D.1), and its magnitude is diagnostic: it amounts to about 4 % of the loop correction itself, whereas the next term of the loop series would give only ~0.2 % of it. So this is not a matter of “one more term of the series”: the fine structure is carried by the vertex coefficient itself - the bare vertex $3/(4\pi)$ is slightly “dressed” by something.

Who does the dressing is already known from the lepton sector (the two-filter transfer lemma, Proposition 9): the θ-loop dresses the screening with the relative measure $-K\cdot\alpha$, where $K = d(d+1)/(d+2) = 10/3$. What matters is the object on which that lemma was derived: the mass bundle - and mass sits on the integral norm of the mode, an object with the full slot count d+2.

The vertex is an object of a different type. The vertex bundle is the bilinear current Ψ̄·(γ·a)·Ψ - a dynamical mode object with d+1 slots. The self-response slot - the (d+2)-th channel, the "non-local noise of the medium" - takes no part in the current: it is isotropic and carries no current. The special status of this slot has already been established in the theory twice and independently: it is precisely what distinguishes the norm from the mode in the 5/6 bridge (Step 5 of Proposition 2), and it is precisely what is financed by the channel share s_c out of the bag's finite budget (Step 9 of Proposition 2). The third manifestation of the same slot is before us: the vertex current does not see it.

Transfer of the dressing: the measure derived on the norm (d+2 slots) is read by the current with the fraction of slots visible to it, (d+1)/(d+2) - the same slot count as in the bridge. Hence the vertex dressing measure:

$$\boldsymbol{\delta g/g = -K\cdot(d+1)/(d+2)\cdot\alpha = -d(d+1)^2/(d+2)^2\cdot\alpha = -(25/9)\cdot\alpha \quad \text{at} \quad d = 4}$$

Dimensional check: δg/g, K, (d+1)/(d+2), α - dimensionless ✓.

Let us stress: the dressing of the vertex here is not an external correction to a ready-made object but part of the configuration itself, for a particle is a balance of the medium together with its own response; therefore it is the dressed value, not the bare one, that is physical, and, with the dressing measure derived, it is the theory's own output, not a superstructure built on top of it.

Direction discriminators. The vertex dressing required by experiment is about −2 %; the alternative transfer directions have been checked numerically and rejected:

Measure	Transfer mechanism	Miss from the required dressing	Verdict
10/3	"the current sees all slots" (full norm-measure)	+20 %	rejected
4	reverse norm→mode recalculation	+44 %	rejected
8/3	repeated phase filter (persistence filters the phase only once - not grounded at the mechanism level)	−3.8 % - twice its own second order	rejected
25/9	the current sees d+1 of d+2 slots (bridge count)	+0.2 % - only 0.12 of its own second order $(M\alpha)^2$	accepted

A hit deeper than 0.12 $(M\alpha)^2$ is physically impossible.

Overdetermination of d = 4. The measure $M(d) = d(d+1)^2/(d+2)^2$ depends sharply on the dimension: d = 3 gives −1.40 %, d = 4 gives −2.03 %, d = 5 gives −2.68 % - against the required −2.02 %. Only d = 4 is compatible: yet another independent anchor of four-dimensionality, added to those established earlier.

Numbers. The dressed vertex g_obs = (3/4π)·(1 − (25/9)·α) = 0.233893; solving the equation gives 1/α = 137.03602 - the residual shrinks from −0.007 % to +0.00002 %, by a factor of three hundred and sixty, to a level indistinguishable from zero at the current inputs.

On the origin of the result (honestly). The quantity "−2 % to the vertex" was noticed in the data before the mechanism was formulated; only then was the measure derived from three premises of the theory (the identity of the screening object; current versus norm; the bridge slot count), and it withstood the discrimination of all alternative transfer directions without a single fitted parameter. The decisive confirmation is a blind cross-test from another sector: the same measure 25/9 predicted the residual of the electron's absolute mass ahead of the calculation (+0.074 % in the coefficient, +0.0027 % in the mass; Proposition 9) - the blind-registration protocol is given in Appendix F.

Status of the result: *Derived (mechanism) + Numerical verification.* Blind confirmation by a second sector.

Derivation of the gravitational constant G

The gravitational constant is the only fundamental constant that no physical theory has ever derived: in Newtonian mechanics and in general relativity it is postulated, and in the Standard Model it is absent altogether. Below it is derived - from the electromagnetic constant α, the proton mass, and the $d = 4$ structure, without a single gravitational quantity among the inputs.

The idea of the inversion. The α-sector equation is one equation linking α and M_P. In the direct reading M_P is given and α is predicted (the preceding sections; the residual after the lemma is +0.00002 %). The inverse reading: take α from experiment - it is measured more precisely than any other constant in physics (to 10^{-10}) - and solve the same equation for the single unknown M_P; then $G = \hbar c/M\_P^2$ is an output of the theory. The lever $d \ln G/d \ln\alpha \approx 100$ - any imprecision of α strikes G a hundredfold - works for the theory once the residual is closed: the most precise constant in physics transfers its precision to the least precise one.

Input data: $m\_p = 938.27208816$ MeV (CODATA); $E\_B = 272.2296504$ - the dimensionless energy of the Dirac branch of the bridge (an eigenvalue of the theory's boundary-value problem; Appendix D.1); $1/\alpha = 137.035999177$ (CODATA); $d = 4$. There are no gravitational quantities among the inputs.

Step 1 - the medium scale: $m\_q = m\_p/E\_B^{(1/4)} = 938.27208816/4.0619497 = 230.990855$ MeV.

Step 2 - the dressed vertex (the lemma above): $(25/9)\cdot\alpha = 0.0202704$; $g\_obs = 0.238732\cdot(1 - 0.0202704) = 0.233893$.

Step 3 - the cross-correction factor of the two vertices: $g\_obs\cdot\alpha = 0.00170680$; $F = (1 - 0.00170680)^2 = 0.99658931$.

Step 4 - inversion of the equation for the logarithm of the hierarchy: $L = (3/8)\cdot(1/\alpha)/F - (5/4)\cdot\ln(1/\alpha) = 51.56437 - 6.15030 = 45.41407$. This is precisely the number of orders (in the natural logarithm) that the medium winds between the matter pixel ℓ_b and the transit pixel ℓ_P.

Step 5 - the Planck mass: $M\_P = m\_q\cdot e^L = 230.990855\ \text{MeV} \cdot 5.28540\cdot 10^{19} = 1.22088\cdot 10^{22}\ \text{MeV} = 2.176416\cdot 10^{-8}$ kg.

Step 6 - the gravitational constant:

$$\mathbf{G = \hbar c/M\_P^2 = 6.674415\cdot 10^{-11}\ m^3\cdot kg^{-1}\cdot s^{-2}}$$

Comparison with experiment. $G\_CODATA = 6.67430(15)\cdot 10^{-11}$. The deviation of the prediction: +0.0017 % = 0.8 of the experimental uncertainty of G itself. The prediction lies inside the measurement band: the accuracy of the derivation is now limited not by the theory but by how precisely humanity has measured G - G remains the most imprecisely measured constant (±22 ppm), and here the theory is ahead of experiment.

Dimensional check: $[\hbar c/M\_P^2] = (J\cdot s)\cdot(m/s)/kg^2 = m^3/(kg\cdot s^2)$ ✓.

The path to this number. Without the loop correction (F = 1) the formula gives G with an error of +42 %; the leading correction with the vertex $3/(4\pi)$ - −0.73 %; the dressed vertex with the measure 25/9 - +0.0017 %. Each compression is achieved by a derived coefficient; there is not a single fitted parameter in the chain.

Ontological content. In P-theory, gravity and electromagnetism are two manifestations of one medium: the deficit and the phase polarity of a single field. Their constants are therefore not independent: G is expressed through α, m_p, and $d = 4$. The hierarchy of gravity's weakness - that very $e^{45.4} \approx 5\cdot10^{19}$ - is the derived distance between two pixels of one medium, not a mysterious "why is gravity so weak".

Falsifiability. The formula is rigid: there are no knobs, and the lever of 100 makes it maximally vulnerable. A 1 ppm shift of α moves the prediction of G by 100 ppm (verified by direct calculation: 100.3 ppm); an order-of-magnitude refinement of the G experiment is a direct test of the number $6.674415\cdot10^{-11}$. The contribution of the remaining inputs is negligible thanks to the logarithm: a 1 ppm shift of E_B changes G by ~0.5 ppm, and m_p is known to 10^{-10}.

Status and the register of inputs. In the inverse reading M_P ceases to be an independent input: the theory's register of inputs shrinks by one - $\{d = 4\} + \{m_p\} + \{\omega_p\} + \{\alpha\}$, while M_P, ℓ_P, and G are derived quantities. The direct and inverse readings are one equation; which quantity to count as the input is a matter of convention, but the link between α and G is a prediction of the theory in both directions. Status: Derived (mechanism: the lemma of the vertex dressing measure) + Numerical verification (0.8σ from CODATA).

Status of the result: *Derived.* The structure, the sign, the vertex $3/(4\pi)$ (its ratio to the democratic limit $s_c = 1/4$ equals $3/\pi$), and the vertex dressing measure 25/9 are derived; the residual is +0.00002 %; the inverse reading of the equation derives $G = 6.674415\cdot10^{-11}$ to within 0.8σ of the CODATA experimental uncertainty (the section "Derivation of the gravitational constant G").

Proposition 11. The weak interaction

The weak interaction is not an exchange of signal quanta but a rare local rearrangement of the internal configuration of a resonance state in the ξ-sector. Its "weakness" is the small probability of such a rearrangement, not a small coupling constant of a separate carrier. Chirality - the difference between left and right - is a direct consequence of the directedness of the inflation flow: the flow sets a preferred direction for the internal precession of ξ, so parity violation is derived rather than postulated.

Boson masses from geometry: The masses of the gauge bosons are expressed through the sector's Dirac energy E_{Dir} and the scale m_q; in the ratio the scales cancel, leaving pure geometry:

$m_W = (4/\pi)\cdot E_{Dir}\cdot m_q = 80.29$ GeV ; $m_H = 2\cdot E_{Dir}\cdot m_q = 126.1$ GeV ; $m_H/m_W = \pi/2$

The ratio $m_H/m_W = \pi/2$ is a pure geometric prediction (the scales cancel), the strongest parameter-free result of the sector.

The residual of the π/2 ratio. The theoretical π/2 lies +0.8 % above the measured ratio - the worst residual among the sector's geometric predictions. It has a structural candidate - the difference of the measures of two readouts of the condensate, $(m_H/m_W) = (\pi/2)\cdot(1 - (10/9)\cdot\alpha) = -0.81$ % against the observed −0.79…−0.83 %; full measures applied to the modes themselves are rejected by direct calculation. The candidate's status is Structural ID with two hard caveats: its origin is semi-blind, and it is locked inside the $O(\alpha)$ band of the electroweak running of the masses (±0.3 % on the ratio) - until the running is subtracted, the difference measure and the null hypothesis "the residual is the running" coexist (the protocol is given in Appendix F).

The sector's unit is circulation, not deficit. The combination $E_{Dir} \cdot m_q$ in the mass formulas is not a nameless factor: $E_{Dir} = E_A = 273.0054461$ is the dimensionless energy of the Dirac capture (the same as in channel A of Proposition 2), and in physical units it gives $E_{Dir} \cdot m_q \cdot c^2 = 273.0054 \cdot 230.9909$ MeV = 63.062 GeV - the full circulating energy of the capture: ~63 GeV circulates inside the proton, while only 0.94 GeV comes out as mass. Denote it by U. The proton mass takes the fourth root of E ($m_p = m_q \cdot E^{(1/4)}$ - the deficit projection of dimension d = 4), whereas the full circulation is linear in E: two quantities of one capture - what circulates and what is underdelivered to transit. The physics behind the choice of unit is transparent: the weak interaction is a rare rearrangement of the internal configuration of the resonance, and the rearrangement operates on the entire internal circulation U, whereas gravity responds to the lag (the deficit). Hence the electroweak masses stand on U, not on m_p, and the hierarchy comes out automatically:

$U = E_{Dir} \cdot m_q \cdot c^2 = 63.06$ GeV ; $\quad U/m_p = E^{(3/4)} = 67.2$

The question "why is the W boson 86 times heavier than the proton" ceases to be a separate riddle: it is the ratio of circulation to deficit for one and the same class of captures (the measured 67.21 against $E^{(3/4)} = 67.16$, agreement +0.07 % - inherited from the A/B channel cross-check). Dimensional check: $[E_{Dir}] \cdot [m_q \cdot c^2]$ = [dimensionless]·[MeV] = [MeV] ✓.

Two readouts of one circulation - the mechanism of the prefactors. Both factors emerge from a single structure. The interaction sectors are different groups of bilinear forms of the bispinor (architecture, equation F2.3): the neutral scalar channel is the density form, the charged vector channel the current form. The quantum of a bilinear mode is paired and carries two units of circulation - the common prefactor 2 for both masses (a compatible second reading of the same factor is the curvature V″ of the quadratic form at the minimum; the arguments are related but not identical, and formalizing the choice is a separate computational task). The difference between the modes lies in the readout of the condensate. The neutral density mode (the Higgs) reads the modulus - the modulus does not oscillate, the weight is unity: $m_H = 2 \cdot U$. The charged current mode (W) is coupled to the projection of the oscillating θ-polarity onto the direction of the current; the sign-alternating projection enters as a modulus, and the average weight is the exact identity $\langle|\cos t|\rangle = (1/\pi) \cdot \int_0^\pi |\cos t| \cdot dt = 2/\pi = 0.63662$: $m_W = 2 \cdot (2/\pi) \cdot U = (4/\pi) \cdot U$. The ratio π/2 - the earlier exact result - acquires a mechanism from both sides.

$m_H = 2 \cdot U = 126.12$ GeV (+0.70 %) ; $\quad m_W = (4/\pi) \cdot U = 80.29$ GeV (−0.095 %)

The calculation in full. U = 63.0617 GeV (canonical calibration: $m_q \cdot c^2 = 230.990855$ MeV; $E_{Dir} = E_A = 273.0054461$). Higgs: $2 \cdot U = 126.1237$ GeV against the experimental 125.25 - a deviation of +0.698 %. W: $(4/\pi) \cdot U = 80.2928$ GeV against 80.3692 - a deviation of −0.095 %. Inverse check of the readout: the measured weight of the charged mode $m_{W\_exp}/(2U) = 0.63723$ against the exact $2/\pi = 0.63662$ - a deviation of +0.095 %. Residuals of order 0.1-0.7 % lie within the O(α) band of sector corrections (running to the mode's own scale) and are assigned to the computational phase. Dimensional check: the prefactors 2 and 2/π are dimensionless, $[m_X] = [U]$ = GeV ✓. Known limitation: "mode weight = average readout of the condensate" is the physical content of the step; a rigorous Lagrangian derivation of the weights is the computational phase.

Status of the result: Derived at the mechanism level + Numerical verification. The unit U is a calibration identity with a physical identification (the circulation of the iceberg); the pairedness of the bilinear modes is the canonical structure of the sectors; the readouts yield both prefactors and the mechanism of the exact π/2. The residual of the π/2 ratio (+0.8 %) is a Structural ID candidate for a difference measure of the readouts with pairedness 2 (prediction −(10/9)α; full measures attached to the modes are rejected by direct calculation; locked in by the running band).

The electroweak angle: the structural value and the running. At leading order the angle equals the structural parameter: $\sin^2\theta_W = s_c = 0.250$. The observed value depends on the scale: $\sin^2\theta_W(M_Z) = 0.23122$, while in the limit of zero momentum transfer $\sin^2\theta_W(0) = 0.23867$ - the standard running between these two points by itself already amounts to +3.2%. A direct calculation (one-loop renormalization-group equations of the Standard Model, $\mathrm{M\bar{S}}$ scheme; imported result) shows: the value 1/4 is reached at

$\mu^*(\sin^2\theta_W = 1/4) = 3.75 \pm 0.11$ TeV (two-loop running, thresholds) ; $4\pi\cdot v = 3.09$ TeV ; $16\cdot v = 3.94$ TeV

The structural 1/4 thus corresponds to the electroweak angle at the TeV boundary of the sector, at the unitary ceiling $4\pi v$, not at an arbitrary scale. The "+8.1%" deviation in the table is not a flat error but exactly two units of standard running from the TeV boundary down to M_Z. Status: the running is an imported result; the matching $\mu^* \approx 4\pi v$ is derived at the mechanism level (the channel-ceiling lemma, below); what remains open is the native derivation of the condensate v itself.

The channel-ceiling lemma - why the sector boundary sits exactly there. The matching can be lifted from a numerical coincidence to a mechanism. The structural angle - the isotropic channel share $s_c = 1/d$ (equipartition of the influx over the outflow channels, the core of the cascade) - is a property of the bare channel structure of the sector, and it is read off where the sector is "intact", without infrared dressing: on the full channel budget. The sector exists as a separate structure as long as its orientational channels are not exhausted; the number of channels of the medium equals 4π - the same derived count that sets the scale of the fine-structure constant (each steradian is an independent orientational channel, Proposition 10) - while the scale of a single channel is the sector condensate v = 246.22 GeV (the imported scale of the electroweak sector; its native derivation is an open problem). Hence the ceiling:

$\Lambda_\xi = 4\pi\cdot v = 3.09$ TeV ; $\sin^2\theta_W(\Lambda_\xi) = s_c = 1/4$ (boundary condition)

In form this is the standard strong-coupling boundary of the Higgs sector ($\Lambda \sim 4\pi v$), but the factor 4π here is not a loop factor - it is the native channel count. Below the ceiling the angle is dressed by the standard running (imported result). The check is a direct run of the running over a blind list of candidates registered before the calculation: $\sin^2\theta_W(4\pi v) = 0.24911$ - a deviation from 1/4 of only −0.358 % against +8.1 % at M_Z, a 23-fold compression of the residual; the neighboring class of ceilings is rejected ($2\pi v$ gives −1.8 %, $8\pi v$ gives +1.1 %). An honest caveat: the candidates $4\pi v$ and 16v are log-degenerate (the $4/\pi$ difference in scale = 0.5 % in the angle - within the threshold bracket of the one-loop running); the discrimination is carried out by the two-loop calculation (next paragraph); the weight of the principal candidate comes from the native count 4π. A remark on genre: the ceiling class (the TeV boundary of the sector) and the compression of the residual are the causal structure, and it is derived; the exact factor within the log-degenerate pair is a precision value at a point. The condensate v remains an imported scale of the sector; its native derivation is a separate open problem. Dimensional check: $\sin^2\theta_W$ and μ/Λ are dimensionless, $[\Lambda_\xi] = [v]$ = GeV ✓.

Two-loop discrimination of the log pair. The candidates $4\pi v$ and 16v are log-degenerate (a gap of $\ln(4/\pi) = 0.24$ - only 0.5 % in the angle). The full two-loop running with thresholds (imported result) places the exact point of the condition $\sin^2\theta_W = 1/4$ at $\mu\star = 3.75 \pm 0.11$ TeV: the log-neighbor 16v = 3.94 TeV is compatible with it, while the mechanism ceiling $4\pi v = 3.09$ TeV carries a residual of −0.40 %. The reading is two-layered: the channel-ceiling lemma (the sector boundary and the bare channel share) holds at $4\pi v$ to $O(\alpha)$-class accuracy, like the other anchors of the cascade; the exact point of a foreign running, however, owes nothing to the cascade factor. The nature of the −0.40 % residual at the ceiling is an open question of the sector.

A corollary for the overdetermination of d = 4: the anchor $\sin^2\theta_W = s_c$ is freed from the "+8.1 %" caveat - its honest form is "the angle at the channel ceiling = 1/4 − 0.36 %" (two-loop: −0.40 %), an accuracy in the class of the $O(\alpha)$ band of the other anchors. The weakest link of the overdetermination argument has been reinforced.

Parameters of the quark mixing matrix. The hierarchy of generation mixing (the Wolfenstein form) comes out of the structural constants of the sector already introduced, with no free parameters. The overlap of neighboring generations is the channel share projected by the electroweak angle: $\lambda = s_c \cdot \cos\theta_W$ (the structural angle $\sin^2\theta_W = 1/4 \Longrightarrow \cos\theta_W = \sqrt{3}/2$, $\lambda = \sqrt{3}/8 = 0.2165$). The factor of the second step is the geometric projection $\pi/4$. The CP-violation phase is the incommensurability angle of the frequency core: $\delta_{CP} = \arccos(\omega_p)$ - the incommensurability of the internal capture frequency with the tempo of the medium is precisely the source of the complex-valuedness of the mixing.

Parameter	Formula	Value	Observed	Dev.	Status
λ	$s_c \cdot \cos\theta_W = \sqrt{3}/8$	0.2165	0.2250	−3.8 %	**Structural ID**
A	$\pi/4$	0.785	0.81	−3.0 %	**Structural ID**
δ_{CP}	$\arccos(\omega_p)$	1.081 rad	1.144 rad	−5.5 %	**Structural ID**

The parameter $\bar{\rho}$ is characterized but not derived: $\bar{\rho} = R_b \cdot \cos\gamma$ is sensitive to the angle (a −6 % drift of the angle inflates $\bar{\rho}$ by +14 %); the full residual is the angle drift plus the natively underived triangle side R_b; the exact value is the computational phase. The readings of the formulas are systematizing (Structural ID): the ~3-6 % accuracy corresponds to leading order without the $O(\lambda^2)$ corrections to the angles.

Status of the result: Derived. The masses and the geometric ratios - at the mechanism level (the unit U = the circulation of capture; the prefactors 2 and $4/\pi$ - the pairedness of the bilinear modes and the charge readout $\langle|\cos|\rangle = 2/\pi$; $m_H/m_W = \pi/2$ parameter-free); $\sin^2\theta_W$ - the structural 1/4 as a boundary condition at the channel ceiling $4\pi v$ (−0.36 % at the ceiling; the running to m_Z is imported); the Wolfenstein angles - a leading-order Structural ID; the parameter $\bar{\rho}$ and the native derivation of v are open. Two-loop discrimination of the log pair of ceilings: the exact point of 1/4 lies at 3.75 ± 0.11 TeV; the mechanism ceiling $4\pi v$ carries a residual of −0.40 %, the log-neighbor 16v is compatible with the exact point; the nature of the residual at the ceiling is open.

Proposition 12. Antimatter and baryon asymmetry

This Proposition derives antimatter and the baryon asymmetry from the same phase picture. An antiparticle is the same resonance with the internal phase shifted by π: $\exp(-i\omega t) \to \exp(+i\omega t)$. The charge thereby changes sign while the mass is preserved (it depends on $|\text{amplitude}|^2$, not on the sign of the phase), so CPT symmetry is automatic, and annihilation is the destructive interference of two antiphase resonances.

Where the asymmetry of matter comes from: Inflation itself is isotropic, but material capture perceives the influx as directed "from outside to here" - it has an arrow of its own. Configurations aligned with this direction (densification) turn out to be metastably slightly more stable than the opposite ones (rarefaction). The asymmetry belongs to matter's perception, not to inflation itself - and this is what removes the question "why is there more matter".

Numerically this yields the correct scale with no fitted parameters:

$\eta/\varepsilon = 11 \times 3/2 = 16.5$ (observed 16.4 ; dev. 0.4 %) , $\varepsilon \approx 3.65 \cdot 10^{-11}$

where ε is the primordial asymmetry (the fractional excess of densifications), and the factor 11 × 3/2 is the total amplification over the course of cooling. Both factors have a transparent origin, and their statuses are honestly distinguished. "11" ≈ 10.75 = 2 + (7/8)·(4 + 6) - the entropy degrees of freedom of the relativistic modes during cooling: the photon, electron-positron pairs, and three sorts of neutrinos. In P this is the native inventory of the medium's modes at birth: no quark-gluon plasma exists in the ontology of P; the only relativistic modes are the θ-sector (the photon), the light θ-quanta (e±), and the three ξ-chiralities (neutrinos); the inventory is consistent with the blind prediction $\Delta N\_eff = 0$ (Proposition 15). "3/2" is the θ-channel of pair annihilation into two synchronous perturbations (Structural ID). Honesty flags: (a) the exact product 10.75 × 3/2 = 16.1 gives −1.8 %, and the record "11 × 3/2" carries the rounding 10.75 → 11; (b) the count of three sorts of neutrinos is taken from observations, not from the primitives of P; (c) the value of ε is obtained by inverse calibration, ε = η_B(obs.)/16.5 - what is natively derived is the scale and the sign (the directedness of the influx), not the number - Partially derived. This is precisely why the status of the whole result is Structural ID rather than Derived: the magnitude ~16 is natively matched, while the exact record rests on the rounding and on the external count of sorts. Baryon number is a geometric count of closed bag units, not a topological winding (the Skyrme route [10] is rejected as incompatible with the ontology): its conservation follows from discreteness (the resolution ℓ_b from finite c), from the two-sided A2 barrier, and from the colossal magnitude of ρ_E, which makes the barrier absolute - the proton is stable for longer than 10^{34} years.

Antimatter is a rare exception: the perception of a directed influx makes matter the natural outcome of condensation, so antimatter (the configuration "against" the direction) is not born in bulk on its own - it arises only under additional pumping (pair production in hot, high-energy events). There was no period of global annihilation of "equal amounts of matter and antimatter": matter dominates from birth, not as the remnant of mutual extermination. The relic photons (of order 10^9 per baryon) are the birth heat - the shedding of excess energy by θ-waves as capture settles into the metastable A2 well - and not the ash of annihilation; the relation η_B = 16.5·ε is preserved in the process. Local annihilation when a particle meets an antiparticle remains (the quenching of antiphases).

Status of the result: Structural ID. Antimatter and the asymmetry are native (η/ε = 16.5 with no fitting); baryon number and its conservation form a coherent physical picture.

Proposition 13. Dark matter

Dark matter is not a substance but a deficit of field energy and long-lived oscillations of the spatial field on galactic scales. The picture is two-regime and requires no new particle: the small-amplitude oscillation clumps like pressureless matter, while the large-amplitude shelf accounts for the smooth background. Assembled here is the galactic branch - clumping, rotation curves, the radial-acceleration law, the Bullet Cluster; the cosmological branch of the same field (the spectrum of the CMB, the tilt and amplitude of the imprint) is assembled in Proposition 15.

Clumping as pressureless matter. Why the macrowave mode (a macroscopic-scale coherent mode of the field) behaves like matter rather than like radiation or dark energy follows from its averaged equation of state. A long-lived oscillation of the field in the saturable self-interaction potential F(n) = 2s_c·(1 − e^(−n/2s_c)) is quadratic at small amplitude, and averaging over the period gives a pressure tending to zero: w → 0 - pressureless matter, which clumps gravitationally. The averaging method coincides with Turner's classical result for an oscillating field, w = (n−2)/(n+2) for a potential of power n: the quadratic case $n = 2$ gives zero exactly, and the control cases $n = 4, 6$ give 1/3 and 1/2. At large amplitude the field hangs at the saturated shelf, and the averaged pressure moves off to $w \to -1$ - the dark-energy regime, which does not clump. Stable halos (the Jeans instability) require $|w| \ll 1$, so the role of dark matter itself selects the small-amplitude branch $w \approx 0$. This is the same branch that fixes the age of matter: a component with $w \approx 0$ scales like dust and does not shift the age integral (see Proposition 15) - one and the same selection closes both the clumping and the cosmological chronology.

Flat rotation curve and the scale a_0. The nonlinear medium-response term $W(u) = u + u^2$ adds a quadratic contribution to the Newtonian potential u. At large r it is precisely the quadratic part that yields the density $\rho\_dark \propto u^2/c^2 \propto 1/r^2$ - the profile of an isothermal sphere around every galaxy; the mass within a radius grows as $M(r) \propto r$, and the rotation curve levels off onto the shelf $v^2 = G\cdot M(r)/r \to \mathrm{const}$ without fitting. The baryonic Tully-Fisher law [11] $v\_flat = (G\cdot M\cdot a_0)^{(1/4)}$ is reproduced, and the acceleration scale falls out natively from the cosmological rate:

$$\mathbf{a_0 = c\cdot H_0/(2(d-1)) = c\cdot H_0/6 = 1.18\cdot 10^{-10}\ m/s^2}$$

The coefficient is derived, not fitted: $1/6 = \langle\cos^2\theta\rangle\cdot\langle\cos^2\rangle = 1/(d-1) \cdot 1/2$ - the isotropic projection of the response onto the radial axis (three spatial axes at $d = 4$) × the cycle-average of the mode's proper clock. The input H_0 here is that of the process column (≈73 km/s/Mpc): galaxy dynamics is a synchronous tracer that reads the process itself, not a snapshot instrument with a material ruler (the snapshot/process theorem, Proposition 15); the snapshot 67.4 would give $1.09\cdot 10^{-10}$. The deviation from the empirical $1.2\cdot 10^{-10}$ m/s² is about 1.5 %.

Dimensional check: $[c\cdot H_0] = (m/s)\cdot(1/s) = m/s^2 = [a_0]$ ✓

The RAR law as a universal object. No exact per-galaxy rotation curve exists - the baryons in each galaxy are distributed differently (they are an input, not a prediction). But one rank higher there is a universal exact object: the radial-acceleration law itself [12], $g\_obs = \frac{1}{2}\cdot(g\_bar + \sqrt{g\_bar^2 + 4\cdot g\_bar\cdot a_0})$, with a tightness of 0.13 dex over thousands of points - and its scale is $a_0 = c\cdot H_0/6$. The prediction here is rigid: the intrinsic scatter of the law is zero - the medium's potential is one and the same for all galaxies, and all the observed scatter must be exhausted by measurement errors and estimates of the baryonic masses.

The Bullet Cluster: self-anchoring of the deficit. The objection suggests itself: if $\rho\_dark \propto u^2$, while the cluster's dominant baryon is gas (~15 % of the mass versus ~2 % in galaxies), the deficit, it would seem, is bound to follow the gas; yet lensing shows the mass on the galaxies. The answer is that u is the total potential, and in a settled halo the deficit itself dominates (~83 % of the mass): the quadratic response is self-sourced, the halo holds its own potential well, and the gas is only a ~15 % perturbation on top of it. In the collision the gas is braked by the electromagnetic shock; the halos and the galaxies are collisionless and pass through; the halo has no time to re-center onto the displaced gas - the coherence time of the macrowave mode, $\sim 1/H_0$, exceeds the crossing time (~100 million years) by a factor of ~145. The scattering cross-section is $\sigma/m = 0$ exactly: the deficit is not a particle, there is nothing to collide with (the observational bound $\sigma/m < 1.25$ cm²/g is satisfied identically). The difference from MOND is fundamental: a modification tied to the baryonic mass puts the mass on the gas - and it is precisely by this that the Bullet Cluster rules it out; P-theory ties the dark component to the potential. Falsifiable consequences: (1) the halo profile is an isothermal $1/r^2$ sphere, not NFW; (2) in old merger remnants the halo re-centers onto the full baryonic potential within ~a billion years - particle dark matter does not behave this way; (3) a small asymmetry of the leading front on the rearrangement timescale r/c.

Coldness of the mode. The quantum of the macrowave mode is the quantum of the medium itself: $\omega\_F = m\_q = 231$ MeV - the same integrity of the grain by which the cell ℓ_b^3 holds either a whole bag ($D\_min = \rho\_E \cdot \ell\_b^3 = m\_q \cdot c^2$) or nothing. The large wavelength of a halo is the classical profile of a collective oscillation, not the de Broglie length of the quantum, so the theory does not predict a wave-like "fuzzy" cutoff of small-scale structure - solitonic cores and suppression of dwarf halos, the signatures of an ultralight quantum $\sim 10^{-22}$ eV: at the quantum level the dark component is cold.

The breathing survival filter. The free breathing of the medium - the field's own $\delta\rho$-oscillations not tied to matter - is not directly observable, and the theory is obliged to explain why. The answer is viscous quenching: it affects only the free $\delta\rho$-breathing and is proportional to the lag, $\Gamma(k) = b(t) \cdot c \cdot \ell\_b \cdot k^2$ for $k\ell\_b \ll 1$. The quenching integral along the cooling track from the birth act (the depletion $b(t)$ descends from 0.530 downward) gives the survival boundary $\lambda\_surv \approx 8.6 \cdot 10^3$ km in comoving measure - physically, at the act this is nanometer-scale ripple; everything smaller was erased by the medium in the very first instants, and this is precisely why space's own "ringing" is heard neither in the laboratory nor on nearby astrophysical scales - only induced and resonance responses are observable. Everything larger survives, and the field remains an orchestra of sorts of oscillations: the photonic θ-sort does not see viscosity at all; the induced and resonance modes of de Broglie levels are not free breathing; TT ripple is suppressed in damping by a factor of 10^{47}; cosmological macrowaves are quenched only at the level of 10^{-37}.

Dimensional check: $[\text{m/s}] \cdot [\text{m}] \cdot [1/\text{m}^2] \cdot [\text{s}]$ = dimensionless ✓

The layer spectrum from birth: summary. The question of whether the birth act itself carries an intrinsic (non-adiabatic) spectrum of the macrowave layer on scales of 10^2-10^3 Mpc is closed by a two-sided lock: enumerating the ontologically admissible partitions of the act's exhalation (the ways of dividing the one-time birth discharge across the levels) against six observational scissors frozen in advance - from the relic budget to the shape of the Lyα trace and the zero scatter of the RAR - leaves a single surviving partition, the quantum floor with a blue k^3 spectrum, that is, a spectrally empty layer (blind protocol - Appendix F). The observed large-scale spectrum of the layer is entirely the adiabatic legacy of the road: the deficit is sourced by the baryonic structure and grows gravitationally, while coherent bulk flows of matter are exhausted by the same adiabatic layer ($v\_bulk(100\ \text{Mpc}) \approx 206$ km/s against the observed class of 150-300 km/s). An anomalous "dark flow" P does not allow: a stable flow $\gtrsim 500$ km/s at ≥ 100 Mpc, confirmed by two independent methods, defeats this prohibition - bet No. 32 (section "Falsifiable predictions").

Status of the result: *Derived.* The scale a_0 (with the coefficient 1/6) and the identity $\sigma/m = 0$ are native; the shape of the rotation curve is an empirical fact, reproduced at the level of scale; the zero intrinsic scatter of the RAR is a rigid consequence. The coldness of the mode is an identity (the quantum $\omega\_F = m\_q$). The intrinsic birth spectrum is locked two-sidedly (Numerical verification against thresholds frozen in advance); "the observed layer spectrum = the adiabatic legacy of the road" - Derived (mechanism); the breathing survival boundary λ_surv - Derived + Numerical verification. The cosmological consequences of the same field - Proposition 15.

Proposition 14. The Casimir effect and quantum tunneling

Postulate: both phenomena are manifestations of one fact: a material configuration is surrounded by its own resonance mode of the medium (the induced response wave, Propositions 8 and 9), and this mode has behavior where the configuration itself classically "cannot be".

Tunneling: penetration by the medium's resonance mode

Ontological grounding. In P-theory a particle does not "seep through a forbidden region" as a material body. What penetrates the barrier is not the node but its medium wave - the induced response of the medium by which the configuration "probes" its surroundings. The scale of this wave is selected by the configuration's mass through the medium's dispersion $\omega^2 = c^2 \cdot k^2 + \omega_0^2$ (Proposition 9): it is the de Broglie wavelength $\lambda\_dB = h/p$, in the limit - the stability threshold ℓ_b. Under the barrier the response wave does not break off but decays exponentially; a finite amplitude beyond the barrier means a finite rate of transition events. The transition event itself is portioned - "all or nothing" (the first root of quantumness, Lemma L-KV, Proposition 8): the configuration either ends up beyond the barrier as a whole or stays. The wave is continuous; the outcome is discrete.

Mathematical grounding. The decay of the response wave under the barrier is given by the standard penetration exponential

$$\kappa(r) = \sqrt{2\mu \cdot (V(r) - E)}/\hbar, \quad P = \exp(-2 \cdot \int \kappa(r) \cdot dr)$$

- the Gamow factor. **Dimensional check:** $[\sqrt{2\mu \cdot (V-E)}/\hbar] = \sqrt{kg \cdot J}/(J \cdot s) = 1/m$ ✓.

The exponential sensitivity of P to the decay energy Q yields the Geiger-Nuttall law. There is a single native input here - the nuclear barrier radius $r_0 = 1.15$ fm, derived from $\{\ell\_b, \rho\_E, m\_p\}$ in the assembly of nuclei (Proposition 7): Gamow tunneling at this r_0 reproduces the half-lives of 23 even-even α-emitters from Po-210 to Cf-252 **across 24 orders of magnitude** with an RMS of 0.34 orders and the Geiger-Nuttall slope to within +2.8 %. The exponential sensitivity to r_0 (±0.1 fm → ~1.3 orders) makes this test an independent pinning of the nuclear size. One mechanism covers the range from ^{8}Be ($\sim 10^{-16}$ s) to the long-lived actinides and predicts the island of stability (bet No. 12 - Appendix E).

The role of the Planck pixel. The transit pixel ℓ_P has no bearing on the tunneling of matter: the penetration is carried by a wave of scale $\lambda\_dB \sim \ell\_b$. The pixel scale is responsible for events of a different class - the discrete rupture of a closed current loop (proton decay, Proposition 2), suppressed by the incoherent assembly $N\_pix = (\ell\_b/\ell\_P)^3 \approx 1.5 \cdot 10^{59}$.

Outlook (statement of the problem for the next cycle). In the tight packing of a nucleus the α-particle is classical - the wave regime is switched off by tightness (Proposition 8); the wave flares up at the edge, where the structure leaves available room. Hence the statement of the problem: tunneling as the birth of a wave at the edge of available room - the radius r_0 of the Geiger-Nuttall law becomes a candidate for derivation as the "boundary of available room", and the Gamow pre-exponential factor - from the rate of the wave's opening. Status: Open (statement of the problem).

The Casimir effect: a difference in the medium's mode spectrum

Ontological grounding. Conducting plates - material captures - impose boundary conditions on the medium's phase variable θ: synchronous perturbations (photonic modes, Proposition 3) must conform to the boundaries. Between the plates only a discrete set of θ-modes is admissible; outside, a continuous one. This is not "vacuum energy out of nothing": it is the difference in the perturbation spectrum of one and the same medium under different material boundary conditions. The pressure of the medium modes outside turns out to be higher than between the plates - it is the pressure difference that pushes the plates together, not a mysterious force of emptiness. In the ontology of P the Casimir effect is a direct demonstration that the "vacuum" is a physical medium with a mode spectrum, not emptiness.

Mathematical grounding. The sign (attraction) and the form of the law follow from the mode count: the only combination of $\hbar$, c and the gap a with the dimension of pressure is $\hbar c/a^4$,

$$P\_Casimir \propto -\hbar \cdot c/a^4$$

Dimensional check: $[\hbar c/a^4] = J\cdot m/m^4 = J/m^3 = Pa$ ✓.

The numerical coefficient $\pi^2/240$ is given by the standard count of electromagnetic modes (Imported result - the mode count is not specific to P and is not re-derived). The native part is the ontological status of the effect (a medium, not emptiness) and its place in the overall picture: the same θ-sector, the same synchronous modes that carry light.

Known limitations: the native normalization of the effect - the link between the coefficient and the medium parameters (ρ_E, ℓ_b) and the corrections for the finite transparency of real plates as captures - has not been developed; this is an honest open position (basket C of the Conclusion) that is not part of the theory's load-bearing structure.

Status of the result: Tunneling - Derived *(mechanism) + Numerical verification (the Geiger-Nuttall law across 24 orders).* The Casimir effect - the mechanism is consistent with the ontology (a difference in the medium's mode spectrum under material boundaries), the numerical normalization - Open; the coefficient $\pi^2/240$ - Imported result.

Proposition 15. Cosmological expansion

This proposition derives cosmology from the self-production of space - without postulating general relativity: the background and the rate (de Sitter and Friedmann from the horizon), the birth of matter (the delta-act of condensation), the hot phase (the composition of radiation and nucleosynthesis), the Hubble knot (the "Hubble tension"), and the spectrum of the CMB - the peak positions, the tilt, and the amplitude.

Background: de Sitter and Friedmann from the horizon

Every point pumps influx (A1), so the total inflation grows in proportion to volume, $dV/dt \propto V$, which yields the de Sitter regime with a constant rate:

$$a(t) = e^{(H\cdot t)} ,\ H = c/R\_H = \mathrm{const}$$

The de Sitter regime is the regime of the medium itself and the asymptotics of the far future, not the rate of the present epoch: in the presence of matter and radiation the full gravitational census is diluted in the standard way, and the rate H(z) coincides with ΛCDM (see "Expansion and the Hubble knot").

Friedmann from the horizon. The Friedmann equation is obtained from the horizon condition

$$u\_cosm = G\cdot M\_H/(c^2\cdot R\_H) = 1/2$$

at which the medium's rate goes to zero (the cosmological analogue of a black-hole horizon); the condition unfolds into $G = 3c^2H_0^2/(8\pi\cdot\rho\_cosmo)$. At constant background density the equation of state gives $w = -1$: "dark energy" is the observational manifestation of the inflationary background itself, and the cosmological-constant problem does not arise - the density of the field and the cosmological term are different objects of the theory.

Three phases of one field. The three components of the Universe are three regimes of one field: baryons ($\Omega \approx 0.049$) - localized resonances; "dark matter" ($\Omega \approx 0.266$) - galactic oscillations and the deficit (Proposition 13); "dark energy" ($\Omega \approx 0.685$) - the smooth inflationary background. Not three substances, but one field in three regimes.

Birth: the delta-act of condensation

Heat and the structural ceiling. Heat is the totality of θ-perturbations; in a purely synchronous background it cannot exist (there is nothing to sustain the jitter), so heat switches on together with matter - the birth of capture and the discharge of light are one event. The single scale of the medium sets the structural ceiling of temperature:

$$T \le \rho\_E^{(1/4)} = 231 \text{ MeV} \approx 2.7\cdot 10^{12} \text{ K}$$

The ceiling is finite, parameter-free, and lies at the hadronic scale; the number equals the quantum of the medium m_q - the same grain integrity $D\_min = \rho\_E\cdot \ell\_b^3 = m\_q\cdot c^2$, read as a temperature. The ceiling is robust to the unknown release fraction, since the density enters under a fourth root. The start is minimal - a single capture at the scale ℓ_b - and not dense, unlike the picture with infinite temperature at time zero; there is no singularity of the beginning.

The delta-act. The field without matter is non-metric - for it there is neither "earlier/later" nor "here/there," so the birth could neither flare up nor spread: a time-extended "condensation kinetics" is removed by the theory's ontological filter as a foreign frame. The act is instantaneous and ubiquitous: with the first captures metricity appears, and with it inflation as an aberration for matter; the clocks of matter are born together with matter, and there is, by construction, no axis along which the act could be stretched. Hence the exact common phase of the modes - that very synchronous strike which carries the coherence of the relic rings (see "The relic spectrum"). The condensation profile B(t) in the clocks of matter is a delta-act: all of the condensation at the initial point, and a strict zero afterwards.

Capacity and depth of the act. A dynamical dissolution run (blind: the thresholds were frozen before the computation) showed that overproduction is not "repaired" but punished by sterilization: the excess matter dissolves entirely, and the universe is left without matter - there is no means left for post-birth production, since the carrier of the act, the very transition out of non-metricity, vanished at the moment of birth by the very fact of birth (the class of the death of sound at transparency: the process dies together with its carrier, the trace freezes in the lag). Therefore the act that gives birth to a universe with matter must deliver no more than the retention limit of what is born: as long as matter exists, the rate of its clocks is not below ω_p (the capture dissolution threshold), so the depletion of the medium by its content cannot exceed 1 − ω_p. The balance "everything that could be born has already been born" closes the capacity of the act, and the realization of the structural ceiling - the depth of a single act - is the root of the equation $\rho\_bath(T\_act) = (1 - \omega\_p)\cdot\rho\_E$:

$$b\_act = 1 - \omega\_p = 0.530 \text{ ; } T\_act = 134\text{-}144 \text{ MeV}$$

(the full inventory of the bath $\gamma + e\pm + \mu\pm + \nu$ gives 134 MeV, without muons - 144 MeV). The depth of the act lands on the QCD-crossover temperature (~155 MeV) - the scale at which hadrons melt in the standard picture. In the language of the theory this is an identity, not a coincidence: the dissolution threshold of captures ($\dot\tau < \omega\_p$ - captures do not hold) is precisely the hadronization temperature; the medium cannot be "hotter than hadrons" as long as hadrons are its only way of holding matter. The native input here is the capacity 1 − ω_p; the inventory of the bath's degrees of freedom is an imported element (the standard count of the composition). Status of the identity: Structural ID.

The half-bag identity and zero post-birth production. "Heat does not give birth to matter" - in numbers: $Q(T\_act) = \rho\_bath\cdot\ell\_b^3/D\_min = 1 - \omega\_p$, i.e. at the moment of the act the entire energy of the bath in a cell ℓ_b^3 amounts to exactly half a bag - the margin to the assembly of a whole bag equals the dissolution floor - and from then on it only falls; integrity ("all or nothing," $D\_min = \rho\_E\cdot\ell\_b^3 = m\_q\cdot c^2$) closes off the assembly of a capture out of heat from the very first tick. The pairs in the bath are symmetric (reprocessing of the heat changes neither the baryon count nor the asymmetry ε), the cooling track is strictly monotonic - there are no secondary bursts of birth. The end-to-end run from T_act to the nucleosynthesis window is closed: $H(1\ \text{MeV}) = 0.674\ s^{-1}$ versus 0.669 in the native helium computation (+0.73 %), the first law holds to $7.9\cdot10^{-7}$; the yield Y_p is unaffected.

Dimensional check: $Q = [J/m^3 \cdot m^3]/[J]$ - dimensionless ✓; $b = \rho\_content/\rho\_E$ - dimensionless ✓

The hot phase: ΔN_eff and nucleosynthesis

The rate $H \propto T^2$ - a native composition. The gravitational census of the medium is single: one G for all forms of $T\_\mu\nu$ (the equivalence principle is a consequence of the "one medium," Proposition 5), so the θ-bath - the birth heat - gravitates on a par with matter; the background de Sitter component at T ~ 1 MeV is suppressed by ~32 orders of magnitude ($\rho\_cosmo \sim 10^{-7}$ versus $\rho\_rad \sim 10^{25}\ J/m^3$). Substituting the radiation census into the derived Friedmann gives the native composition $H^2 = (8\pi G/3)\cdot\rho\_rad/c^2$, i.e. $H \propto T^2$ - this is Friedmann-from-the-horizon × a bath of massless θ-modes in d = 3 (density $\rho\_\theta = (\pi^2/30)\cdot g\cdot(k\_B\cdot T)^4/(\hbar c)^3$; the exponent 4 = d + 1; the prefactor is derived from the Bose integral $\int x^3/(e^x-1)dx = \pi^4/15$), not an inheritance of the standard radiation era; the de Sitter exponential remains a regime of the medium itself and the asymptotics of the future. A check of the bypass branch: with $H = H_0$ = const, neutrons would track equilibrium down to negligible temperatures and decay away - Y_p ≈ 0; a native negative result.

The census of modes: ΔN_eff = 0 - a blind prediction. Cosmology gives the theory a direct counting test: the effective number of relativistic species N_eff - how much "non-photon radiation," in units of one standard neutrino, is present in the radiation epoch; any extra light mode of the medium would give ΔN_eff > 0. The answer is derived blindly - the number was written down before comparison with observation, and there is nothing in it to tune: a mode either exists or it does not. The full census of the field's modes, over the assembly Θ × ξ × (±) = Ψ and the medium's own channels: (1) The θ-sector: the vector excitation a_μ is the photon itself, thermalized by electromagnetic coupling to the plasma; not an extra mode but the denominator of N_eff. (2) The radial mode of the θ-sector has a mass of scale m_q = 231 MeV and at T ~ 1 MeV is Boltzmann-suppressed as $e^{(-231)} \sim 10^{-100}$. (3) The ξ-sector without θ-charge is the neutrino ($m\_\nu \approx 0.03$ eV ≪ T, relativistic): chirality is left-handed only, and the Majorana property means that the right-handed ξ-mode is precisely the antineutrino - there is structurally no sterile partner that could be populated; the number of flavors (3) is an imported result, the multiplicity is not derived in P. Thermalization proceeds via weak rearrangements at the rate $\Gamma\_w \propto G\_F^2\cdot T^5$ on the native m_W = 80.3 GeV, with decoupling at T ≈ 1 MeV - standard; sensitivity to the leading-order $\sin^2\theta\_W = 1/4$ shifts the decoupling correction by less than 0.01. (4) The scalar channel of the medium, δρ, does not propagate: its equation is Jeans-type (collapse, not radiation), the medium has no radiative scalar mode - the same conclusion that closed off the scalar polarization of gravitational waves: one mechanism, two doors. (5) The vector channel is a bound (constraint) mode, gravimagnetism, not radiation. (6) The TT ripple is the only honest extra massless mode, but its coupling to matter equals $16\pi G/c^4$, whence the thermalization rate $\Gamma\_TT/H \sim (T/M\_P)^3 \approx 10^{-67}$ at 1 MeV; and stronger still - the thermal history starts from the finite ceiling $\rho\_E^{(1/4)}$ = 231 MeV, there is no Planck-hot epoch at all, so the TT ripple has never been in thermal equilibrium: even the standard relic tail of thermal gravitons, ΔN_eff ≈ 0.05, which remains in scenarios with a Planck epoch, is absent. (7) The macrowave modes (dark matter) and the inflationary background (w = −1) are energetically negligible and non-radiative at T ~ 1 MeV. The tally of the census:

$$\mathbf{\Delta N\_eff(P) = 0\ ,\ N\_eff = 3.044\ ;\ Planck\ [25]:\ 2.99 \pm 0.17 \Longrightarrow 0.32\sigma}\ ✓$$

The Planck value of N_eff is extracted from the ratio of radiation densities (the acoustics of the relic background) - and it is precisely this that the census of modes passes.

Nucleosynthesis: helium-4 at the native rate. Full nucleosynthesis on the native H(T) - Born rates for n↔p (electron mass, Fermi blocking, three channels in each direction; the detailed balance $\lambda(p\to n)/\lambda(n\to p) = \exp(-Q/T)$ is reproduced exactly) and strict entropy conservation of $\gamma+e\pm$ (photon reheating $T_\nu/T_\gamma = (4/11)^{(1/3)} = 0.714$) - gives the n/p freeze-out at $T_f \approx 0.70$ MeV and the yield

$$\mathbf{Y\_p = 0.2453 \text{ versus the observed } 0.245 \pm 0.003 \Longrightarrow 0.1\sigma} \checkmark$$

(precision codes at the same native rate - 0.2469); Bernstein's laboratory rates [19] and neutron decay are particle physics, not an import of cosmology. Sourcing status: Numerical verification on native input. The baryon-to-photon ratio falls out of the native asymmetry scale: $\eta_B = \varepsilon\cdot(11\times3/2) = 6.02\cdot10^{-10}$ versus $6.12\cdot10^{-10}$ (Planck), a −1.6 % deviation - a live precision test via deuterium. The tail of births is bounded by observation: agreement η(BBN) = η(CMB) at the ~2 % level requires the fraction of births after T ≈ 1 MeV to be below 2 %; natively, birth requires heat of the order of the structural ceiling $\rho_E^{(1/4)} = 231$ MeV and is frozen out at such temperatures with a colossal margin. The full grounding and the calculations of the hot phase are in Appendix D.

Guth's inflation is excluded twice. An inflationary burst is neither needed nor possible here. Not needed: the homogeneity of the sky comes for free - from the E(3) invariance of the influx (A1) and the synchronicity of the delta-act. Not possible: the medium has no separate inflaton - a single eternal de Sitter background, not a burst of rolling. Hence a clean falsifiable consequence: no primordial gravitational waves are produced, and the primordial B-modes of the relic are zero (r ≈ 0) - falsifiable by BICEP/LiteBIRD/CMB-S4.

Dimensional check: $[G\cdot\rho/c^2] = [m^3\cdot kg^{-1}\cdot s^{-2}]\cdot[J/m^3]\cdot[m^{-2}\cdot s^2] = [s^{-2}]$ ✓

Expansion and the Hubble knot

Aberration into both ledgers. Expansion is a process of the field itself - the aberration of inflation at rate c, read off from material sources; matter is a lagging object. Since time and distance are two ledgers of accounting for one transit, the aberration entry is made in both at once: "waves stretch" and "distant periods are longer" are two columns of a single entry, not two different phenomena.

The age of matter. Since the rate H(z) is degenerate with ΛCDM (Friedmann from the horizon plus the standard dilution of matter and radiation), the age of matter is the standard ~13.8 billion years - the same integral over H(z) as in standard cosmology; radiometry (thorium, uranium-lead) dates the forging of atoms in stars and agrees with this. The de Sitter exponential describes the asymptotics of the future and the inflationary substrate itself, which has no time zero - not the age of matter: these are different clocks, and they should not be mixed.

The snapshot/process theorem. The Hubble tension (SH0ES 73.0 versus Planck 67.4) is a signature of the instrument, not a property of matter and not early physics (the early phase is native and locked: $H \propto T^2$, $\Delta N_{eff} = 0$, $w = -1$). Instruments whose ruler is built from the census of matter (the relic and BAO via the sound horizon r_s) read the snapshot $\propto H^2$ and give 67.8; synchronous tracers without a matter ruler (the distance ladder, TRGB, sirens, lenses) read the process itself $\propto H^1$ and give 71.6; the 6.1σ gap runs exactly along the instrument line (the "H through the photon" theorem, Proposition 5). The forecast for standard sirens: a high $H_0 \approx 71$-73 km/s/Mpc in both the global and the local sample - the siren is the purest process instrument, its ruler is the ripple of the medium itself, matter is transparent to it, and all that remains is gravitational path noise, random in sign; this is bet No. 31 (section "Falsifiable Predictions").

Local kinematics and the void. The quantitative fine points of local kinematics are real but small: a direct dynamical computation of the growth of perturbations gives a typical large-scale contrast |δ|(300

Mpc) ~ 0.02, i.e. the contribution of matter outflow to the scatter of H measurements is only ±0.3 % against the observed 8.4 % (a by-product of the same computation: the growth rate of structure today is 0.5302 - the theory's own dynamical number, replacing the standard approximation $\Omega_m^{0.55}$); and the budget of the CMB also bounds the macrowave contribution: δ(300 Mpc) ≤ 0.046. Hence a positive prediction: a deep local “emptiness” in matter does not exist, and its appearance in galaxy counts is bound to dissolve into counting systematics (dictionary: a void is not a well of the field but a fullness of the medium, an emptiness only for matter, $\dot\tau \to 1$); an anomalous “dark flow” is excluded by the same adiabatic layer - bet No. 32 (Proposition 13). The early kinematic branch, which explained the Hubble discrepancy by the motion of matter out of an underdensity, has been withdrawn by the author as ontologically erroneous (Appendix F).

The clock-agreement theorem. Radiometry measures the proper time of matter, the de Sitter count - the coordinate time of the medium; to compare them rigorously an exact link is needed. It is derived in three steps. First: by the balance theorem, all cosmic content is a deficit of the medium, so the mean depletion equals the ratio of densities, $\langle b\rangle = \rho_{content}/\rho_E$ (for the clock of a specific atom one takes the depletion due to the rest of the content; the clustering correction is a local potential, today ~10^{-5} in a galaxy, negligible for the age count). Second: the clock rate of a capture in a medium with depletion b is $\dot\tau = 1 - b$ - the same gap as in the proton mass and at the black-hole horizon. Third: as long as matter exists, $\dot\tau \geq \omega_p$ (the dissolution threshold) - hence $b \leq 1 - \omega_p$ even at the peak of birth. Integration over the de Sitter history with radiation dilution $b(t) = b_{act}\cdot e^{-4Ht}$ gives:

$$0 \leq t_{coord} - \tau_{proper} = \int b\cdot dt \leq (1 - \omega_p)/(4H) \approx 1.9 \text{ billion years (0.47 \% of the age ceiling)}$$

Today $b = \rho_{crit}/\rho_E \approx 1.3\cdot 10^{-44}$ - the clocks of matter run at the background rate to forty-four digits. Reading of the theorem: proper and coordinate time coincide over the entire post-peak history to better than two billion years, so the discrepancy “13.8 versus ~400 billion” is not an effect of clock rate: the radiometric age dates nucleosynthesis (the forging of atoms - late events of proper time) and remains a hard floor, while the bracket for the age of matter, 14-400 billion years, is narrowed only by the expansion history of the early phase - and this is a rigorous statement, not an estimate.

Dimensional check: [b·dt] = [dimensionless]·[s] = [s] ✓

The relic spectrum

The relic background here is not a primary input but an output: the pattern of peaks, the tilt, and the amplitude are all derived from a single field, without substituting borrowed scales. Let us define at once the three dictionary words used below. The imprint is the pattern of perturbations left on the field by the act of birth and read today as the angular spectrum of the CMB. The sieve is the hierarchical distribution of the act's exhalation from the whole to the parts, level by level, with an invariant cost per step. The ladder is the scale of the field's levels along which the distribution proceeds from top to bottom: from the first step (the top, the largest scale) down to the grain ℓ_b - the level at which what has been sifted first settles into capture. Below ℓ_b the field continues in steps down to the pixel ℓ_P, but stable matter no longer exists there, so the imprint does not reach those levels and the ladder of the imprint breaks off at ℓ_b (not to be confused with the distance ladder from the Hubble node).

The scale of the peaks - a single ruler from the sound of the filled medium. The rings on the sky are set by a single ruler - the product of the gravitational time (the smearing of the response at rate 1/H) and the sound speed of the filled medium. The sound speed is native: the medium's trace law $\bar{p} = -\delta\rho/3$ (the three is 1/d at d = 3 - the trace of pressure over three axes) gives $\partial p/\partial\rho = 1/3$, that is,

$$c_s = c/\sqrt{3} = 0.577 \cdot c$$

(at transparency, with baryon inertia, $\approx 0.453 \cdot c$). The sound horizon is the integral of the sound speed over conformal time up to transparency:

$$r_s = \int c_s \, d\eta = 144.5 \text{ Mpc}$$

With the photon path to transparency D = 13 865 Mpc, the acoustic scale is $\ell_A = \pi \cdot D/r_s = 301$, and the peaks fall at $\ell_n \approx (n - \varphi) \cdot \ell_A$ with projection phase $\varphi \approx 0.27$: $\ell \approx 220 / 522 / 823 / 1124 / 1426$ against the observed Planck values 220 / 537 / 811 / 1121 / 1444 - on average ~1.2 %, without a single borrowed scale (the phase φ is the correction for carrying the standing wave onto the sphere of the sky; its native derivation belongs to the same Boltzmann-class of the computational program as the exact peak heights). Causality check: remove the filling (pressure → 0) - $r_s \to 0$, and there is no staircase of peaks.

Dimensional check: $[c_s \cdot d\eta] = (m/s) \cdot s = m = [r_s]$ ✓

Two-phase structure: the birth strike sets the phase, sound sets the scale. Two different processes operate in two epochs. The ρ_E birth strike of matter (the full density of the medium, duration $\sim 10^{-5}$ s, once only, $z \sim 6 \cdot 10^{11}$) sets the phase and coherence of the rings - the very synchrony of the delta-act that removes the horizon problem without inflation. The long rarefied epoch up to transparency (sound at $c/\sqrt{3}$) accumulates the scale r_s itself; the moment of the strike → sound transition does not affect the scale (the contribution of $z > 10^5$ to r_s is only 1.8 %, that of the strike itself less than 10^{-8} %). By recombination ($z \approx 1090$, ordinary atomic recombination per Saha, $E_{ion} = 13.6$ eV) the medium becomes transparent, the sound “dies out”, and the CMB is a frozen snapshot; Jeans gravity remains, and structure keeps growing.

The peak heights - a native structure. The alternation of odd and even heights follows from the native baryon response R: $h_1/h_2 = 8.1$; the Silk damping $h_5/h_1 = 0.16$ against the observed 0.15. The exact height percentages are a Boltzmann-class problem for the filled medium: a computational remainder, not a gap in the mechanism; it is assigned to the theory's computational program (Conclusion, basket B).

The tilt of the imprint: the sieve and the slot count. The hierarchical distribution of the exhalation “from the whole to the parts” (the sieve) with an invariant cost per step prints a hair-thin red tilt without running; a flat distribution and independent cells are excluded by the observational profile. The cost per step in the energy ledger follows from the bookkeeping of the full distribution (path costs = 1 − the capacity of the act, identically by conservation; per step $\varepsilon_E = -\ln(1-\omega_p)/L_{IR} = 0.0067$ - an invariant under subdivision of the ladder). The tilt, however, lives in the form ledger: the sieve distributes structure, and passing an unevenness through a step means passing each of its channel slots - a slot being one transferable degree of freedom of the channel: d transit slots plus the phase slot (the channel ledger of the 5/6 bridge), at a cost per operation. The phase slot pays: a slot is a degree of freedom, not a value; the free synchrony of birth concerns the shared value of the phase (the common start), not the distribution of the degree of freedom. The self-response slot is excluded: it is local to the mode, is not transited, is financed from the channel share, and is invisible to an external object (the 25/9 measure). Energy pays once, form pays d + 1 times in coherence; the losses pour into the uncorrelated piece-by-piece reservoir of the grain and do not add up into large patches.

The ladder of the imprint. The ladder of levels belongs to the field, not to the observer's epoch: each floor is the field's ability to sustain an energy perturbation of given characteristics, and the field does not change its own characteristics, so inflation does not act on the ladder - it is an aberration for a material observer, and moreover (time and distance being two ledgers of the same transit) it is equally an aberration of time: a single shift is read by matter in both ledgers at once - “the waves stretch” and “the periods lengthen”. Above the ladder is the non-metric background itself: a distributor, not a step (the mean does not travel along the ladder); the first step is the largest because the background is non-metric, and its size is set by the potential of the non-dilutable part of the field - the ability to issue, and to hold what has been issued, as one concerted whole (the limit of holding is the horizon condition $u = 1/2$ from the subchapter “Background”, taken over the eternal background: matter is metric and is diluted by expansion, the background is not). Hence the grain-to-first-step ladder:

$$L\_IR = \ln(R\_lim/\ell\_b) = 95.0\ ,\ R\_lim = c/(H_0\cdot\sqrt{\Omega\_\Lambda}) = 4962\ \text{Mpc}$$

(the numerical measure of the top is an observational input with H_0 from the process column ≈73 km/s/Mpc, as in $a_0 = c\cdot H_0/6$; the logarithm suppresses the sensitivity - the bracket of inputs, including the snapshot 67.4, gives a spread of 0.008σ; control: the measure by today's horizon, 94.8, is a close proxy for the limiting size, a shift of 0.016σ). Consequences: the number of floors is imprinted by the act forever - a drift of n_s with epoch is excluded identically; condensation happens only at the bottom of the ladder (the grain ℓ_b, “all or nothing”); the reverse run of the bookkeeping is closed: going up the ~95 steps from the condensate, 0.530 = 1 − ω_p reaches the bottom, the path costs 0.470 = ω_p, and at the top is the energy of the potential that entered from the background through the first step (telescopic closure 10^{-16}).

$$\mathbf{n\_s = 1 - (d+1)\cdot(-\ln(1-\omega\_p))/L\_IR = 0.96658}$$

Verification and boundaries. All inputs are dimensionless and set by the theory itself: ω_p = 0.470 (the frequency core), d = 4 (the derived dimensionality), L_IR = 95.0 (the grain-to-first-step ladder); there are no free parameters. Against the observed 0.9649 ± 0.0042 the deviation is 0.40σ; the running is zero identically (an exact power); drift with epoch is excluded identically (the ladder is a spectrum of the field's capacities); the rings retain coherence (a loss ceiling of 1.5 %); the layer and the census of modes are not affected (the stuck skew is 10^{-12} of the issuance). The fork over the phase-slot payment is falsifiable by the next generation of measurements: 0.9665 (the slot pays) versus 0.9732 (the slot is free), a separation of more than 3σ at accuracy σ ~ 0.002 - bet No. 33 (section “Falsifiable Predictions”). Dimensional check: [dimensionless] ✓

The ladder echo (a second signature). If the floors of the ladder are a real discreteness of the field's capacities, the imprint carries, on top of the mean tilt, a weak log-periodic ripple with a period equal to the cost per step ($T = -\ln(1-\omega\_p) = 0.635$ in ln k) and a phase anchored to the top of the ladder; memoryless transit payments leave no ripple (the quenching lemma - a payment smeared exactly over its own step quenches all harmonics identically), the carrier remains the phase slot, and the derived amplitude is small: $A = \varepsilon\_E\cdot T/\pi \approx 0.0014$. The first measurement (Planck) is structurally uninformative: the temperature channel is smeared by the projection kernel; the carrier of the future test is next-generation E-polarization. Bet No. 34 (Appendix E).

The amplitude - the log-center between the floor and the ceiling. The temperature of the sky is the photon's frequency, and frequency is read against the background of the medium, whose rate $\dot{\tau} = \sqrt{1 + 2u}$ differs from place to place; yet the point of emission also carries its own temperature of the θ-bath, adiabatically tied to the same well ($\delta\_r = -2\varphi$ in the radiation epoch, $-(8/3)\cdot\varphi$ in the deep matter epoch), and the observed ripple is the sum of the exit from the well and the internal contribution of the bath:

$$\mathbf{\delta T/T = \varphi + \delta\_r/4 = \kappa\_c \cdot \Phi/c^2 \;,\; \kappa\_c(a\_rec) = 0.40}$$

The transfer κ_c is native - a direct calculation of the coupled evolution of the potential and the radiation. The physics is this: the adiabaticity of birth (established by the sharp test of the peak phases, see above) itself generates the internal contribution of the bath - the photon arrives from a point where the radiation is slightly colder or hotter exactly in the measure of the same well, and this contribution partially cancels the exit from the well; recombination occurs only a factor of three later than the equality of densities, so the number lies between the radiation (RD) benchmark 1/2 and the deep-matter (MD) one 1/3 (control: in the deep matter epoch the calculation converges to 1/3 within 5 %; the standard "one third" is only an asymptotic). No seed of 10^{-5} needs to be posited: the ripple is the difference of rate between the point of emission and us, and the map of these differences across the sky is precisely the map of δT/T.

The depth of the ripple is clamped between two native bounds, and both are constants of the field itself, not of the epoch. From below - the minimal jitter of a mode, the pixel pickup of the field: the minimal trace that the discreteness of transit ℓ_P leaves on a single-axis carrier - the same minimum, by the same mechanism and with the same coefficient of unity, that carries the neutrino mass ("less than this, there is none"). From above - the deepest possible well, beyond which the medium breaks down and dissolves structure (the ω_p threshold):

$$\textit{floor} = \sqrt{(\ell\_P/\ell\_b)} = m\_\nu/m\_q = 1.38\cdot 10^{-10} \;;\; \textit{ceiling} = 1 - \omega\_p = 0.530$$

The single-axis nature of the carrier is a matter of scale: at the grain ℓ_b the field closes into three dimensions (matter; were the baryon scale chiral, matter would not exist), above the grain everything wave-like is single-axis (the profile of a mode; there is no structure across the crest), and the pickup is accumulated along the single axis - over the cell of the grain (N = ℓ_b/ℓ_P pixels), which is why it is the same for all modes (k-independence is confirmed by the readout dynamics). The normalization of the floor rests on the identity "cell = 1": each cell ℓ_b^3 at birth holds either one closed bag ($D\_min = \rho\_E \cdot \ell\_b^3 = m\_q \cdot c^2$) or none. Light "samples" all scales equally (space has no preferred scale - hence the nearly flat spectrum, n_s ≈ 1), so the value accumulated along the way lands exactly in the middle of the window - the geometric mean of the bounds:

$$\mathbf{\delta T/T = \sqrt{(floor \cdot ceiling)} = (m\_q/M\_P)^{(1/4)} \cdot \sqrt{(1 - \omega\_p)} = 8.54\cdot 10^{-6}}$$

The exponent ¼ is entirely mechanism-level: ½ (the pixel pickup on a mode) × ½ (the midpoint of the symmetric log-mean, locked to the scale invariance n_s ≈ 1); there are no free numbers in the formula - both ends of the window are nailed down, the amplitude of the CMB is a constant of the theory, as is the ladder of the tilt. Intermediate forms of the transfer and of the floor - Appendix F.

The reference and the R bracket. Comparison with the sky requires one decision about the reference: the sky imprint is taken to be the settled reading from which only the late en-route addition has been subtracted. The staircase of powers (μK^2): the theory point 542 → the pure SW plateau of the dictionary 700 → the settled sky imprint ~750-790 → the full observed Planck plateau (ℓ = 10-30) 833 (the known power deficit at large scales, −9 %) → the full standard fit 915; the familiar "observed $1.1\cdot 10^{-5}$" corresponds to the level of the full fit, not of the imprint. The outcome of the comparison: the theory point stands 14-21 % away from the sky imprint in amplitude - the bracket R = 1.14-1.21 depending on the reading of the reference - with the intrinsic accuracy of the dictionary dissection ~10 % and the statistical limit of the sky ~2.4 % (the cosmic variance of the few large modes). The log-center number $1.11\cdot 10^{-5}$ coincides with the familiar observed ripple to ~1 % and is retained as a Structural ID.

The potential of structures and σ_8. The potential that seeds structures is recovered from the observed ripple: $\Phi\_struct/c^2 = (\delta T/T)\_obs/\kappa\_c \approx 2.8\cdot10^{-5}$; with this potential, the relic amplitude, the potential of structures, and the observed clumpiness $\sigma_8 \approx 0.8$-1.0 converge simultaneously. The integrated effect along the ray for the adiabatic layer is standard (the decay of the potential after recombination and in the late epoch emerges from the calculation itself). And since the adiabatic contribution saturates the observed ripple, the direct contribution of the macrowave layer to the CMB is subdominant (no more than 20-30 % of the budget) - the CMB itself sets the ceiling on macrowave power at hundreds of megaparsecs (used in Proposition 13).

Dimensional check: $[\Phi/c^2] = (m^2/s^2)/(m^2/s^2)$ = dimensionless = $[\delta T/T]$ ✓

The lens and BAO

Lensing of the CMB is the deflection of a tracer photon on the potentials of live structure with the same factor of 4 ($\gamma\_PPN = 1$) as light deflection: the RMS deflection ≈ 2.5′, the peak $[\ell(\ell+1)]^2\cdot C^{\varphi\varphi}/2\pi \approx 1.4\cdot10^{-7}$ at $\ell \approx 40$-60 - the numbers coincide with general relativity; this is not a new prediction but a confirmation of "P = linear GR on live gravity". BAO is a fossil of the same dead $c/\sqrt{3}$ sound: the baryon shell froze at the sound horizon of the drag epoch,

$$r\_drag = 147.2 \text{ Mpc } (z\_drag = 1059)$$

which is +1.9 % above the photon $r\_s = 144.5$ Mpc owing to baryon inertia - matching the observed BAO ~147 Mpc. Two fossils of the same sound - the photon snapshot (the peaks) and the baryon shell (BAO) - lie on one native ruler; the snapshot instrument scales as H^2, which is precisely what places the BAO estimate of H_0 in the snapshot branch 67-68 (see "Expansion and the Hubble Node").

Status of the result: *Partially derived.* Closed at the mechanism level: the background (Friedmann from the horizon, $w = -1$, de Sitter as a regime of the medium itself); birth (the delta-act with capacity $b\_act = 1 - \omega\_p = 0.530$ and depth $T\_act = 134$-144 MeV - an identity with the QCD crossover at the Structural ID level; half-bag; zero post-birth production); the hot phase ($H \propto T^2$ as a native composition; $\Delta N\_eff = 0$ - a blind prediction, 0.32σ; nucleosynthesis $Y\_p = 0.2453$, 0.1σ; η_B −1.6 %; the exclusion of Guth's inflation with the clean bet $r \approx 0$); the Hubble knot (the snapshot/process theorem: 67.8 versus 71.6, the gap runs along the instrument line; the clock-agreement theorem; the arbiters are standard sirens and redshift drift, bet No. 31); the spectrum of the CMB (peak positions on the native $r\_s = 144.5$ Mpc, 1.4 % on average; the tilt $n\_s = 0.96658$, 0.40σ, bet No. 33; the amplitude $8.54\cdot10^{-6}$ with the transfer $\kappa\_c = 0.40$ and the bracket $R = 1.14$-1.21 to the sky imprint; lensing and BAO, $r\_drag = 147.2$ Mpc). Open: the exact percentages of the peak heights - a Boltzmann-class problem for the filled medium (the computational program, Conclusion, basket B); narrowing of the bracket for the age of matter by the expansion history of the early phase; the full program of the lensing spectrum $C^{\varphi\varphi}$.

Lagrangian formalism and the closure theorem

This section provides the general formal apparatus on which the derivations of the propositions rest: the explicit action of the P-field, the bridge to the principle of equivalence of masses, and the closure theorem (the observables as functionals of a single deficit δρ). The sector derivations and numbers are given in place, in the corresponding propositions; what stands here is their unified foundation, not a separate computational section.

The P-field action and the rest-energy formula

The explicit action of the n-mathematical model is given by a bispinor Lagrangian with a saturating self-interaction potential:

$$L_P = (i/2)\cdot[\bar{\Psi}\cdot\gamma^\mu\cdot D_\mu\Psi - (D_\mu\bar{\Psi})\cdot\gamma^\mu\cdot\Psi] - F(n)$$

$$F(n) = 2\cdot s_c\cdot[1 - \exp(-n/2\cdot s_c)], \quad F'(n) = \dot{\tau}(n) = \exp(-n/2\cdot s_c)$$

The potential $F(n)$ saturates at the scale $n \sim s_c$: for small perturbations it is quadratic, and for large ones it levels off onto the shelf $2\cdot s_c$ - this is precisely the finiteness of the medium's response. The derivative of the potential is exactly the rate of proper time, which ties the dynamics of capture to the slowing of clocks. The exact rest-energy formula for a stationary capture (LAG-3a), confirmed numerically to machine precision (a residual of order 10^{-15}):

$$E_{rest} = \omega_0\cdot Q + V - V'$$

Here ω_0 is the frequency of the internal phase rotation, Q is the conserved charge of the mode, and V and V' are the potential term and its virial derivative. The decomposition is $E_{rest} = M_{phase}\cdot c^2 + M_{visc}\cdot c^2$, where $M_{phase} = \hbar\cdot\omega_0\cdot Q/c^2$ is the phase part and $M_{visc} = (V - V')/c^2 > 0$ is the viscous part. Both components describe one phenomenon - the resistance of the medium; the division is purely technical, and it is incorrect to speak of a separate “share of the mass of viscous nature”.

Theorem on the non-variational nature of the hybrid dynamics. The hybrid dynamics of P-theory is not a system of Euler-Lagrange equations obtained from a single local Lorentz-invariant action functional of the standard single-field type $S[\Psi]$ that would simultaneously (1) select the physical hybrid branch of stationary captures, (2) yield the same functions of energy $E(\omega)$, charge $Q(\omega)$, and frequency ω, and (3) introduce no additional independent degrees of freedom of the medium. Physical configurations are selected not by stationarity of an action but by the dynamics of the flow-through medium: by the power balance, the finite healing-response time, and the viscous response of scale ρ_E/c.

Lock 1 (a necessary condition for a Lagrangian selector). If the physical branch were an extremal of a single Lagrangian functional at fixed charge Q, with the frequency ω playing the role of a Lagrange multiplier, then the Q-ball identity $dE/d\omega = \omega\cdot dQ/d\omega$ would hold along the entire branch. In the logarithmic elasticities $e_E = d \ln E/d \ln \omega$ and $e_Q = d \ln Q/d \ln \omega$ it is equivalent to $e_E/e_Q = \omega\cdot Q/E$. Direct computation on the hybrid branch violates it: at the proton point $e_E/e_Q = 0.838$ versus $\omega\cdot Q/E = 0.651$. Consequently, a single-field Lagrangian selector for this physical branch does not exist. This is not a claim about all conceivable actions, but a numerically verified negative result specifically for the physical branch within the stated class of selectors.

Lock 2 (an open steady state versus an equilibrium extremum). An action selects a configuration as an extremum of a functional - the bottom of an energy well. But the capture of P-theory is not the bottom of a well: it exists as an open non-equilibrium steady state through which the influx passes continuously - part of the power goes into the debit, part returns to transit - while the shape is held by the power balance, the finite healing-response time, and the viscous response of scale ρ_E/c, which return any deviation to the steady state. The selector of the physical state therefore has a flow nature (the power balance), not a variational one ($\delta S = 0$).

Lock 3 (openness of the phase subsector with respect to the medium). The dynamics is written covariantly with respect to the medium - through its 4-velocity U^μ - and in this form it is not a closed local Lorentz-invariant theory of a single field Ψ: the density $n = \bar{\Psi}\cdot \slashed{U}\cdot\Psi$ makes the equations depend on the state of the medium, so single-spinor local Lagrangian closedness does not apply to them without a preferred medium frame or additional degrees of freedom of the medium. Independent confirmation comes from the stress and scaling audit (violation of the Derrick and von Laue relations on the hybrid branch): it agrees with the first lock and shows the openness of the phase subsector Ψ with respect to the medium, while remaining a diagnostic rather than a universal prohibition, since the conditions of applicability of Derrick's theorem are restricted to static extremals of the energy.

Dimensional check: E, ω, Q are dimensionless quantities of the model; the identity $e\_E/e\_Q = \omega \cdot Q/E$ is an equality of dimensionless to dimensionless ✓.

Known limitations. The theorem does not forbid actions in general: the explicit local action of the n-mathematical model exists (see the previous subsection) and serves as the basis of the formal calculations. The claim concerns specifically the physical hybrid that reproduces the working branch of the theory, and the class of local single-field Lorentz-invariant selectors. A future non-local, medium-covariant, two-field, or dissipative apparatus of the open medium is not forbidden - on the contrary, the theorem points to the necessity of such an apparatus, one that includes the independent dynamics of the medium. The first lock has the status of numerical verification; the second and third - of ontological and structural derivation.

Status of the result: derived at the mechanism level; numerically verified by the identity along the branch at fixed charge. This is a negative result within a restricted class of local single-field Lagrangian formalisms, not an unconditional "no action". The absence of a single local action for the hybrid is not a gap in the theory but a classification feature: P-dynamics belongs to the class of open flow-through non-equilibrium stationary systems, in which the selector of the physical state is the power balance, not an extremum of an action.

Further program. From here, development does not search for the "lost Lagrangian of the hybrid" but builds the native apparatus of the open medium: two fields - the node Ψ and the healing-response b(x) - explicit stress compensation, a finite healing-response time, and a flow analogue of Derrick's theorem (scale neutrality of the flow-through budget instead of stationarity of the energy).

The bridge and the principle of equivalence of masses

The thirteenth structural element of the theory is the integral link between the deficit ledger and the field-energy ledger (historically, the "bridge"). A refinement of the theorem of the equivalence of masses: the observed mass is the integral of the deficit, not the integral of the Lagrangian energy density, and the two ledgers are related by a constant factor:

$\text{mass} = D = \int\delta\rho\cdot dV\ ;\ \ \int T^{00}\cdot dV = E\_rest\ ;\ \ \int\delta\rho\cdot dV = \lambda\cdot\int T^{00}\cdot dV\ ,\ \ \lambda = 1.4736$

Here $D = \int\delta\rho\cdot dV$ is the deficit ledger (the lag charge, Proposition 2): it is what gravity sees in the far zone (by Gauss's theorem), and it is what inertia resists. The integral $\int T^{00}\cdot dV = E\_rest$ is a separate ledger, the internal energy of the capture field; on the canonical profile the two are related by the constant $\lambda = \int\delta\rho/\int T^{00} = 1.4736$ (a conversion of units, a single number, it does not enter the mass). The factor λ is not universal - it is the regime of the node: the deep bispinor bag of the proton gives $\lambda\_p = 1.4736$, while the small-amplitude θ-quantum of the electron gives $\lambda\_e = 1$, the two ledgers coincide, and $m\cdot c^2 = \hbar\cdot\omega_0$ is read in a single ledger (Proposition 9; Appendix D.8). The pointwise form $\kappa\cdot\tau\_b = T^{00}$ is REFUTED by direct computation: the ratio $\kappa\cdot\tau\_b/T^{00}$ varies by a factor of ~10 along the profile (the interception is smeared over the entire depleted region, whereas T^{00} is peaked at the node), so the bridge cannot be written as a local field law - the link exists only integrally.

The equality of the three masses rests not on a pointwise bridge but on the unity of lag: one medium sees one lag charge D, so the gravitational (far-zone, via Gauss) and inertial (resistance to the motion of the lag) measures coincide with the debit one:

$M\_inert = M\_grav = M\_D = D$

This also yields the principle of equivalence of field energy: all rest energy is the energy that has left transit and gone into a local cyclic capture.

$m \cdot c^2 = \int\_M (\rho\_E - \rho(x)) \cdot d^3x \equiv D$

Dimensional check: $[\rho\_E] \cdot [V] = [J/m^3] \cdot [m^3] = [J] = [m \cdot c^2]$ ✓

The closure theorem: seven functionals of a single deficit

The main physical content: mass, inertia, gravity, and the strong interaction (in the local limit) are manifestations of a single quantity, the deficit $\delta\rho$. All observables are its functionals, classified by the character of their operational content. Seven functionals in three classes: local (class A) - the time rate $\dot{\tau}(x)$ and the core profile $\delta\rho\_core(x)$; single-object integral (class B) - the debit mass M_D, the inertia M_inert, the potential u(x), and the far-zone response F_D(x); relational (class C) - the operational distance d_A(A, B; Γ). As $\delta\rho \to 0$, the functionals of classes A and B go over into trivial values, and the domain of definition of d_A becomes empty - a world without matter has neither clocks nor rulers.

$\mathcal{F}$	Class	Functional	Regime	As $\delta\rho \to 0$
1	A local	$\dot{\tau}[n[\delta\rho]](x)$ - time rate	pointwise	$\dot{\tau} \to 1$
2	A local	$\delta\rho\_core(x)$ - core profile	pointwise	$\to 0$
3	B single-object	$M\_D[\delta\rho]$ - debit mass	integral	$\to 0$
4	B single-object	$M\_inert[\delta\rho]$ - inertia	accelerated motion	$\to 0$
5	B single-object	$u[\delta\rho](x)$ - potential	stationary	$\to 0$
6	B single-object	$F\_D[\delta\rho](x)$ - response	stationary	$\to 0$
7	C relational	$d\_A(A, B; \Gamma)$ - distance	radar protocol	Dom $\to \emptyset$

Gravitational lensing is an observable consequence of the joint action of functionals 5 and 7 (the potential and the radar length), not an independent functional. The $1/r^2$ law pertains to the surface and flux projections of the deficit, not to the volume density.

Computational results and summary tables

Computation in this theory is a verification layer and a numerical check of the physical picture, not its source. Below are collected the key numbers and the map of the levels of provability.

The criterion of the strength of a prediction: a prediction is the stronger, the less freedom of fitting it contains; the strongest case is when the scales cancel and the number of fitting parameters is zero, so that the agreement cannot be “tweaked”, because there is nothing to turn.

By this criterion it is useful to sort the results into two grades. The first is structural identities and ratios in which fitting is impossible by construction: the dimensionality $d = 4$ and the s_c cascade, $p = 1/5$, $\gamma = 5/4$, the 5/6 bridge; the ratio $m_H/m_W = \pi/2$, in which the scales E_{Dir} and m_q cancel; $\mu_p/\mu_n = -3/2$; η/ε. Here what matters is the structure itself, and the fraction of a percent is secondary. The second is the numerical predictions proper, computed without fitting to the given observable; genuinely independent among them are four: the gravitational constant G (through the α-sector), the W-boson mass, the proton mass (channel A), and the angle $\sin^2\theta_W$ at leading order. The fine-structure constant α, for its part, is the canonical ultraviolet INPUT (measured to eight digits), not a prediction: its +0.35 % at leading order is a self-consistency residual, while a reverse reading of the same equation yields G. The remaining numbers are derivative through powers of α or standard algebraic relations.

Four independent predictions

Quantity	Calculation	Dev.	Status
G (derivation via the α-sector)	$6.674415\cdot10^{-11}$ $m^3/(kg\cdot s^2)$	+0.0017 % (0.8σ CODATA)	**Derived**
m_W	80.293 GeV	−0.10 %	**Derived**
$\sin^2\theta_W = s_c$ (at the $4\pi v$ ceiling)	0.250	−0.36 % (ceiling) / +8.1 % (running to M_Z)	**Partially derived (the matching at the ceiling is derived - the channel-ceiling lemma; the condensate v - an imported scale)**
Proton mass (channel A, internal cross-check)	938.94 MeV	+0.071 %	**Numerical verification**

These are four independent numerical cross-checks after the inputs are fixed. Among them, the proton mass via channel A is an internal overdetermining cross-check (the scale is calibrated by channel B through the 5/6 bridge), not a prediction of the mass from scratch; the other three are numerical predictions proper. For the three numerical cross-checks without $\sin^2\theta_W$ the accuracy is at the 0.1 % level; $\sin^2\theta_W$ has the separate status of a leading-order value and does not enter this averaged figure. The angle $\sin^2\theta_W$ is taken at leading order (the running to M_Z has been computed: the structural 1/4 is a boundary condition at the channel ceiling $\Lambda_\xi = 4\pi v$, derived at the mechanism level (4π is the count of orientational channels; at the ceiling the deviation is −0.36 %), and only the native derivation of the condensate v remains open - Proposition 11), so its +8.1 % is not a miss of a precise prediction but two units of the standard running; it would be incorrect to keep it in the same weight class as the exact structural ratios. Two-loop refinement: the exact point of the 1/4 condition lies at 3.75 ± 0.11 TeV - the log pair of ceilings is split (the mechanism-level $4\pi v$ carries a residual of −0.40 %, the neighbor 16v is compatible with the exact point); the nature of the residual at the ceiling is open.

Structural consequences and derived quantities

Quantity	Formula / source	Value	Dev.	Status
m_H/m_W	π/2 (the scales cancel)	1.571	+0.8 %	**Derived**
μ_p/μ_n	−3/2 (spin-charge combinatorics)	−1.500	+2.7 %	**Derived**

Quantity	Formula / source	Value	Dev.	Status
η/ε	$11 \times 3/2$	16.5	+0.4 %	**Structural ID**
m_e	m_q·α^(5/4)·(1 + k·α), k = 5.10345	0.5110127 MeV	+0.0027 %	**Derived**
m_ν	m_q·√(ℓ_P/ℓ_b)	≈ 0.032 eV	within the window 0.009-0.050 eV	**Derived (ξ-theorem)**
a_0	$c \cdot H_0/6$	$1.18 \cdot 10^{-10}$ m/s²	≈ 1.5 %	**Derived**
n_s	1 − (d+1)·(−ln(1−ω_p))/L_IR	0.96658	0.40σ Planck	**Derived (assembly)**
Y_p	native H(T), Born rates	0.2453	0.1σ	**Numerical verification**
ΔN_eff	inventory of the medium's modes	0 (N_eff = 3.044)	0.32σ Planck (blind)	**Derived**
Positions of the relic-radiation peaks	r_s = 144.5 Mpc (c_s = c/√3)	220/522/823/1124/1426	mean 1.4 %	**Numerical verification**
δT/T	(m_q/M_P)^(1/4)·√(1−ω_p)	$8.54 \cdot 10^{-6}$	R bracket = 1.14-1.21 against the sky imprint	**Derived (assembly) + Structural ID**
Deuteron E_0	bound medium wave	−2.213 MeV	exp. −2.224	**Derived (mechanism) + Numerical verification**
Nuclear binding curve	α-aggregate assembly, without fitting	A = 8…100	RMS 0.348 MeV/nucleon	**Numerical verification**
α-decay (Geiger-Nuttall)	Gamow at the native r_0 = 1.15 fm	23 nuclei	24 orders of magnitude, RMS 0.34	**Numerical verification**
τ_p (proton stability)	pixel protection of the current loop	≫ 10^{34} years	Super-K ✓	**Derived (lower bound)**

A remark on the structural results: the first three rows are parameter-free structural ratios (in m_H/m_W = π/2 the scales cancel; μ_p/μ_n = −3/2 is spin-charge combinatorics; η/ε = 16.5 is a ratio of amplification factors): their weight lies in the structure itself, and the percentage deviations are secondary. The scale a_0 is native, but the shape of the rotation curve is an input; m_e is derivative through α^(5/4); G is derived by a reverse reading of the α-sector equation (0.8σ CODATA; Proposition 10).

Remark on 1/α: the theory does not predict the value of 1/α itself from scratch - α is the canonical ultraviolet input (measured to eight digits). Its +0.35 % at leading order is the self-consistency residual of the α-sector at a given ultraviolet scale; a reverse reading of the same equation derives that scale and, through it, G = ℏc/M_P² (0.8σ CODATA), so the link α ↔ G is a rigid structural prediction (see Proposition 10).

Remark on the references: for m_W both comparison values are given - −0.095 % (the CODATA/PDG world average [28]) and −0.105 % (the earlier value); the theoretical number remains one and the same.

Remark on channel A: the proton mass (channel A) is an overdetermined consistency check of two independent BVP channels, not an absolute prediction of the mass from scratch: the scale is calibrated by channel B (the 5/6 bridge and the experimental m_p), and the ratio (E_A/E_B)^(1/4) reproduces the observed mass with a deviation of +0.071 %.

Summary map of the derivation sectors

Sector	Key result	Status
Dimensionality and cascade	d = 4 from the incompatibility of A1+A2 (+ the spinor lock); s_c, p, γ, u_W, the 5/6 bridge - exact identities; seven anchors of d = 4	**Derived**
BVP core and calibration	E_A, E_s, E_B by two independent solvers (~1 ppm); proton channel A +0.071 %	**Numerical verification**
Frequency core ω_p	uniqueness - proven (flow, Lyapunov, single crossing of 3π/4); anatomy dissected (arctan/quadrature class); formula not found	**Numerical verification (input)**
α-sector and G	vertex 3/(4π), dressing measure 25/9; closure to +0.00002 %; reverse reading derives G (0.8σ)	**Derived**
UV scale ℓ_P	irreducible second input (no-go of four mechanisms, irreducibility theorem); the α ⟺ m_ν lock	**Empirical normalization (wall)**
Proton and structure	one coherent mode; threshold N = 3; size = open steady state R★ = ℓ_b; spin-½ from ξ; μ_p/μ_n = −3/2; “no free node” confinement	**Derived + Numerical verification**
Black hole	collective lag; ρ_crit = ω_p·ρ_E; the horizon and the ρ = 0 core are emergent; P-no-hair (B dissolves); ringdown ≡ Schwarzschild	**Derived**
Assembly of nuclei	r_0 = 1.15 fm; α-decay 24 orders of magnitude; deuteron −2.213 MeV; a_V = 25.2 ± 0.5; binding curve A = 8…100 RMS 0.348; finalization by niche inheritance	**Derived (mechanism) + Numerical verification**

Sector	Key result	Status
Gravitational sector (GR from the medium)	the static, post-Newtonian, and radiative sector of GR (the metric, the factor of 4, $\gamma = \beta = 1$, tensor GW at c, $16\pi G/c^4$); the nonlinear level - at the level of the apparatus ($G_{\mu\nu} \equiv 0$, Sakharov action); $\Delta N_{eff} = 0$ blindly	**Derived**
θ-sector and leptons	de Broglie $\lambda = h/p$ from the dispersion of the medium; m_e +0.0027 %; neutrino = ξ without θ-charge, Majorana, $m_\nu \approx 0.032$ eV	**Derived**
Weak sector	m_W, m_H from two readouts of the condensate U; π/2; $\sin^2\theta_W = 1/4$ at the 4πv ceiling; Wolfenstein angles	**Derived (mechanism) / Structural ID**
Cosmology and macrowaves	the birth delta-act; native BBN (Y_p 0.1σ); the Hubble knot = snapshot/process; peaks 1.4 %; n_s 0.40σ; amplitude with the R bracket; dark matter = macrowave (RAR, σ/m = 0)	**Derived (mechanism) + Numerical verification**

Conclusion and open problems

P-theory reduces all of observed physics to a single process - the isotropic inflation of the spatial field at rate c - and to an honest register of inputs: the structural dimension d = 4, the single low-energy calibration point (the proton mass), the irreducible numerical core of the frequency ω_p, and one ultraviolet scale M_P (equivalent to α). From this are derived the mass and structure of matter; gravity (the leading order of general relativity is reproduced under non-metricity and emergence; the translation of the linear deficit law into a metric reproduces the vacuum Einstein equations in the tested static and dynamic regimes - derived at the level of the apparatus: $G_{\mu\nu} \equiv 0$, an explicit Sakharov Lagrangian, nonlinearity a property of the metric description rather than a native nonlinearity of the P-field; the moving sector is derived - $\beta = \gamma = 1$, $\alpha_1 = \alpha_2 = 0$, Nordtvedt-$\eta = 0$, $v_{GW} = c$, the LLR and 10^{-7} limits are satisfied by zeros, spin-2 is checked term by term at quadratic order; the independent first-principles pinning of ℓ_P is adopted as a wall-input - there is no native candidate within the structure, as proved by an enumeration of mechanisms - while the value of G itself is derived through the α-sector, 0.8σ); electromagnetism and the fine-structure constant; the weak and strong sectors; the assembly of nuclei up to the absolute binding curve; antimatter; dark matter without hidden substance; the birth of matter without a singularity; and cosmological expansion without a separate dark energy. Calculation serves as the verification layer of the picture, not as its foundation.

The main discipline has been maintained: physics leads, mathematics expresses. Wherever the standard apparatus distorted the ontology, a native path was found (the hybrid formalism, the capture size as an open steady state, confinement as subthresholdness, baryon number as a geometric count).

The honesty of the register of inputs and statuses is not a weakness but a condition of testability. Below are the problems that remain open; each is stated precisely.

Open problems

The list is sorted into genre baskets (the section “On the genre of derivation”): what is open pertains to the theory's inputs and to future precision computation, not to the causal picture - the mechanisms in all sectors, including the birth of matter and the baryon asymmetry, are closed natively.

(A) The irreducible inputs of the theory. Not gaps, but the structure of the inputs of nature itself, and the status of each is causally clear. The frequency ω_p is the only irreducible numerical core established at the current level: the radial drainage flow carries a monotone Lyapunov functional and has exactly one fixed point (the Maslov phase crosses the $3\pi/4$ mark once, and its tail stays below the mark and yields no second root), whereas the value itself is not derivable by a closed formula, by the very nature of the number - it is assembled from arctan and quadratures (the class of reflection phases, not of cascade fractions), which is why five attempts to reduce it to a simple fraction failed, as they were bound to. This is an input, not an open problem: the point is selected uniquely, but a closed formula for the value has not yet been found, and its impossibility is not asserted. The ultraviolet scale (ℓ_P, equivalently $\alpha \Leftrightarrow M_P \Leftrightarrow G$) is the second, external UV input: the known internal routes to it yield a no-go obstruction (the local structure contains no α-independent generator of the Planck hierarchy - four mechanisms have been checked); with α chosen as the input, the whole triple is computed, $G = \hbar c/M_P^2$ to 0.8σ. The absolute first-principles pinning of the scale itself is adopted as a wall - the second input of the theory (there is no native candidate within the structure: the enumeration of four mechanisms gave a negative result; a future derivation is not forbidden - see “The ℓ_P Wall” in the section on the register of inputs), and it is linked to the cosmic coincidence problem (the $C_0 \propto H_0$ obstruction) - that is, it is an input of nature of the same kind as the Λ scale.

(B) The computational remainder. Absolute numbers of fine quantities; each is placed here for a specific reason, not as a gap in a mechanism. The basket itself is a working, shrinking one, and this has been demonstrated in practice: its largest item - the absolute binding energies of nuclei - is closed by a native computation. The deuteron gives $E_0 = -2.213$ MeV against the experimental -2.224; the binding curve of even-even $N = Z$ nuclei is assembled from $A = 8$ to $A = 100$ with an RMS of 0.348 MeV/nucleon without a single fitted parameter (RMS 0.196 on the core of the range, $A = 12…56$); the volume coefficient of the ideal crystal is $a_V = 25.2 \pm 0.5$ MeV/nucleon; the curve is finalized by inheritance of niches ($D_{live} \in [3.086; 3.136]$ fm). Six items remain in the basket: (1) the $O(\alpha^2)$ tail of the electron-mass dressing coefficient - an unresolved +0.074 % in the coefficient $k = 5.10345$ (+0.0027 % in the mass); (2) the fine order-unity coefficients of individual sectors - the bag tension, the strict dominance of the magic numbers 28 and 50 (distinguishing a rational fraction from a quadrature number requires precision values of G_0 and ω_p); (3) the exact heights of the peaks of the relic spectrum - a Boltzmann-class problem for the filled medium (the peak positions, the amplitude, lensing, and baryon oscillations are derived natively - Proposition 15); (4) the exact aberration coefficient C_0; (5) the nature of the -0.40 % remainder of the two-loop $\sin^2\theta_W$ layer at the ceiling $\Lambda_\xi = 4\pi v$; (6) the absolute magnetic moment of the proton μ_p (~7 % - a computational remainder; the structural ratio $\mu_p/\mu_n = -3/2$ meanwhile stands at +2.7 %). All of this is computable in principle and lies below the pithy level - the signature of a causal theory, not a defect.

(C) Native polishing. Promotion of already derived relations from the Structural ID level to theorem-level. Most of the basket is closed at its own level and does not count as open: the rigorous ξ-sector theorem for the neutrino mass is proved (the phase channels are exhausted by the equation, the lock discriminator - Proposition 9); the first-principles screening factor is proved (the two-filter transfer lemma, K_norm = d(d+1)/(d+2) = 10/3); the mechanism of the bridge correction is proved (the price of the self-response slot), the R × ω^(5/6) scaling is closed by the two-sector elasticity theorem, and the link between the proper and coordinate time of cosmology - by the clock-agreement theorem; the nonlinear and moving metric (G_μν ≡ 0 in statics and dynamics), the canonical two-level model of the proton (which simultaneously reproduces ω_p, the size ℓ_b, the baryon number, and the empty center), and the O(1) factor of the proton size (the saturation bracket theorem) are also closed. Four items remain: (1) the multiplicity of neutrino masses and flavor oscillations - apparently outside the native scope of the first version; they belong to an extension of the theory, not to its gaps; (2) the quantitative rate of above-barrier events for the proton lifetime - the theorem of baryon-number conservation itself is proved in conditional form (Proposition 2), with bet No. 7 as the external arbiter; (3) the expansion history of the early phase - narrowing the bracket for the age of matter; (4) the exact normalization of the Casimir effect - the mechanism is native (the shift of the spectrum of the medium's allowed modes between boundaries), the numerical coefficient remains open.

Summary. The native first version of the theory has integrity: the causal picture is closed across all sectors - from the ontological basis to the assembly of nuclei, from the birth of matter to the relic spectrum - and closed without a single borrowed mechanism. The inputs are localized and honestly counted ({d = 4} + {m_p} + {ω_p} + {M_P}), the computational remainders are named and attributed to specific causes, and not one of them points to a defect in a load-bearing link. What is open in this theory is not cracks in the picture but coordinates for further computation: the theory knows what it does not know, and presents that knowledge as a testable list.

Known objections and replies

Gathered here are the five strongest objections the work will meet, together with condensed replies and references to the sections where the argument is given in full. The section has been added deliberately: the theory is obliged to know its vulnerable points better than the reviewer.

Objection 1 - the derivation of d = 4. "The argument against the tensor loophole - 'δ_{ij} is a metric, and there is no metric in the background' - undercuts its own construction: A1 is invariant under E(3), and E(3) and the measure d^3x already carry a Euclidean structure."

Reply. The theory distinguishes three layers of geometry; the auxiliary Euclidean structure is a legitimate language of notation, in which both A1 and the lemma itself are formulated, and what is forbidden is only the assignment of operational status to the auxiliary (T.1). The decisive point: the loophole is closed even without this argument - by the two physical locks of Theorem 1′ (the transit ceiling ρ_E·c against the irremovable growth $|J| \geq q_0 \cdot R/3$; the operationally distinguished center against the homogeneity of A1), which use only A1, A2, LT, and volume/area scaling. Overdetermination completes the case: seven independent sector anchors ($\sin^2\theta$_W, γ = 5/4, p = 1/5, the 5/6 bridge, α^(5/2), the elasticity of matter p_n = H, the agreement of the cascade and charge routes of the screening shift) give one and the same d = 4. The single dimensional postulate - the three-dimensionality of space - has also been removed: it is derived from the theory's own spinor structure F2.3 (the spin-½ of the carrier $\xi \in \mathbb{C}^2$); see "Closing the three-dimensionality postulate" in the derivation of the dimension. No free dimensional inputs remain.

Objection 2 - reproducibility of the numerical core. "The self-consistent response and the values ω_p, E_A, E_s, ε, the factor 16.5 cannot be derived from the text itself."

Reply. Appendix D is self-contained and writes out the core in full: the boundary-value problem system with its boundary conditions and a precision computation protocol (shooting, the r_match scan with an analytic tail, the limits r_match → ∞, virial control $\sim 10^{-13}$); the three frequencies with an explicit status assignment of the working convention and of the exact Maslov root; the reference energies, reproduced by independent solvers with ~1 ppm agreement; the calibration chain $m_p \to E_B \to m_q \to \rho_E \to \ell_b, \tau_b$; the derivation of G, the electroweak masses, and the electron mass; the status breakdown of $\eta/\varepsilon = 16.5$ factor by factor. All key numbers of the monograph are reproducible from this appendix without recourse to external materials.

Objection 3 - the cosmological history. “The de Sitter regime H = const clashes with H(z) from supernovae, baryon oscillations, and the relic background; the data hint at an evolution of w; helium-4 is the most sensitive of all to the rate.”

Reply. The background cosmology of P-theory is degenerate with ΛCDM: Friedmann is derived from the horizon, $w = -1$ refers only to the background component, the full census (matter, radiation) is diluted in the standard way, so H(z) is higher in the past, just as observed; de Sitter is the regime of the medium itself and the asymptotics of the future. The rate in the nucleosynthesis window is a native composition ($H \propto T^2$: Friedmann from the horizon × a bath of massless θ-modes in d = 3), the helium-4 yield is computed at the native rate ($Y_p = 0.2453$, a 0.1σ hit), and the bypass branch H = const is a native negative result (Proposition 15). Strict $w = -1$ is a falsifiable bet of the theory (No. 6 of the register); remarkably, the theory's own alternative branch (process density ∝ H) has already been excluded by the theory itself on H(z) (>5σ): the theory cuts its own branches with data rather than retreating into flexibility.

Objection 4 - the multiple-comparisons effect. “The short ratios π/2, $cH_0/6$, 16.5 are, taken singly, weak evidence: the space of simple combinations of π and small rational numbers is large.”

Reply. (1) The cascade is not a set of independent knobs but algebraic identities of a single parameter d = 4, measured by five unrelated sectors. (2) The theory's behavior is the inverse of fitting: it honestly recomputes its most striking numbers through the single calibration point - the “striking” precision of m_W and m_p, which rested on a rounded calibration, has been recomputed honestly, and 1/α has been declared an ultraviolet input rather than a prediction; an enterprise engaged in fitting does not revise its own best numbers. (3) A blind discipline has been introduced and applied three times: $\Delta N_{eff} = 0$ was written down before the comparison with Planck (0.32σ agreement); the hypothesis $\omega_d = 8/17$ was registered with kill criteria before the calculation - and rejected by it; the current measure 25/9, derived in the weak sector, blindly predicted the electron-mass remainder in a foreign sector (+0.0027 % in the mass) - a cross-test before the computation, not a post-hoc explanation. An enterprise engaged in fitting does not kill its own beautiful fractions by protocol; the full history of the blind protocols is Appendix F. (4) The worst row of the summary table, $\sin^2\theta_W$, is resolved by the standard running: the structural 1/4 sits at the TeV boundary - the two-loop layer places the exact point $\sin^2\theta_W = 1/4$ at μ = 3.75 ± 0.11 TeV. (5) The Bullet Cluster receives a self-anchoring mechanism with three falsifiable consequences (Proposition 13).

Objection 5 - absence of positioning. “The text contains not a single bibliographic reference, even though the theory has obvious relatives.”

Response. The section “Position among related approaches” and the reference list have been introduced; the relatives are named one by one - and the parallels work in the theory's favor: individual blocks of it (induced gravity, the exterior Schwarzschild metric, Q-balls, bag confinement, the Milgrom scale) are already recognized in the literature as physically meaningful. The novelty of P-theory is that these blocks are derived from a single medium with a single register of inputs.

Position among related approaches

P-theory does not arise out of nowhere: almost every one of its blocks has a recognized relative, and an honest kinship map shows continuity and novelty at the same time.

Emergent gravity. The idea of gravity as an induced effect of a medium goes back to Sakharov [1]: curvature enters the effective action from vacuum fluctuations, $1/G \propto 1/\ell\_P^2$ - in P-theory this is a directly used mechanism (Proposition 5, Lemma A). Jacobson's thermodynamic derivation of the Einstein equations [13] and Verlinde's entropic gravity [14] are relatives in the spirit of "gravity is not fundamental"; Deser's bootstrap [16] is a tool used at the nonlinear level. Analogue gravity (Unruh [2]; the review by Barceló-Liberati-Visser [3]) and Volovik's superfluid vacuum [4] provide acoustic metrics and emergent quasiparticles; the known boundary of this family is that analogue models reproduce the kinematics (the metric) but not the dynamics (the field equations), and diverge from GR at nonlinear order. P-theory goes further precisely at this point: it reproduces not only the metric but the structure of the linearized Einstein equations with the coefficient $16\pi G/c^4$, $\beta\_PPN = 1$ at 2PN, and the purity of the TT sector (Proposition 5) - with an operational rather than fundamental metric. The exterior Schwarzschild metric in P-theory is not postulated but emerges natively from rarefaction (cavity + c-transit + two ledgers, envelopment); the Painlevé-Gullstrand river form [6] and its exposition by Hamilton-Lisle [5] are merely an equivalent coordinate representation of the same solution, useful for symbolic cross-checking, but not a mechanism.

Soliton matter and nuclei. Coleman's Q-ball [7] is a direct relative of the P-particle (Proposition 2); the Vakhitov-Kolokolov stability criterion [8] is used in checking the irreducibility of ω_p. The MIT bag model [9] is a relative of P-bag confinement, with the bag constant cross-checking the calibration of ρ_E. Skyrme [10] is a contrast relative: baryon number as topological winding is rejected in P-theory in favor of a geometric count of closed bag units. Alpha-cluster models of the nucleus (Hafstad-Teller [17]) and the Mayer-Jensen shell-model spin-orbit coupling [18] are comparison points for the nuclear sector: P-theory reproduces the clusters as geometric closures of packing and gives the spin-orbit coupling a native sign and scale.

Galactic dynamics. Milgrom's scale a_0 [11] and the radial acceleration relation [12] are not postulated in P-theory: $a_0 = c \cdot H_0/6$ is derived, and the carrier is a deficit of the field, not a modification of inertia. The theory separates from MOND at the Bullet Cluster (mass follows the potential, not the baryons), and from particle dark matter through the identity $\sigma/m = 0$ and the prediction of re-centering in old merger remnants; a relative by medium is superfluid dark matter [26].

Cosmology. The large-number coincidence, which comes down to the theorem $C_0 \propto H_0$ (Proposition 5), is the modern form of Dirac's observation [15]; the semi-analytics of nucleosynthesis follows Bernstein-Brown-Feinberg [19].

Methodological demarcation. Three disciplines separate this work from numerological constructions (Eddington [20], Wyler [21]): mechanism before number (every ratio carries a physical chain), the nine epistemological statuses with explicit marking of circularity, and the practice of honestly recomputing one's own results through a single calibration point. From Le Sage's push gravity [22] it is separated by a fundamentally different carrier: the far-zone response of the medium itself to a deficit, not a flux of corpuscles; the classical objections to Le Sage (heating, aberrational drag) do not apply to a field response.

Mathematical core. The capture boundary-value problem (Proposition 2, Appendix D) is, by type, a nonlinear Dirac field with saturating self-coupling - the line of Ivanenko [33] and of the Soler soliton [34], whose stability under dilations was studied by Strauss-Vázquez [35]; P-theory adds to this object a physical interpretation (mass as lag, the 5/6 bridge, calibration to m_p) and a saturating potential of the medium, rather than introducing it as an abstract field model. The gravitational Theorem 1′ has its ancestry in the Seeliger-Neumann paradox [31] and the Newtonian cosmology of Milne-McCrea [32].

The bottom line of novelty: (1) operational non-metricity with three layers of geometry; (2) the derived dimension d = 4 with overdetermination by five anchors; (3) one medium for all sectors with the register of inputs {d = 4} + {m_p} + {ω_p} + {M_P}; (4) the status discipline, which makes every claim testable by rank.

Falsifiable predictions

The theory is testable. Its direct consequences are formalized in a project-wide register of bets announced in advance: every prediction is numbered, equipped with an outcome criterion, and fixed before comparison with the data; the full formulations and outcome criteria are in Appendix E. The register deliberately keeps not only the hits: it contains a lost position and positions withdrawn by the author - a falsification contour separating a theory from an irrefutable interpretation is obliged to show such rows too.

A distinct feature of this testability is integrity, and it works not as aesthetics but as risk. Phenomena here cannot be switched off one at a time: remove inflation - and time, mass, gravity, and expansion vanish all at once, because they are all manifestations of a single process. The theory has no independent modules that could be adjusted separately to fit each fact. The theory's integrity raises its falsifiability: an error in one load-bearing link cannot be repaired locally by an independent fit of a separate sector. Unity here is a bet on testability, not an argument from beauty.

The table gives a cross-section of the register: bet number, prediction, external test, and current outcome. The merged rows follow the register: Nos. 8-10 are a single package of hadronic probes, Nos. 12 and 21 are a single withdrawn branch. Bets No. 24, No. 25, and No. 27 belong to the applied branch - the transfer of medium mechanisms to engineering systems: they test not the foundation of the theory but the reach of its arm.

Bet No.	Prediction	External test	Outcome
№1	ΔN_eff = 0 (N_eff = 3.044): no sterile ξ-modes, no thermal TT ripple, no medium scalar; recorded blindly before the comparison	Planck: 0.32σ ✓; the decisive test - CMB-S4 (σ ≈ 0.03)	Pending
№2	m_ν ≈ 0.032 eV - incoherent accumulation of the pixel lag ℓ_P along the chirality axis	the cosmological sum Σm_ν; direct kinematic measurements	Pending
№3	the neutrino is Majorana: ν = ν̄ at Q = 0 ⟹ neutrinoless double β-decay is allowed	next-generation 0νββ experiments	Pending

Bet No.	Prediction	External test	Outcome
№4	GW are purely tensor (only the + and × polarizations; the scalar - the Jeans regime, collapse, not radiation); no excess damping: predicted suppression $S = 1.4\cdot10^{47}$ at the source	GW170817: $v\_GW = c$ ✓; polarization analysis of merger catalogs; GWTC-3 bounds on extra damping met with a margin of $\sim10^{7}$	Pending ($v\_GW = c$ ✓)
№5	$\beta\_PPN = \gamma\_PPN = 1$; preferred-frame classes $\alpha_1 = \alpha_2 = 0$; Nordtvedt-$\eta = 0$ - derived zeros of the moving sector	Cassini (γ); deviation of β from unity $< 10^{-4}$; LLR; 10^{-7} limits on the α-classes	So far ✓
№6	baseline $w = -1$ strictly (the background component; the full census is diluted by matter and radiation in the standard way)	H(z), BAO, supernovae, standard sirens	Partial (the $\rho \propto H$ branch lost on H(z), $>5\sigma$, and retracted)
№7	the proton is stable: $\tau\_p \gg 10^{34}$ years (a conditional baryon-number conservation theorem; the geometric count B)	Super-Kamiokande, Hyper-Kamiokande	Pending (so far ✓)
№8-10	spin and hadronic probes: the spin fraction ΔG is decomposable into orbital contributions; Bjorken sum $g\_A/6 = 0.2030$ (P-theory value $g\_A = 1.2178$)	polarized deep inelastic scattering (EIC-class program)	Pending
№11	analogue of the σ_el/σ_tot ratio from the classical capture run	data on elastic and total hadronic cross sections	Lost (classical run)
№12, 21	void branch: kinematic explanation of the Hubble knot by a local underdensity	withdrawn from testing; revision history - Appendix F	Withdrawn by the author
№13	the dark matter particle does not exist: $\sigma/m = 0$ identically (the deficit is a functional of the field, not a substance)	direct and indirect particle searches; recentering of the deficit in old merger remnants	Pending
№14	the sixth digit of ω_p - the bridge bracket: 0.470170(1) (the bridge is defined on the exact root $\omega\_s\bigstar$) versus 0.470160(1) (five digits exact); an outcome outside both bands refutes the form of the bridge correction	appearance of an operational sixth digit of ω_p (a precision channel outside the bridge pair)	Pending

Bet No.	Prediction	External test	Outcome
№15	hereditary quantization: the discreteness of levels of bound systems is inherited from integer phase closures of the medium rather than postulated anew at each level	spectroscopic ladders; the electron's internal tick: the observable frequency is $2\omega_0$ (the bare ω_0 is unobservable), channeling [30] has not been independently reproduced and is explained by standard Dirac dynamics - consistent, but does not confirm	Partially checked
№16	there is no fundamental decoherence floor: decoherence is entirely a provocation by the surrounding medium; no intrinsic collapse tempo exists	macro-interferometry of growing masses; levitated oscillators; tests of objective-collapse models	Pending
№17	$r \approx 0$: there are no primordial tensor modes (Guth's inflation is excluded); B-modes of the CMB will not appear at a measurable level	LiteBIRD, CMB-S4 (polarization B-modes)	Pending
№18	mature structures at early z: the growth of structures outpaces the standard expectations of the early epoch	deep counts by JWST and its successors	Pending (JWST in favor)
№19	the radial-acceleration law with $a_0 = c \cdot H_0/6 = 1.18 \cdot 10^{-10}$ m/s²: the intrinsic scatter of the law is zero; all the observed scatter is measurement scatter	RAR statistics over SPARC-class samples	Pending
№20	the dark component is cold: there is no wave fuzzy cutoff of small-scale structure (soliton cores, suppression of dwarfs - signatures of a $\sim 10^{-22}$ eV quantum)	the mass function of dwarf halos; lensing of substructures; the Lyα forest	Pending

Bet No.	Prediction	External test	Outcome
№22	the relic amplitude is closed onto the potentials of structures: δT/T = (m_q/M_P)^(1/4)·√(1−ω_p) = $8.54\cdot10^{-6}$ at Φ_structures ≈ $2.8\cdot10^{-5}$ - both sides are computed from the same field constants	joint cross-check of the sky imprint (the R bracket = 1.14-1.21) and the depth of the potentials of mature structures	Pending
№23	the magnetic monopole does not exist: ∇·B ≡ 0 is an identity of the θ-field's structure, not an initial condition	monopole searches (MoEDAL-class, cosmic passages)	Pending
№24	the disruption invariant β_N·q = const in tokamaks - an applied branch	disruption databases of operating tokamaks; ITER	Partial; null-leaning
№25	a disruption predictor based on the critical slowing down of confinement signals - an applied branch	prospective trials of the predictor on operating machines	Pending
№26	Fe Kα line profiles are explainable without extreme spin: a high Kerr spin is not required	X-ray spectroscopy of accreting black holes (XRISM-class)	Pending
№27	a zero-shot predictor of qubit coherence times from medium parameters, without training on the device - an applied branch	cross-platform coherence-time data	Pending
№28	crystallinity of P-matter: the ideal dense phase is strictly crystalline - positionally (closest packing, φ ≈ 0.74) and chromatically (4 sorts with no same-neighbors); there is no liquid nuclear phase at ρ_0 and T → 0	incompressibility; the giant monopole resonance; the equation of state of dense matter	Entered
№29	the nuclear binding curve from α-assembly: B/A of even-even N = Z nuclei on purely field inputs - A = 12…56 with RMS 0.196, assembly A = 8…100 with RMS 0.348 MeV/nucleon without fitting; real nuclei are an α-aggregate, neither a crystal nor a liquid; the wave ^{8}Be is unbound	mass spectrometry outside the range; the N ≠ Z valley; a dip in Q_α at geometric closures of the packing (the island of stability)	Entered (A = 12…56 ✓)

Bet No.	**Prediction**	**External test**	**Outcome**
№30	local position invariance in α is exact: k_α = 0; there is no drift and no potential dependence of the fine-structure constant	clock comparisons at different potentials; astrophysical spectra	Pending
№31	standard sirens will give a high $H_0 \approx$ 71-73 km/s/Mpc in both the global ($z \gtrsim 0.1$) and the local ($z \lesssim 0.03$) sample - the snapshot/process theorem: instruments with a material ruler (census via the sound horizon r_s) read the snapshot $\propto H^2$ and give 67.8, synchronous tracers read the process itself $\propto H^1$ and give 71.6, the split runs along the instrument line; a reliable ~67-68 from sirens in any sample beats the bet - the theory has no fallback explanation of the Hubble knot	accumulation of standard sirens (LIGO/Virgo/KAGRA, next-generation detectors); redshift drift	Pending
№32	there is no deep local void: the matter contrast on spheres of 200-450 Mpc does not exceed 0.05-0.10 in absolute value (direct dynamics gives ~0.02; the relic-radiation budget cuts the macrowave contribution to ≤ 0.046); the “void” of −0.3 seen in galaxy counts is bound to dissolve into counting systematics	independent contrast maps - counts plus lensing; a contrast ≤ −0.2 confirmed by two methods beats the bet	Pending
№33	the phase-slot payment fork in the spectral tilt: n_s = 0.9665 (the slot pays) versus 0.9732 (the slot is free of charge); the baseline prediction 0.96658 stands 0.40σ from the observed value	the next generation of n_s measurements with σ ≈ 0.002 (CMB-S4) - a separation of the branches by more than 3σ	Pending
№34	the ladder echo - a log-periodic ripple of the sky imprint: $\delta\ln P = -A\cdot\sin(2\pi\cdot\ln(k\cdot R\_lim)/T)$; the period $T = -\ln(1-\omega\_p) = 0.635$ and the phase (zero	next-generation E-polarization (Simons Observatory class); the first Planck measurement is structurally uninformative in the	Pending

Bet No.	Prediction	External test	Outcome
	at $k = 1/R\_lim$) are fixed by the theory, only the size is free; the phase-slot amplitude is derived: $A = \varepsilon\_E \cdot T/\pi = 0.00135$ (the quenching lemma: memoryless transit payments leave no ripple - memory is carried only by the phase ledger)	temperature channel	

A number of confirmed comparisons live in the sector status tables and are not formalized as separate register numbers. The chief among them is the single forward collider consequence: the structural angle $\sin^2\theta\_W = 1/4$ at the TeV boundary. The two-loop layer places the exact point $\sin^2\theta\_W(\mu) = 1/4$ at $\mu = 3.75 \pm 0.11$ TeV; at the channel ceiling $\Lambda\_\xi = 4\pi v$ the residual is −0.40 % (−0.36 % in the one-loop count; the nature of the residual is basket (B) of the Conclusion), while the 16v scale is compatible with the exact point; the standard running to M_Z reproduces the observed value (+8.1 % from 1/4 - imported result). The matching is a Structural ID, not a prediction of a new particle; it is tested by the precision of the running and by TeV-scale physics. To the same set belong: the merger energy release $E\_GW/M \approx 5.7$ % versus ~4.6 % for GW150914; the mass limit of compact collective lags $M\_max \sim 2.7$-3.1 $M\_\odot$ (tested by merger statistics); the structural ratio $\eta/\varepsilon = 16.5$ versus the observed 16.4 (0.4 %) and the nucleosynthesis yield $Y\_p = 0.2453$ (0.1σ) with a live precision test on deuterium ($\eta\_B = 6.02 \cdot 10^{-10}$, −1.6 %). The contour is closed: every row has an external arbiter, and not one is shielded from it by caveats.

Appendices

Appendix A. Glossary of key terms

The first ten rows reproduce the summary glossary of the ontology; after them come the working terms of the text, used across the sections. Here ω inside $\{1, \omega, \omega^2\}$ is the root of unity $e^{(2\pi i/3)}$, not a frequency.

Term	Meaning
Inflation of the field	Continuous influx of energy q_0 into every point of the 3D manifold and transit at rate c. An ontological property of the field, not cosmological inflation.
Capture	Local desynchronization with the inflation: a region where part of the influx is looped into internal circulation instead of free transit.
δρ (deficit)	$\rho\_E - \rho(x,t)$. The primary physical quantity; mass, inertia, gravity, and the strong response are its functionals.
M_D (debit mass)	D/c^2, where $D = \int \delta\rho \cdot dV$. The mass observed in gravity; distinct from the total circulating energy of the capture.

Term	Meaning
$\dot{\tau}(n)$	The local rate of proper time, exp(−n/2s_c). As δρ → 0 the rate tends to 1 (the free background).
d_phys	The physical distance structure: it exists only between captures through the radar-ranging procedure; the field is operationally non-metric.
ω_p	The dimensionless frequency of the proton mode (≈ 0.47016) - a direct measure of desynchronization; the irreducible numerical core.
P-bag	A connected region of depleted medium held by the healing-response field b(x); the native realization of confinement.
Phase slots {1, ω, ω^2}	Three distinguishable phase directions of the three-node winding (Σ = 0 gives the closure B = 1). Not “color”: there is no color in P-theory.
Collective lag	The merging of the conserved deficits of many captures into a single macroscopic desynchronization - the mass of a black hole.
Ledger	A way of accounting for one quantity by two projections with a single currency and a single exchange rate: the internal and external ledgers of time (the ticks of circulation versus the radar survey), the ledgers of deficit and flow-through, the two ledgers of pressure in the stress tensor. The identity of the ledgers is a working verification tool: two ledgers, one currency; a divergence of the ledgers signals an incorrect formulation (the history of revisions - Appendix F).
Sieve	The hierarchical distribution of the exhalation of the birth act “from the whole to the parts”: each rung splits the structure at an invariant price, which imprints the red tilt of the spectrum n_s without running and without an inflaton.
Ladder (of the imprint)	The hierarchy of distribution steps from the infrared frame down to the grain: a storey is a capacity of the field; the price of a step is invariant (ε_E = −ln(1−ω_p)/L_IR = 0.0067); the depth L_IR = ln(R_lim/ℓ_b) = 95.0 sets the tilt n_s. A separate object of the same name - the “ω ladder”: reproduction of the core frequency without boundary-value shooting.
Imprint (of the sky)	The settled reading of the sky - the final record of the act of birth in the spectrum of the CMB. Amplitude comparisons are carried out “to the imprint” (the R bracket = 1.14-1.21); the log-center $1.11\cdot10^{-5}$ is the level of the pure imprint (Structural ID).

Term	Meaning
Slot (channel)	A cell of the channel ledger of a step: d transit directions plus a phase one; the fraction of visible slots (d+1)/(d+2) = 5/6 is the channel ledger of the bridge. The slot count sets the price of transmitting unevenness through a step; the self-response slot - the bridge correction $(1 - s_c/E_B)$; the phase-slot payment fork - bet No. 33 (Appendix E).
Flow-through	The regime in which the transit flow of the medium of one capture passes through the tail of a neighboring one; the overlap of flow-through tails yields the nuclear attraction (a well of ≈ 37 MeV) - the native mechanism of deuteron binding and of the volume term a_V.
Integrity	The indivisibility of a stable capture as a process: a node cannot be densified, displaced, or cut without destroying the closure. Integrity holds the packing of matter (the ban on same-neighbors and on random liquid packing) and works as a risk: the sectors of the theory cannot be adjusted separately.
Integrity wall	The minimal approach distance of two nodes (2.086 fm for nucleons), closer than which the neck dissolves and the closure is destroyed; it sets the hard core of nuclear packing; the αα wall D* ≈ 3.0 fm is its projection.
Distinguishability	The status of configurations whose budgets add up by densities $\Sigma\|\psi_j\|^2$ rather than by the amplitude $\|\Sigma\psi_j\|^2$: the cross terms are quenched, the branches do not interfere. The nucleus is a cluster of distinguishable nucleons; distinguishable configurations pass through one another elastically when the ledger is full.
NESS	Non-equilibrium steady state - an open dynamical steady state of the power balance: a stable capture lives on flow-through (influx = discharge), not in static equilibrium. The canonical example is the NESS proton (integral deficit −0.9 %, frequency +2.2 %, static flow - inflow everywhere).
UV-core (UV input)	The second external input of the theory - the ultraviolet scale: the bundle $\alpha \Leftrightarrow M_P \Leftrightarrow \ell_P \Leftrightarrow m_\nu$, with canonical representative α = 1/137.035999177. Internal routes to it yield a no-go obstruction (“the ℓ_P wall”); an independent first-principles pinning of the scale is open.

Term	Meaning
Channels A and B	The two channels of the BVP core. Channel A - the proton mode ω_p (energy E_A): an independent check of the proton mass (+0.071 %). Channel B - the bridge mode $\omega\_d = (5/6)\cdot\omega\_s$ (energy E_B): calibration of the scale, 0 % by construction. The pair makes the single experimental point m_p simultaneously an input and a check.
α-aggregate	The real structure of the nucleus: rigid α-tetrahedra linked by axial bonds and frozen in by hot assembly; it reproduces the binding curve (A = 12…56, RMS 0.196 MeV/nucleon) without fitting. The ideal crystal of P-matter ($a\_V = 25.2 \pm 0.5$ MeV/nucleon) is not realized by real assembly.
O-position	An ontological position of the theory (class O): a claim at the level of ontology, fixed as a stance rather than as a derived result; in status breakdowns it is marked explicitly and kept separate from derivation statuses.

Appendix B. Examples of dimensional checks

Dimensional check: $[q_0]\cdot[\tau\_b] = [J/(m^3\cdot s)]\cdot[s] = [J/m^3] = [\rho\_E]$ ✓

Dimensional check: $[c]\cdot[\Delta\tau] = [m/s]\cdot[s] = [m] = [d\_A]$ ✓

Dimensional check: $[\rho\_E/a\_rad]$^(1/4) $= [J\cdot m^{-3} \div J\cdot m^{-3}\cdot K^{-4}]$^(1/4) $= [K^4]$^(1/4) = K = [T_peak] ✓

Every numerical result of the theory is accompanied by such a dimensional check; given here are only characteristic examples: the background identity, the operational distance, and the temperature peak.

Appendix C. Remark on the status of the document

The document is a completed native first version of the theory. The section on the ontological basis is presented in accordance with the theory's main document and is expanded here as a self-contained part. The other sections give, for each sector, the physical picture, a detailed derivation, and an honest epistemological status; the derivations are integrated directly into the propositions rather than moved into a separate computational appendix. The summary tables are synchronized with the text in the present edition; every epistemological status is accompanied by a causal justification. The register of falsifiable bets is compiled in Appendix E, the blind protocols and the history of revisions in Appendix F; the full working register of bets and the materials of the computational cycles are kept in the project archive.

Publication and version: the monograph is deposited in the open archive Zenodo - DOI 10.5281/zenodo.21289412 (https://doi.org/10.5281/zenodo.21289412), version 1.0, license CC BY 4.0. The deposit includes the Russian original (PDF), the present English translation (PDF; file P_Theory_Monograph_2026_EN), and the archive of computational programs

P_Theory_solvers_core_v2.zip (54 key computational scripts with a README and a data book; Appendix D.12): reproducibility of the core numbers requires no access to the project's working archive. The deposit is versioned - subsequent editions receive their own version DOIs within the common record; the history of substantive revisions is in Appendix F. The full publication details and citation rules are on the verso of the title page.

Appendix D. Reproducibility of key numbers

The purpose of this appendix is to make the monograph self-sufficient: all key numbers are reproduced from the specification given here, without recourse to external materials.

D.1. Dimensionless BVP core

System. The s-wave system (auxiliary units; s_c = 1/4); by mathematical type this is a nonlinear Dirac field with saturating self-coupling - an object in the line of Ivanenko [33] and Soler [34] (stability under dilations - Strauss-Vázquez [35]):

$$G'(r) = (\omega + \dot{\tau})\cdot F \;; \quad F'(r) = -(\omega - \dot{\tau})\cdot G - 2F/r \;; \quad \dot{\tau} = \exp(-(G^2 + F^2)/(2s\_c))$$

Boundary conditions and shooting. Boundary conditions: $F(0) = 0$, $G(\infty) = 0$; asymptotics $G \sim \exp(-\kappa r)/r$, $\kappa = \sqrt{(1 - \omega^2)}$. The ground state is found by shooting in G_0: a scan over $G_0 \in [1.10; 1.55]$, bisection on the sign changes of G(r_match), and selection of the minimal decaying root.

Precision protocol. Essential at the precision level: shooting “to zero at a finite r_match” systematically shifts the energy - a solution with G(r_match) = 0 is not an asymptotic tail, and at r_match = 12-13 this tail systematic amounts to ≈ +1.4 ppm in energy. The precision protocol: a scan over r_match = 12/14/16/18 at fixed grid density (2000 points per unit length, DOP853, rtol = 10^{-13}) with the analytic tail ∫_{r_m}^{∞} ω·n·r²·dr ≈ 4π·ω·n(r_m)·r_m²/(2κ); the convergence is exponential (the residual of the 16 → 18 step does not exceed $1\cdot10^{-7}$), and the virial residual is $\leq 4\cdot10^{-13}$ on all solutions. For excited states r_match grows with the number of nodes; in a saturating system non-eigen solutions do not diverge but pass into a bounded oscillating wave, so the criterion for a genuine root is convergence in r_match and an exponential tail, not the absence of divergence.

Channel frequencies. ω_p = 0.47016 (channel A); ω_s = 0.56471 (the scalar channel, canonical 5-digit record; the WKB condition with the Maslov index δ = 3/4 - derived); ω_d = (5/6)·ω_s = 0.47059167 (channel B; the bridge 5/6 = (d+1)/(d+2) from d = 4).

Benchmark and historical cross-check. Result (benchmark; the limits r_match → ∞ with the analytic tail): E_A = 273.0054461(1); E_s = 153.2376443(1); E_B = 272.2296504(1); node amplitude G_0(ω_p) = 1.31937094(3). To reproduce both historical records: the earlier benchmark values E_A = 273.005838, E_s = 153.237559, E_B = 272.230037 are the same quantity at finite r_match ≈ 12-13 (tail systematics of +1.44/−0.55/+1.42 ppm, respectively); a replicating computation will obtain them exactly by stopping the shooting at r_match = 12-13, and the limits - by continuing the scan.

Solver control. Two independent solvers (DOP853 and a fixed-step RK4 written from scratch without scipy) agree with one another to within ~1 ppm at the same r_match; the virial residual is $\sim10^{-13}$. Moving the benchmark to the limits shifts none of the predictions: the tail systematic was common to all three energies and cancelled in the ratios (channel A: +0.0711 % → +0.0712 %; m_e, m_W, m_H - changes in the fourth digit; the m_q shift +0.355 ppm; the contribution to G through the α-lever +0.00007 % - four orders of magnitude below the sector's honest precision).

The calibration pair of the bridge. Essential for repeatability: the working calibration pair of the bridge is (ω_s = 0.56471 - the 5-digit convention; from it, ω_d = (5/6)·ω_s = 0.47059167 and the reference $E\_B = 272.2296504$) - it is on the 5-digit ω_s that independent solvers mutually reproduce E_B at the same r_match to +0.0 ppm. Substituting the full archival $\omega\_s = 0.56471494$ puts the same energy −27.1 ppm lower; with the exact Maslov root $\omega\_s\star = 0.564722903$ - −70.9 ppm lower. The origin of both shifts has been laid open by direct computation and holds no mystery: the sensitivity is $dE\_B/d\omega\_s \approx -1495$ (a stiff bridge; in logarithms, $d \ln E\_B/d \ln \omega\_s = -3.10$), and every $+10^{-5}$ in ω_s yields −55 ppm in E_B - the "−27" and "−71 ppm" are simply different candidates for ω_s read through one and the same derivative. The shifts are physically negligible for the masses (m_q changes by +7…+18 ppm against the bridge budget of ~0.1 %), but they are a matter of principle for the precision bookkeeping of the bridge correction, so the status of the frequencies is fixed explicitly below.

Why the working definition of the bridge is a convention and not the exact root (a methodological clarification). The exact root of the Maslov condition $I(\omega) = 3\pi/4$ of the scalar σ-problem is known two orders of magnitude more precisely than the convention: $\omega\_s\star = 0.564722903(4)$ (the square-root singularity at the edge of the action is removed by the substitution $u = \sqrt{(r\_t - r)}$; Gauss-Legendre with 400/800 nodes; control variations of the integrator accuracy and of the σ_0 bracketing depth shift the root by less than 10^{-9}; I/π at the point 0.5647229 equals 0.7500000009). Nevertheless, it is the convention that is substituted into the bridge chain, and the reason is not convenience but the arithmetic of uncertainties. The bridge ratio and its correction c_1 are the difference of two frequencies, ω_p and ω_s, and the accuracy of a difference is set by the worse participant: ω_p is known to five digits, and no operational route to its sixth digit exists (the best canonical route - channel A - gives ~0.07 %). Substituting the ultra-precise root while ω_p remains five-digit does not raise the accuracy of the difference but destroys the mutual cancellation of the pair's shared instrumental systematics: it has been established by direct check that under a concerted shift of both frequencies the channel-A prediction stands still (+0.0712 %), whereas a one-sided substitution of the root shifts channel A (+0.0712 % → +0.0729 %), m_e (+0.018 % → +0.019 %) and m_H for the worse - by amounts comparable to the residuals themselves. The convention is thus standard handling of correlated uncertainties - a pair of one instrumental generation, whose shared systematics cancels in ratios - and not a choice of a number for the beauty of its predictions. The exact root ω_s★ is canonized as a separate object of the anatomy of the frequency (Step 7 of Proposition 2) and does not enter the D.2 calibration chain.

The bracket of two readings (fixed explicitly; no arbiter exists today). The gap between the convention and the root admits exactly two readings, and they are told apart by a future measurement, not by a choice. Reading (a) - "the bridge is defined on the exact root": then from $\omega\_p = (5/6)\cdot\omega\_s\star\cdot(1 - s\_c/E\_B)$ follows the prediction $\omega\_p = 0.470170(1)$ - higher by $+1.0\cdot10^{-5}$ than the conventional record 0.47016, i.e. the entire gap must sit in the as yet undetermined sixth digit of ω_p. Reading (b) - "ω_p = 0.47016 is exact to five digits": then the bridge contains a real residual of −47 ppm beyond the slot correction (Step 9 of Proposition 2) - a new object requiring a mechanism. The arbiter is the appearance of an operational sixth digit of ω_p. The bracket has been entered into the register of pre-announced falsifiable bets (Appendix E, bet No. 14) before the arbiter exists: a measured sixth digit landing in 0.470170(1) confirms reading (a) and the slot mechanism as one bundle; landing in 0.470160(1) confirms reading (b); an outcome outside both bands refutes the form of the bridge correction at the level of the sixth digit. Until the bracket is resolved, discriminating among the normalization forms of the slot correction (E_B versus E_A versus the α-forms) is locked by this gap - not by the accuracy of the computation (which is ppm-class) but by the definition of the frequency; this is an honestly recorded boundary of knowledge, cast as a testable bet rather than hushed up by a convention. The anatomy of the frequency and the reproduction of ω without shooting (accuracy 0.001-0.004 %) are Step 7 of Proposition 2.

D.2. The calibration chain (one experimental point)

The entire dimensional part of the theory grows out of the proton mass:

$$\mathbf{m\_p = 938.27208816\ MeV \rightarrow m\_q{\cdot}c^2 = m\_p/E\_B\text{^}(1/4) = 230.990855\ MeV \rightarrow \rho\_E = m\_q^4c^5/\hbar^3 = 5.9365{\cdot}10^{34}\ J/m^3}$$

$$\ell\_b = \hbar/(m\_q{\cdot}c) = 0.854263\ fm\ ; \quad \tau\_b = \ell\_b/c = 2.8495{\cdot}10^{-24}\ s$$

Dimensional check: $[m\_q^4c^5/\hbar^3] = J^4{\cdot}(m/s)^5{\cdot}(J{\cdot}s)^{-3} = J/m^3$ ✓

D.3. Status breakdown of η/ε = 11 × 3/2 = 16.5

The factor 11 is the standard thermal degrees of freedom during cooling (imported result); the factor 3/2 is the θ-sector factor of the annihilation channel $\sigma \rightarrow \gamma\gamma$ (Structural ID); the primordial asymmetry ε comes from the directedness of the perception of the influx (Partially derived). The product is 16.5 against the observed 16.4 (0.4 %); the absolute value η_B = ε·16.5 = $6.02{\cdot}10^{-10}$ against $6.12{\cdot}10^{-10}$ (Planck, −1.6 %).

The ε procedure. The value ε ≈ $3.65{\cdot}10^{-11}$ is obtained by inverse calibration, ε = η_B/16.5, against the reference baryon-photon ratio of the nucleosynthesis layer, η_B ≈ $6.0{\cdot}10^{-10}$ (deuterium); the product ε·16.5 = $6.02{\cdot}10^{-10}$ is then checked against the independent CMB value of Planck, $6.12{\cdot}10^{-10}$ - the −1.6 % discrepancy is precisely the live precision test on deuterium (Proposition 15). What is natively derived is the scale and the sign (the directedness of the perception of the influx), but not the value itself - status Partially derived.

Honesty flag. An exact count of the thermal degrees of freedom gives 10.75 × 3/2 = 16.1 (−1.8 % from the observed value); the record 11 × 3/2 = 16.5 (0.4 %) uses the rounded factor 11 - the ratio remains a Structural ID, not a precision derivation.

D.4. The structural cascade from d = 4

All dimensionless exponents of the theory are exact rational consequences of d = 4 (with the single postulate d_sp = 3):

$$\mathbf{s\_c = 1/d = 1/4}$$

$$p = s\_c - s\_c^2 + s\_c^3 - \ldots = s\_c/(1 + s\_c) = (1/4)/(5/4) = 1/5 \quad (1/p = 1/s\_c + 1 = 5)$$

$$H = 1 - p = 4/5\ ;\ \ \gamma = 1/H = (d{+}1)/d = 5/4\ ;\ \ u\_W = 2{\cdot}s\_c = 1/2\ ;\ \ bridge = (d{+}1)/(d{+}2) = 5/6$$

The dressing measures of the vertex are of the same arithmetic: the norm measure K_norm = d(d+1)/(d+2) = 10/3; the current measure K_curr = $d(d+1)^2/(d+2)^2$ = 25/9 (the norm→current transfer by the fraction of visible slots (d+1)/(d+2) = 5/6). Five canonical anchors yield one and the same d = 4: $\sin^2\theta\_W$ = s_c (at the ceiling 4πv, −0.36 %, Proposition 11); the electron-mass exponent γ = 5/4; the screening p = 1/5 in G; the frequency bridge 5/6; the exponent α^(5/2) in G; plus two more independent ones - the elasticity of matter p_n = H = 4/5 (Step 8 of Proposition 2) and the agreement of the cascade and charge routes to the screening shift (Proposition 9) - seven in all: overdetermination.

D.5. The proton mass from the core (two channels)

The scale is taken from the single experimental point m_p through channel B (calibration), while channel A is an independent check of the same mass:

$$m_q \cdot c^2 = m_p / E_B^{(1/4)} = 938.272 / 272.2297^{(1/4)} = 230.9909 \text{ MeV}$$

$$m_p \text{ (channel A)} = m_q \cdot c^2 \cdot E_A^{(1/4)} = m_p \cdot (E_A/E_B)^{(1/4)} = 938.94 \text{ MeV } (+0.071\ \%)$$

Channel B (the 5/6 bridge: $\omega_d = (5/6)\cdot\omega_s$) calibrates the scale - 0 % by construction; channel A (the energy E_A) is a prediction, with deviation +0.071 % = $(E_A/E_B)^{(1/4)} - 1$. The shared BVP tail systematics cancels in this ratio.

Dimensional check: [m_p]/[dimensionless] = MeV = $[m_q \cdot c^2]$ ✓

D.6. The fine-structure constant and the derivation of G

The α-sector and the gravity formula are one equation, $L(x) = \ln(M_P/m_q)$; α is the canonical ultraviolet input, G the output:

$$1/\alpha = (8/3)\cdot F\cdot[\ln(M_P/m_q) + (5/4)\cdot\ln(1/\alpha)]\ , \quad 8/3 = (4\pi)^2/(6\pi^2)$$

The cross-correction coefficient $3/(4\pi)$ is derived by the dipole selection rule on the sphere of channels S^2 (the photon vertex ∝ n̂ is pure ℓ = 1; the multiplicity 2ℓ+1 = 3 divided by the channel count 4π); the factor $3/\pi = (3/4\pi)/(1/4) = 0.955$. The dressing of the vertex by the θ-loop carries the current measure 25/9:

$$g_{obs} = (3/4\pi)\cdot(1 - (25/9)\cdot\alpha) = 0.233893\ ; \quad F = (1 - g_{obs}\cdot\alpha)^2$$

The reverse reading of the same equation derives the ultraviolet scale and, through it, G:

$$L = \ln(M_P/m_q) = (3/8)\cdot(1/\alpha)/F - (5/4)\cdot\ln(1/\alpha) = 45.41407$$

$$M_P = m_q\cdot e^L = 2.176416\cdot 10^{-8} \text{ kg}\ ; \quad G = \hbar c/M_P^2 = 6.674415\cdot 10^{-11} \text{ m}^3\cdot\text{kg}^{-1}\cdot\text{s}^{-2}\ (+0.0017\ \% = 0.8\sigma \text{ CODATA})$$

The inputs are {α, m_p, E_B, d = 4}, without a single gravitational quantity. The lever is $d \ln G/d \ln(1/\alpha) = -100.3$ (1 ppm in α → ~100 ppm in G), so the accuracy of G is entirely contingent on the accuracy of the α-sector. The hierarchy of scales: $\ell_b/\ell_P = M_P/m_q \approx 5.3\cdot 10^{19}$.

Dimensional check: $[\hbar c/M_P^2] = (J\cdot s)\cdot(m/s)\cdot kg^{-2} = J\cdot m\cdot kg^{-2} = m^3\cdot kg^{-1}\cdot s^{-2}$ ✓

D.7. Electroweak masses from the circulation unit U

The electroweak masses stand on the full circulating capture energy U (not on the deficit m_p):

$$U = E_{Dir}\cdot m_q\cdot c^2 = 273.006 \cdot 230.991 \text{ MeV} = 63.06 \text{ GeV}$$

$$m_W = (4/\pi)\cdot U = 80.293 \text{ GeV } (-0.10\ \%, \text{ more precisely } -0.095\ \%; \text{ reference PDG } 80.3692 \text{ GeV})\ ; \quad m_H = 2\cdot U = 126.12 \text{ GeV } (+0.70\ \%)\ ; \quad m_H/m_W = \pi/2$$

The prefactor 2 is the pairedness of the bilinear modes; $4/\pi = 2\cdot\langle|\cos|\rangle$ with $\langle|\cos|\rangle = 2/\pi$ (charge readout of the oscillating θ-polarity). The angle $\sin^2\theta_W = s_c = 1/4$ is a boundary condition at the channel ceiling $\Lambda_\xi = 4\pi v$ (−0.36 % at the ceiling; the standard running to M_Z gives the observed value, +8.1 %). The “Higgs” is the density mode of U (a medium resonance); there is no spontaneous symmetry breaking, and there is one vacuum.

Dimensional check: $[U] = [E\_Dir]\cdot[m\_q\cdot c^2]$ = dimensionless·MeV = MeV ✓

D.8. The electron mass (the dressed chain)

The electron is a quantum of the θ-field; the exponent $5/4 = 1/H$ comes from the $d = 4$ cascade, and the prefactor is closed by dressing:

$$\mathbf{m\_e = m\_q\cdot\alpha^{(5/4)}\cdot(1 + \alpha\cdot k)\ ,\ \ k = 1/(p\cdot(1 - (25/9)\cdot\alpha)) = 5.10345}$$

$$\mathbf{m\_e = 0.5110127\ MeV\quad (+0.0027\ \%)}$$

The chain of accuracy: −3.6 % (bare $m\_q\cdot\alpha^{(5/4)}$) → −0.070 % (the factor $1 + \alpha/p$) → +0.018 % (norm screening 10/3) → +0.0027 % (current measure 25/9, a blind cross-test, forecast before the computation). The chronicle of revisions is in Appendix F.5.

The bridge θ-clock → δρ → mass: two ledgers. The same deficit that carries the mass sets the bridge to the internal clock. The single θ-node is a complex scalar $\Theta = f(r)\cdot e^{(-i\omega t)}$, with U(1) symmetry and the saturating self-coupling $F(n) = 2s\_c\cdot[1 - \exp(-n/2s\_c)]$, $n = f^2$, $s\_c = 1/4$, $F'(n) = \dot\tau$ (mass² = $\dot\tau$, de Broglie dispersion $\omega^2 = k^2 + \omega_0^2$). The radial equation (auxiliary units $\ell\_b = c = \rho\_E = 1$): $f'' + (2/r)\cdot f' = (\dot\tau(f^2) - \omega^2)\cdot f$, $\dot\tau = \exp(-f^2/2s\_c)$; boundary conditions $f'(0) = 0$, $f(\infty) = 0$, tail $\exp(-\sqrt{(1-\omega^2)}\cdot r)$, the ground state found by shooting in $f(0)$. Two ledgers: the field energy $T^{00} = \omega^2 f^2 + f'^2 + F(f^2)$, $E\_rest = 4\pi\cdot\int T^{00}\cdot r^2\cdot dr$; the deficit (which gravitates) $\delta\rho = \rho\_E\cdot(1 - \dot\tau)$, $D = 4\pi\cdot\int\delta\rho\cdot r^2\cdot dr$; the ratio $\lambda = D/E\_rest$.

Check on the proton. With the same recipe $\delta\rho = 1 - \dot\tau$ on the bispinor core of D.1 ($n = G^2 + F^2$, $\omega\_p = 0.47016$), one gets $D = 402.30$, $E\_rest = 273.006$ and $\lambda\_p = 1.4736$ - reproducing the two canonical ledgers (virial residual $\leq 10^{-8}$). This calibrates the recipe.

λ_e = 1 (the θ-quantum, the limit ω → 1). The identity $F = 2s\_c\cdot(1 - \dot\tau) = 2s\_c\cdot\delta\rho$ at $s\_c = 1/4$ gives $\int F = \frac{1}{2}\cdot D$, whence $E\_rest = \int[\omega^2 f^2 + f'^2] + \frac{1}{2}\cdot D$, and $\lambda \to 1$ if and only if the kinetic share equals the potential one (equipartition, reached in the limit $\omega \to 1$). The numerical branch (scalar): λ = 0.602; 0.653; 0.720; 0.794; 0.850; 0.909; 0.949 at ω = 0.55; 0.70; 0.82; 0.90; 0.94; 0.97; 0.985 - monotonically → 1. Dimensional check: λ is dimensionless; $[\delta\rho] = J/m^3$; $[D] = [\int\delta\rho\cdot dV] = J = [m\cdot c^2]$ ✓.

Cross-check of the apparatuses: why 1 and not 2. The value of λ depends on how the field energy is counted, whereas the deficit $\delta\rho = \rho\_E\cdot(1 - \dot\tau)$ does not depend on it - it is the slowing of the time rate and is determined by the density alone. For a first-order field (the Dirac bispinor, the apparatus of the proton bag) the energy is the eigenvalue of the Hamiltonian, $E \approx \omega\cdot\int n$; for a second-order field (the Klein-Gordon scalar) the energy density $\omega^2 f^2 + f'^2 + F$ counts both the temporal and the mass shares, giving $E \approx 2\cdot\int f^2$ in the small-amplitude limit - exactly twice as much. Hence on one and the same deficit the bispinor gives λ → 2 while the scalar gives λ → 1; the exact factor-of-two difference is the known distinction between first-order and second-order energy accounting. The electron's native apparatus is set by its dispersion: the de Broglie relation $\omega^2 = c^2k^2 + \omega_0^2$ is a second-order equation (Klein-Gordon), so the physical choice is the scalar, and λ_e = 1. This is no arbitrariness of the calculation: the ratio of the ledgers separates two different kinds of node - the small-amplitude θ-quantum (the electron, λ = 1) and the deep bispinor bag (the proton, λ = 1.4736).

Stability (Vakhitov-Kolokolov). The θ-charge is $Q = 2\omega\cdot4\pi\cdot\int f^2\cdot r^2\cdot dr$, with the conservation $\partial\_\mu J^\mu = 0$ holding identically. The sign of the slope along the branch (scalar): Q = 1305 (ω = 0.55) → 427 (0.70) → 171 (0.85) → 116 (0.94) - monotonically decreasing, $dQ/d\omega < 0$, the criterion of classical stability is satisfied along the entire branch, including ω → 1. A direct 1D radial run: a perturbed node retains 100 % of its charge in the core and returns to its shape; a sub-threshold Gaussian loses its core charge (10.4 → 0.1) and dissolves; the total θ-charge is conserved in both runs (a dynamical Noether check).

The bound $2\omega_0$. The ±-superposition $\Theta = f\cdot(e^{-i\omega t} + \varepsilon\cdot e^{+i\omega t})$ gives $|\Theta|^2 = f^2\cdot(1 + \varepsilon^2 + 2\varepsilon\cdot\cos 2\omega t)$ - a beat at $2\omega_0$. Frozen $\dot{\tau}$ (linear ±-structure): peak = $1.004\cdot 2\omega_0$ (exactly $2\omega_0$ up to the finite-difference grid), the $4\omega_0$ harmonic = 0. Self-consistent $\dot{\tau}$: the ±-beat frequency is the same, but the nonlinearity pumps the observable density signal into the node's breathing mode $\approx 1.83\cdot\omega_0$ and suppresses the direct $2\omega_0$ density signature by a factor of ≈ 65 (the full swing of the oscillation is preserved). Conclusion: $2\omega_0$ is the true ±-beat frequency of the bound node; boundedness does not move it but hides it in the density more strongly than in the free case.

Frame and status. The θ-Q-ball is a native model of the bound θ-node (the carrier of mass, clock and charge), not an identification of the electron with the capture soliton; $\lambda_e = 1$ is shown as the limit $\omega \to 1$. An independent cross-check reproduced all the key numbers; in the scalar charge the r^2 Jacobian has been corrected (this affects neither the sign of $dQ/d\omega$ nor λ). Status: the mechanism $\theta \to \delta\rho$ and $\lambda_e = 1$ - Derived + Numerical verification; the stability and the $2\omega_0$ of the bound node - Numerical verification.

D.9. The dark sector: the scale a_0 and the neutrino mass

The dark-matter acceleration scale falls out of the cosmological rate:

$$\mathbf{a_0 = c\cdot H_0/(2(d-1)) = c\cdot H_0/6 = 1.18\cdot 10^{-10}\ m/s^2}$$

The coefficient $1/6 = \langle\cos^2\theta\rangle\cdot\langle\cos^2\rangle = 1/(d-1)\cdot 1/2$ (the isotropic projection of the response onto the radial axis × the cycle average of the proper clock); H_0 - the process-column value ≈73 km/s/Mpc (galaxy dynamics - a synchronous tracer; Proposition 13). The radial-acceleration law: $g_{obs} = \frac{1}{2}\cdot(g_{bar} + \sqrt{g_{bar}^2 + 4\cdot g_{bar}\cdot a_0})$; $\sigma/m = 0$ identically (a mode of the field, not a particle).

The neutrino mass is an incoherent accumulation of lag over the pixels ℓ_P along the chirality axis:

$$\mathbf{m_\nu = m_q\cdot\sqrt{(\ell_P/\ell_b)} \approx 0.032\ eV \quad (1/\sqrt{N},\ N = \ell_b/\ell_P)}$$

Dimensional check: $[c\cdot H_0] = (m/s)\cdot(1/s) = m/s^2 = [a_0]$ ✓

D.10. Cosmological numbers

The cosmological density scale from the aberration of inflation (the transit shortfall $f = H_0\cdot\tau_b$) and the equation of state of the background:

$$\mathbf{\rho_{cosmo} = \rho_E\cdot(\ell_b/R_H) = \rho_E\cdot H_0\cdot\tau_b = 3.70\cdot 10^{-7}\ J/m^3\ ;\ \ w = -1}$$

Sound horizon and peak positions. The sound speed $c_s = c/\sqrt{3}$ (the trace law at $d = 3$);

$$\mathbf{r_s = \int c_s\, d\eta = 144.5\ Mpc}$$

the integral is taken from the birth act to recombination $z \approx 1090$; the background parameters are the derived Friedmann with $\Omega_m = 0.315$ and $H_0 = 67.4$ of the snapshot column (a snapshot instrument; for the process quantities a_0 and R_{lim} the ≈73 column is taken - D.9). Peak positions:

$$\ell_n \approx (n - \varphi)\cdot\pi\cdot D/r_s\ ,\ \ D = 13\,865\ Mpc\ ,\ \ \varphi \approx 0.27$$

$\ell \approx 220/522/823/1124/1426$ versus Planck 220/537/811/1121/1444 (mean deviation ~1.2 %); r_drag = 147.2 Mpc.

Amplitude. The pixel pickup with the capacity of the act:

$$\delta T/T = (m\_q/M\_P)^{(1/4)}\cdot\sqrt{(1 - \omega\_p)} = 8.54\cdot 10^{-6}$$

with the relic transfer $\kappa\_c(a\_rec) = 0.40$; comparison with the sky imprint gives the R bracket = 1.14-1.21; the log-center $1.11\cdot 10^{-5}$ - Structural ID.

Depth of the act and nucleosynthesis. T_act = 134-144 MeV (≈ the QCD crossover, Structural ID; the structural ceiling $\rho\_E^{(1/4)} = 231$ MeV); $Y\_p = 0.2453$ (0.1σ); $\eta\_B = \varepsilon\cdot 16.5 = 6.02\cdot 10^{-10}$ (−1.6 %).

Dimensional check: $[\rho\_E\cdot(\ell\_b/R\_H)] = (J/m^3)\cdot(m/m) = J/m^3$ ✓

D.11. Assembly of nuclei

Nuclear saturation from incompressibility (the floor $\delta\rho \le \rho\_E$) gives a constant density and the radius:

$$r_0 = (3\cdot m\_p\cdot c^2/(4\pi\cdot f\cdot \rho\_E))^{(1/3)} = 1.15 \text{ fm} \quad (f = 0.40 = 0.99\cdot\rho\_nuc)\ ;\ \ R = r_0\cdot A^{(1/3)}$$

The native r_0 reproduces the α-decay of 23 even-even emitters over 24 orders of magnitude in lifetimes (Geiger-Nuttall, RMS 0.34); the sample consists of even-even α-emitters from ^{210}Po to ^{252}Cf. The magic numbers 2/8/20 are the tetrahedral packing of alphas; 28/50/82/126 - spin-orbit from the Dirac nature of F2.3 (inverted sign, scale $\lambda \sim \ell\_b^2/2$). The deuteron binding is derived natively: $E_0 = -2.213$ MeV versus the experimental −2.224 MeV - a bound state of the relative medium wave above the floor wall (well depth ≈37 MeV, rms separation 3.82 fm; Proposition 7); the binding curve of even-even N = Z nuclei is assembled from A = 8 to A = 100 without fitting (RMS 0.348 MeV/nucleon).

Dimensional check: $[(m\_p\cdot c^2/\rho\_E)^{(1/3)}] = (J/(J/m^3))^{(1/3)} = (m^3)^{(1/3)} = m = [r_0]$ ✓

D.12. Computational scripts of the project

The full corpus is ~240 files; the key ones (54 scripts of the deposit archive P_Theory_solvers_core_v2.zip): qball.py - the BVP core of the three channels; indep_solver.py - independent RK4 control; tier0_verify.py - rational arithmetic of the d = 4 cascade; wkb.py - the Maslov index and ω_s; omega_s_precision_test.py - the precision Maslov root (the edge of the action via the u-substitution); omega_anatomy.py - the anatomy of the frequency (the free core, the drainage H, the action budget); omega_ladder.py - the ω ladder without shooting (the wall system (H, r)(u), tail matching, Maslov); pde_full.py - the canonical two-sector model of the proton; S2_strict_modesum.py - the 3/(4π) coefficient of the α-sector; theta_solver.py, scalar_solver.py, scalar_vk.py, branch_run.py, branch_high.py, pde_theta.py, zitter4.py, zitter_phi23.py - the electron θ-sector (the two ledgers and λ_e = 1, the λ(ω) branch, Vakhitov-Kolokolov stability, node dynamics, the internal tick $2\omega_0$); b8v3_deuteron_wall.py with the b8v1_books.py module and the attached ledger of profiles - the deuteron (−2.213 MeV); t12_E1/E4 - nuclear saturation and α-decay; t12_assemble.py - the nucleus assembler; ray_bending_ogibanie.py, native_metric_1PN.py, native_strong_field_sqrt.py, verify_strong_field_numbers.py, beta_ppn_native.py, native_gw_sakharov.py - native envelopment gravity (the factor of 4, γ_PPN = β_PPN = 1, Schwarzschild from the c-transit link, the strong field, tensor GW and the Sakharov action); t10_gw_*, tt3d_*, lemma_*.py - the gravitational sector; beta_ppn_2pn.py - β_PPN at 2PN; m6_native_ruler.py - the sound-horizon ruler and the peak positions (r_s = 144.5 Mpc, φ ≈ 0.27); b10_pixel_floor.py and b10p2_reference.py - the imprint amplitude ($8.54\cdot10^{-6}$) and the reference (the R bracket); b9_ladder.py - the L_IR ladder and n_s = 0.96658; nativ_goryachaya_faza.py and bbn_native_Yp.py - the hot phase and nucleosynthesis; t11_final.py, t11_wDE.py - Friedmann and $w = -1$; thm_macrowave.py - the macrowave dark matter theorem; amplitude_CANONICAL.py - the amplitude mechanism; t9_confine.py - confinement. Every number in the main text is reproduced by a run of the corresponding script.

The corpus of scripts (~240) is stored in the project archive together with the working reports of the cycles; the key 54 are attached to the monograph deposit as the archive P_Theory_solvers_core_v2.zip (inside - a README with a map of the scripts, the dependencies, and run examples). The heavy computational machinery with its data ledgers (the nuclear binding curve from the α-aggregate assembly and similar cycles) remains in the working archive - the corresponding numbers are marked in the text; external publication of the full corpus is a separate repository-preparation task.

Appendix E. Register of falsifiable bets

The discipline of the register is simple and admits no exceptions: (1) a bet is declared before the data, with an outcome criterion; (2) lost bets are not deleted and not reformulated after the fact; (3) withdrawal is possible only by the author, before the data, with the reason recorded (the history of withdrawals - Appendix F). The numbering is continuous across the whole project: No. 8-10 form a single package of hadronic probes; No. 12 and No. 21 are one withdrawn branch; No. 24, No. 25, and No. 27 belong to the applied branch - the transfer of medium mechanisms to engineering systems: they test not the foundation of the theory but the reach of its arm. Legend of outcomes: “Pending” - the arbiter lies ahead; “So far ✓” - the current data agree, the decisive arbiter lies ahead; “Partial” - some of the faces have been verified or the branch has been retracted; “Lost” - the bet has been beaten by the data and is kept in the register; “Withdrawn” - the author's withdrawal before the data; “Entered” - registered in the present edition, external verification lies ahead.

№	Bet	Outcome
№1	$\Delta N_{eff} = 0$ ($N_{eff} = 3.044$): no sterile ξ-modes, no thermal TT ripple, no medium scalar; recorded blind before the comparison (Planck: 0.32σ); the decisive arbiter is CMB-S4 ($\sigma \approx 0.03$)	Pending
№2	$m_\nu \approx 0.032$ eV - an incoherent accumulation of the pixel lag ℓ_P along the chirality axis; arbiters - the cosmological sum Σm_ν and direct kinematic measurements	Pending
№3	the neutrino is Majorana: $\nu = \bar{\nu}$ at $Q = 0 \Longrightarrow$ neutrinoless double β-decay is allowed; arbiter - next-generation 0νββ experiments	Pending

№	Bet	Outcome
№4	GW are purely tensor (only the + and × polarizations; the scalar - the Jeans regime, collapse, not radiation); there is no excess damping: the predicted suppression $S = 1.4 \cdot 10^{47}$ at the source (the GWTC-3 bounds are satisfied with a margin of $\sim 10^{7}$)	Pending (v_GW = c ✓)
№5	β_PPN = γ_PPN = 1; the preferred-frame classes $\alpha_1 = \alpha_2 = 0$; Nordtvedt-η = 0 - derived zeros of the moving sector; arbiters - Cassini, LLR, the 10^{-7} bounds	So far ✓
№6	at the base level w = −1 strictly (the background component; the full census is diluted by matter and radiation in the standard way); arbiters - H(z), BAO, supernovae, standard sirens	Partial (the ρ ∝ H branch lost on H(z), >5σ, and retracted)
№7	the proton is stable: $\tau_p \gg 10^{34}$ years (a conditional theorem of baryon-number conservation; the geometric count B); arbiters - Super-Kamiokande, Hyper-Kamiokande	Pending (so far ✓)
№8	the spin fraction ΔG is decomposable into orbital contributions (package of hadronic probes No. 8-10); arbiter - polarized deep inelastic scattering (an EIC-class program)	Pending
№9	the freezing bracket: at γ ≫ 1 the mass bag is a spectator, all the inelasticity of hadronic collisions lives in the thin sectors (charge winding, θ-quanta); the classical field branch is closed with a negative result - the carrier must be quantum (package of hadronic probes No. 8-10)	Pending
№10	the Bjorken sum (tree): $\Gamma_1^p - \Gamma_1^n = g_A/6 = 0.2030$ at the P-value of the axial charge $g_A = 1.2178$ (node level); first cross-check: COMPASS within +0.4…0.65σ (package of hadronic probes No. 8-10)	Pending

№	Bet	Outcome
№11	an analogue of the σ_el/σ_tot ratio from the classical capture run; arbiter - data on the elastic and total hadronic cross sections	Lost (classical run)
№12, №21	the void branch: a kinematic explanation of the Hubble knot by a local underdensity; taken off testing until data arrive; the history of revisions - Appendix F	Withdrawn by the author
№13	the dark-matter particle does not exist: σ/m = 0 identically (the deficit is a functional of the field, not a substance); arbiters - direct and indirect particle searches, the recentering of the deficit in old merger remnants	Pending
№14	the sixth digit of ω_p - the bridge bracket: 0.470170(1) (the bridge is defined on the exact root ω_s★) versus 0.470160(1) (five digits are exact); an outcome outside both bands refutes the form of the bridge correction; arbiter - the operational sixth digit of ω_p	Pending
№15	spectroscopic ladders; the electron's internal tick: the observed frequency is $2\omega_0$ (the bare ω_0 is unobservable), channeling [30] has not been independently reproduced and is explained by standard Dirac dynamics - consistent, but not confirming	Partially cross-checked
№16	there is no fundamental decoherence floor: decoherence is entirely provocation by the surrounding medium, and no intrinsic collapse rate exists; arbiters - macro-interferometry of growing masses, levitated oscillators, tests of objective-collapse models	Pending
№17	r ≈ 0: there are no primordial tensor modes (Guth's inflation is excluded), and there will be no B-modes of the relic at a measurable level; arbiters - LiteBIRD, CMB-S4	Pending

№	Bet	Outcome
№18	mature structures at early z: the growth of structures outpaces the standard expectations of the early epoch; arbiter - deep counts by JWST and its successors	Pending (JWST in favor)
№19	the radial-acceleration law with $a_0 = c \cdot H_0/6 = 1.18 \cdot 10^{-10}$ m/s²: the law's intrinsic scatter is zero, all of the observed scatter is measurement scatter; arbiter - RAR statistics over SPARC-class samples	Pending
№20	the dark component is cold: there is no wave-like fuzzy cutoff of small-scale structure (solitonic cores, suppression of dwarfs); arbiters - the mass function of dwarf halos, lensing of substructures, the Lyα forest	Pending
№22	the relic amplitude is closed onto the potentials of structures: $\delta T/T = (m_q/M_P)^{(1/4)} \cdot \sqrt{(1-\omega_p)} = 8.54 \cdot 10^{-6}$ at $\Phi_{structures} \approx 2.8 \cdot 10^{-5}$ - both sides are computed from the same field constants; arbiter - joint cross-check of the sky imprint (the R bracket = 1.14-1.21) and the depth of the potentials of mature structures	Pending
№23	the magnetic monopole does not exist: $\nabla \cdot B \equiv 0$ - an identity of the structure of the θ-field, not an initial condition; arbiters - monopole searches (MoEDAL-class, cosmic traversals)	Pending
№24	the disruption invariant $\beta_N \cdot q$ = const in tokamaks - an applied branch; arbiters - the disruption databases of operating tokamaks, ITER	Partial; null-leaning
№25	a disruption predictor from critical slowing down of confinement signals - an applied branch; arbiter - prospective trials on operating machines	Pending

№	Bet	Outcome
№26	the Fe Kα line profiles are explainable without extreme spin: a high Kerr spin is not required; arbiter - X-ray spectroscopy of accreting black holes (XRISM-class)	Pending
№27	a zero-shot predictor of qubit coherence times from medium parameters, without training on the device - an applied branch; arbiter - cross-platform coherence-time data	Pending
№28	crystallinity of P-matter: the ideal dense phase is strictly crystalline - positionally (densest packing, $\varphi \approx 0.74$) and chromatically (4 sorts with no same-sort neighbors); there is no liquid nuclear phase at ρ_0 and $T \to 0$; arbiters - incompressibility, the giant monopole resonance, the equation of state of dense matter	Entered
№29	the binding curve of nuclei from α-assembly: B/A of even-even N = Z nuclei on purely field inputs - A = 12…56 with RMS 0.196, assembly A = 8…100 with RMS 0.348 MeV/nucleon without fitting; real nuclei - an α-aggregate, neither a crystal nor a liquid; the wave ^{8}Be is not bound; arbiters - mass spectrometry outside the range, the N ≠ Z valley, the island of stability	Entered (A = 12…56 ✓)
№30	local position invariance in α is exact: k_α = 0, the fine-structure constant has no drift and no potential dependence; arbiters - comparisons of clocks at different potentials, astrophysical spectra	Pending
№31	standard sirens will give a high $H_0 \approx$ 71-73 km/s/Mpc both in the global ($z \gtrsim 0.1$) and in the local ($z \lesssim 0.03$) sample - the snapshot/process theorem: instruments with a matter ruler read the snapshot $\propto H^2$ (67.8), synchronous tracers - the process itself $\propto H^1$ (71.6); a reliable ~67-	Pending

№	Bet	Outcome
	68 from sirens in any sample beats the bet - the theory has no backup explanation of the Hubble knot; arbiters - the accumulation of sirens, redshift drift	
№32	there is no deep local void: the matter contrast on spheres of 200-450 Mpc does not exceed 0.05-0.10 in absolute value (direct dynamics gives ~0.02; the relic budget cuts the macrowave contribution to ≤ 0.046); the "emptiness" of −0.3 seen in galaxy counts is bound to dissolve into counting systematics; a contrast ≤ −0.2 confirmed by two methods beats the bet	Pending
№33	the fork over the phase-slot payment in the tilt of the spectrum: n_s = 0.9665 (the slot pays) versus 0.9732 (the slot is free); the base prediction 0.96658 stands 0.40σ from the observed value; arbiter - the next generation of n_s measurements with σ ≈ 0.002 (CMB-S4), a separation of the branches by more than 3σ	Pending
№34	the ladder echo - a log-periodic ripple of the sky imprint: $\delta \ln P = -A\cdot\sin(2\pi\cdot\ln(k\cdot R_{lim})/T)$; the period $T = -\ln(1-\omega_p) = 0.635$ and the phase (the zero at $k = 1/R_{lim}$) are fixed by the theory, only the size is free; the amplitude of the phase slot is derived: $A = \varepsilon_E\cdot T/\pi = 0.00135$ (the quenching lemma: memoryless transit payments leave no ripple - memory is carried only by the phase ledger); the first measurement (Planck) is structurally uninformative in the temperature channel - the carrier of the test is next-generation E-polarization (Simons Observatory class)	Pending

Appendix F. Blind protocols and the history of revisions

Revisions are not a weakness of the theory but the working mechanism of its honesty: an enterprise engaged in fitting does not kill its own beautiful fractions under a blind protocol and does not withdraw its own branches before the data. The main text presents the outcome; collected here is the history scrubbed from the main text - the blind registrations with their outcomes, the author's withdrawals, and the major revisions of values with the reasons for each.

F.1. Blind protocols - victories

(1) Radiation content: $\Delta N\_eff = 0$ was recorded before the comparison with Planck; the comparison gave 0.32σ (bet No. 1). (2) The current measure 25/9 - a blind cross-test on the electron mass: the prediction of the residual was declared before the computation, the result +0.0027 % (Appendix D.8, F.5). (3) The two-face registration of elasticity: both faces of the blind check of the two-sector elasticity were declared before the computation; the test benches converged within the ±0.8 % band with saturation → 1 (Maslov control $2\cdot10^{-6}$), and the elasticity of matter coincided with the Hurst exponent $H = d/(d+1) = 4/5$ - an independent anchor of $d = 4$.

F.2. Blind protocols - rejections

(1) The rational-point hypothesis $\omega\_d = 2d/(d^2+1) = 8/17$ (the Pythagorean triple (8, 15, 17), generated by the same $d = 4$ as the whole cascade) was registered with kill criteria before the calculation - and rejected by the precision Maslov root 0.5647229: the true root stands $3\cdot10^{-5}$ away from the fraction, with the numerical error two orders of magnitude smaller. (2) The blindly registered fraction $W = 10/9 = 1.111111$ passed the formal threshold at the first computation (+0.0048 %) at the very edge of the input budget; a precision recomputation at the limits of the boundary-value problem closed the question: $W = 1.1111596(4)$ - the fraction is rejected with a margin of $\sim120\sigma$. (3) Pure powers of the Doppler factor for the absolute coefficient C_0 - rejected by computation; the obstruction $C_0 \propto H_0$ was subsequently proved as an exact theorem of cosmic coincidence: the route was closed not by a failure but by a theorem. The rejections are kept in the register: they calibrate the price of blind discipline no worse than the victories do.

F.3. Author's withdrawals

The kinematic void branch of the Hubble knot - an explanation of the discrepancy of H_0 measurements by the motion of matter out of a local underdensity - was withdrawn by the author in 2026, before the data, as ontologically mistaken: a process phenomenon was being read through the alien kinematics of matter. This is the precedent of rule M.6 (the ontological filter): the rule closes off the very way such branches arise, not only this branch. A sanitary dynamical computation performed after the withdrawal confirmed the decision independently: the physical contribution of the channel amounts to ±0.3 % against the required 8.4 %. In the register the branch occupied two positions (No. 12 and No. 21); both were processed by the withdrawal procedure - before the data, with the reason recorded - and are kept in the table of Appendix E as withdrawn.

F.4. Major revisions of values

(1) The gravitational constant: the early entry "+0.08 %" was recognized as an artifact; the sector was moved to an honest "Open"; the closure of the α-sector yielded the derivation $G = 6.674415\cdot10^{-11}$ $m^3\cdot kg^{-1}\cdot s^{-2}$ (+0.0017 % = 0.8σ CODATA) - the road to precision ran through renouncing the wrong number, not through defending it. (2) The relic transfer: the original full transfer $\kappa\_c = 1$ was rejected by the theory's own dynamics; the outcome is $\kappa\_c(a\_rec) = 0.40$. (3) The amplitude floor: the form

$\sqrt{(H_{birth}/\omega_F)}$ was replaced by the pixel pickup $\sqrt{(\ell_P/\ell_b)}$ - the amplitude $\delta T/T = (m_q/M_P)^{(1/4)} \cdot \sqrt{(1 - \omega_p)} = 8.54 \cdot 10^{-6}$; the log-center $1.11 \cdot 10^{-5}$ is retained as a Structural ID. (4) The liquid-drop volume parameter "16 MeV" was re-identified: the ideal crystalline phase of P-matter has the exact $a_V = 25.2 \pm 0.5$ MeV/nucleon; real nuclei are an α-aggregate, not a drop. (5) The strong deuteron core "247 MeV" is an artifact of a wrong accounting ledger; in the deficit ledger the core is weak (the deuteron is a loose bound state of the medium wave). (6) The damping-lemma coefficient "0.48" was decomposed into 0.5 × 0.9615 - a convention of definition times a numerical factor of the test bench; the physical coefficient equals 1: $\eta_{eff} = \tau_b \cdot \delta\rho/(1 + (k\ell_b)^2)$. (7) The historical BVP energies (E_A = 273.005838 and kindred entries) were replaced by the limits $r_{match} \to \infty$: E_A = 273.0054461(1), E_s = 153.2376443(1), E_B = 272.2296504(1); the tail systematics of finite r_{match} was common to all the energies and cancelled in ratios, so the change of benchmark did not shift a single prediction (Appendix D.1).

F.5. Chronicle of the electron-mass precision

−3.6 % (the bare $m_q \cdot \alpha^{(5/4)}$; the historical entry "−4.0 %" corresponded to the earlier rounded calibration of the scale) → −0.070 % (the factor $1 + \alpha/p$) → +0.018 % (the norm screening 10/3) → +0.0027 % (the current measure 25/9, a blind cross-test, prediction before the computation). Each step is a derived mechanism, not a fit; the chronicle is kept as a specimen of the convergence of the dressed chain and as a measure of the price of each physical layer.

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