

RM — RELATIVITY OF MATTER

BOOK V

THE UNIVERSE IS NOT INFINITE

Who Pays for Gravity?

The Unified Treatise

Space is bounded. Geometry describes. $\mathcal{A}E$ bears the cost.

ENGLISH HARMONIZATION — WORKING DRAFT

VERSION v11.4.0 — 22 SEPTEMBER 2026

Three Volumes / Maria Thermometer / P-CIN

“Nothing is lost. The Universe refuses the hemorrhage.”

PIERRE BENAROS

Independent Researcher • ORCID 0009-0000-0427-0217

benaros@relativityofmatter.org

PREFACE — 22 SEPTEMBER 2026

THE UNIVERSE IS NOT INFINITE

The novelty is not the unit of measurement. It is the cosmic body that RM proposes to measure.

To say that the Universe is finite commits us to a physical description: an extent, a geometry and a volume. Finitude is an RM proposition; calculation must give it content, state its conditions and make confrontation with observation possible.

There is no need to invent a new ruler. The light-year is a unit of length, not a duration. Its cube, written ly^3 , is a unit of volume. RM keeps these units and separates what they measure: diameter is not volume, and neither of them is the age of the cosmos.

Three states, three volumes

The **Cosmic Core** denotes the state of maximal cohesion. The **present Universe** is the intermediate reference. The **terminal extent** is the endpoint of the expansion considered here. These three landmarks place the cosmic body on one common representation without reducing its history to an initial point or to a spectacular number.

To make that representation readable, Chapter 50 uses a Euclidean spherical example in which

$$V^{\text{flat}} = \frac{\pi}{6} D^3.$$

The former value of 500 000 ly is reused *here as an illustrative diameter* of the Core, not as a result of R–NC. The present diameter of 93 billion ly and the radial fraction $f_R = 0.30$ are likewise illustrative inputs. They give a terminal diameter of 310 billion ly.

Cosmic reference	Illustrative spherical volume
Cosmic Core	$V_{\text{NC}}^{\text{flat}} \simeq 6.545 \times 10^{16} \text{ ly}^3$
Present Universe	$V_{\text{now}}^{\text{flat}} \simeq 4.212 \times 10^{32} \text{ ly}^3$
Terminal extent	$V_t^{\text{flat}} \simeq 1.560 \times 10^{34} \text{ ly}^3$

Three volumes calculated under the same conventions, not three presently established measurements of the entire Universe.

PREFACE — CONTINUED

Where are we between the two extremes?

A ratio of diameters is not a ratio of volumes. In the flat example, if the present diameter is 30 % of the terminal diameter, then

$$\frac{V_{\text{now}}^{\text{flat}}}{V_t^{\text{flat}}} = \left(\frac{D_{\text{now}}}{D_t} \right)^3 = (0.30)^3 = 0.027.$$

The present state therefore occupies **2.7 % of the terminal volume in this example**. It is not halfway along this volumetric scale. This measures neither the time elapsed since Ignition nor the duration remaining before the terminal extent. A geometrical position is not a date.

In the return scenario studied by RM, the Core may be read as a **hinge**: the endpoint of a contraction and the origin of a new expansion. The terminal extent occupies the other extreme of this representation. Returning from one to the other still requires dynamics, transitions and a closed budget. Chapter 51 keeps those calculations as open programmes. A possible cycle of physical states never closes the open universal time line T into a loop.

STATUS — What the three volumes commit us to

The displayed values follow from assumed diameters and Euclidean geometry. The physical volume must be calculated with the spatial geometry of the solution. The illustrative Core is not identified with the present central remnant; the diameter of an observable domain does not fix the diameter of the entire Universe. R-NC, the fraction f_R , the terminal volume and the return dynamics retain their own open locks.

The ruler can therefore remain ordinary; the calculation must become demanding. No change of unit proves that the Universe is finite. No large number replaces its geometry. RM defines the objects, exposes the assumptions and displays the volumes that follow from them.

Three states. Three volumes. One unit.

A finite Universe is no longer only a formula: it becomes a cosmic body whose dimensions must be calculated.

Pierre Benaros — 22 September 2026

AUTHOR'S PREFACE – 18 SEPTEMBER CONSOLIDATION

The Test of the Sky

A theory does not choose a sky to suit itself. It states what it expects from the sky and the conditions under which it must abandon that expectation.

Relativity of Matter postulates State $\mathcal{A}$ as the physical continuum of the manifested Universe and time as an open universal line. These postulates commit it to mechanics. They do not remove the need to construct that mechanics.

The work assembled here begins with an almost familiar question: what would an observer see away from the centre of a spherical cosmic body? The geometric answer is exact under its assumptions: the sky retains the observer–centre axis. But the axis is not the amplitude. The body, its cadence and its boundaries must still produce a compatible field.

That second task gives this edition its unity. The Core is a State-E body. The bulk carries a background and a reservoir. New volume is born with a reference and a cost. Their equations must hold together. Density alone does not select active mass; a gradient alone does not select sky temperature.

I therefore do not expect a survey to confirm an arrow already drawn on a map. I expect a confrontation whose rules are fixed before the data. Two dipoles genuinely attributed to the same spherical structure but noncollinear would refute that common origin. Agreement of axes would be a compatibility to examine, not sufficient proof of the whole theory.

The calculation now has precise handles: a global variation, two constraints to preserve, boundary pressures, a flux identity and a transfer law. The next physical profile must satisfy each of those conditions.

To your telescopes. The conditions of the test are written before comparison.

Pierre Benaros, Cannes, 18 September 2026

STATUS — How to read this edition

Chapters 43 to 52 collect the CART consolidation, the volumetric landmarks and the return programme. This working English draft has already received the v11.4.0 preface and Chapter 50; the remaining v11 scientific harmonization is still in progress. Results are distinguished from constitutive postulates and open programmes. The previous preface is retained below. CART V5's detailed formulas remain the technical reference for the new chapters; this edition does not turn an AI-assisted review into editorial or experimental validation.

PREFACE

Without $\mathcal{A}$, what becomes of a star?

*A physician does not begin by explaining an illness to a patient with a forest of symbols. The physician begins by saying what is happening. This book will do the same with the Universe: **words and images first; equations afterwards, whenever we must check that the image has not misled us.***

The question sounds almost childish: **without State $\mathcal{A}$, would a star collapse?**

The first answer is tempting: yes, because its support would have been removed. But that answer secretly preserves half of the mechanism. It keeps a gravity that would act exactly as before and then removes only what balances it. That is not RM's proposition.

In RM, gravity remains fundamental, but its transmissible manifestations belong to a relational architecture containing State $\mathcal{A}$. Light propagates in this domain. Within the RM programme, the nuclear passage is also conditioned by the interface with $\mathcal{A}$. Removing $\mathcal{A}$ therefore does not amount to pulling a cushion out from under an already constituted star. It removes part of the physical conditions that allow that star to exist as we know it.

WITHOUT $\mathcal{A}$, THE STAR AS WE KNOW IT CANNOT EXIST.

For the Universe, the question becomes still more radical. RM does not describe objects placed inside an empty box. It proposes that the manifested Universe is a physical domain of State $\mathcal{A}$. Asking what becomes of that Universe after removing $\mathcal{A}$ is therefore like asking what becomes of waves when the ocean is removed.

The waves do not collapse. They cease to be a possibility.

That is the entrance to Book V. It does not ask the reader to begin with a metric, a Dirac matrix or a hydrostatic equation. It asks first: *what physical mechanism are we actually trying to describe?* Only then come algebra, constraints, numerical calculations and death clauses.

I cannot see $\mathcal{A}$. Where is it?

Marie sees the apple fall, her hand exist, and the Sun remain in the sky. She sees none of the interactions that make these things possible — she sees their effects.

This ordinary question imposes an extraordinary demand for clarity on RM. A physical interaction does not need to be visible as an object lying on a table; it must nevertheless leave consequences accessible to observation. Gravity is not seen directly in a falling apple: its effect is. The strong interaction is not visible to the naked eye in a hand: the stability of the

matter composing it carries its consequences. In RM, the Exclusion Interaction must obey the same discipline: it gains no physical status merely because a symbol names it; it must appear through the configurations it makes possible and, ultimately, through a signature that can be confronted with experiment.

APPLE	HAND	SUN
↓	↓	↓
Gravity	Strong interaction	Exclusion Interaction

Pedagogical triptych. The three columns show visible or familiar consequences; by themselves they do not constitute discriminating evidence for the RM ontology.

For the Sun, the wording must remain precise. Standard stellar physics explains its equilibrium without $\mathcal{A}$. RM proposes an additional reading: in its strong-field solutions, the Exclusion Interaction is a constitutive limit capable of preventing the indefinite continuation of a compression channel. The Sun is therefore used here as a pedagogical image of what it means to “see an effect”; it is not presented as exclusive experimental validation of $\mathcal{A}$.

PRINCIPLE — Phenomenological presence of $\mathcal{A}$

$\mathcal{A}$ is not a renamed fourth dimension and must not replace one abstraction with another. In RM, $\mathcal{A}$ is postulated as a physical state of the manifested domain. Such a proposition acquires content only if it follows the chain

$$\mathcal{A} \longrightarrow \text{physical state or response} \longrightarrow \text{observable consequence.} \quad (1)$$

A visible consequence makes the concept concrete; a discriminating signature must additionally distinguish RM from competing descriptions.

GEOMETRY DESCRIBES. $\mathcal{A}$ MUST EXPLAIN.

AND IF IT IS PHYSICAL, $\mathcal{A}$ MUST LEAVE A TRACE.

The starting rule: Newton before ontology

The success of a construction does not come from the amount of formalism mobilised, but from choosing the right starting point. RM now adopts an explicit rule: **start from the phenomenon, not from its interpretation.** Where Newton is sufficient, Newton is the zero benchmark. Where ordinary microphysics is sufficient, it remains untouched. $\mathcal{A}$ is introduced only at the exact point where RM claims that an additional physical property is required.

$$\begin{array}{l} \text{phenomenon} \longrightarrow \text{minimal known law} \longrightarrow \text{limit or question} \\ \longrightarrow \mathcal{A} \longrightarrow \text{equation} \longrightarrow \text{prediction.} \end{array} \quad (2)$$

This discipline forbids, in particular, placing spacetime among the premises when the very question is whether spacetime is a physical reality or a representation. A more general theory need not declare Newton false: it must recover Newton within Newton’s domain and show exactly where a correction becomes necessary.

Newton is not RM's enemy. Newton is its zero benchmark.

Three sentences for entering RM

Æ — THE MISSING ELEMENT OF THE UNIVERSE.

THE EXCLUSION INTERACTION — THE MISSING FUNDAMENTAL LAW.

SPACETIME — ONE DIMENSION TOO MANY.

RM GRAVITATIONAL SIGNATURE

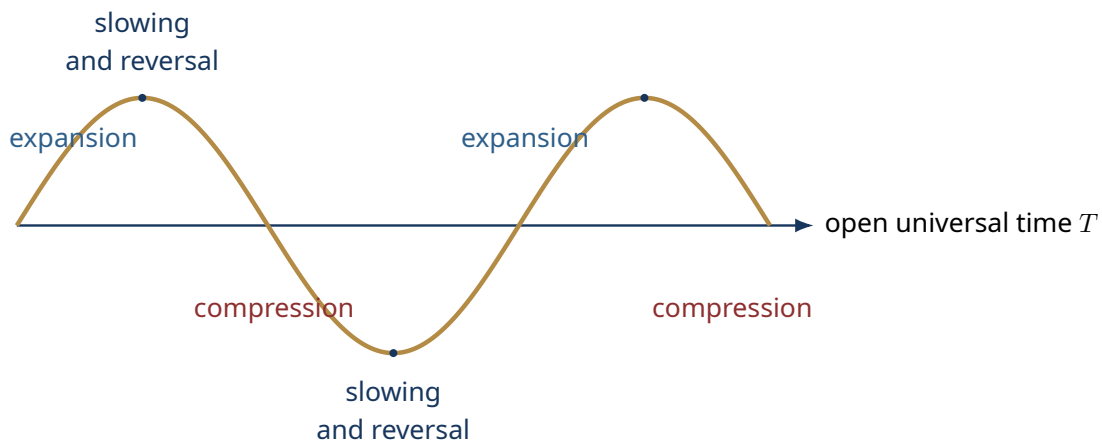
$$c_{\text{RM}}(r) = \sqrt{1 - \frac{2GM}{rc^2}} = \sqrt{1 - C(r)}$$

TIME DOES NOT SLOW DOWN. MATTER CHANGES CADENCE.

These three sentences are RM's manifesto, not a substitute for proof. The rest of the book imposes on them exactly what advertising never imposes on a slogan: an action, equations, domains of validity, conditional results, preserved contradictions and means of refutation.

Time does not loop: the Universe may breathe along it

A second image immediately simplifies the question of the fourth dimension. In RM, time is an open line. A cosmic history may, on the other hand, rise, slow, descend, slow again: **time is not what oscillates; the state of the Universe evolves along time.**



RM conceptual image. A possible cyclic cosmic history would describe the state of the manifested domain along T; it would never close time into a loop. No particular quantitative cycle is constitutionalised by this image.

The shortest formulation is therefore:

Time is not what loops. The state of the Universe may oscillate along an open time line.

The contract with the reader

Book V is RM's major synthesis volume. This English edition has a French twin edition built on the same scientific architecture and the same status register. It may contain equations, because a theory that refuses calculation is only a story. But no important equation should appear before the reader can say, in ordinary words, what it is meant to represent.

A real number, an extra coordinate, a singularity or a topological construction may be remarkable mathematical tools. Their formal usefulness does not automatically confer physical existence on them. The editorial rule of this book can therefore be stated in one sentence:

The Universe is explained with words and images; equations decide whether the explanation holds.

The reader may now open the hood.

PROLOGUE

What if Relativity of Matter were demonstrated?

What if Relativity of Matter were demonstrated?

The first consequence might not be the discovery of a new physical object. It might be the disappearance of several objects that we have come to regard as physical because our mathematics allowed us to write them down.

Spacetime would cease to be a substance of the Universe. Space would not disappear: it would remain the three-dimensional physical domain in which matter, radiation and State $\mathcal{A}$ exist. But time would lose any claim to become a geometric material that can be stretched, folded or stitched. It would return to what RM has asserted from the beginning: the universal ordering of transformations.

TIME IS A DATE. JUST A DATE.

*Clocks do not measure time.
They count the cadence of physical phenomena.*

Two clocks could therefore accumulate different numbers of oscillations without two different times ever having existed. If this reading were demonstrated, one consequence would follow almost for free: **travel into the past would lose its physical support**. A date is not a material that can be bent. It orders what happens; it is not what happens.

The first bomb: remove rather than add

A wormhole could continue to exist as a solution within certain geometric constructions. But it would gain no automatic right to become a material tunnel. No more spacetime sheet to fold, no more throat obtained by topological stitching, no more shortcut turned into an object by the sole power of an equation. Any real structure would have to pay for its continuity, curvature, junctions and energy.

A singularity would suffer the same fate. An equation may tend to zero. A density may diverge. That does not give zero a physical volume, nor does it give infinity material existence. A divergence may signal that a description has left its domain; by itself, it does not create a new object in nature.

This is where one of RM's most radical disciplines enters: the **Googol ceiling**,

$$\boxed{10^{100}}. \quad (3)$$

It is not a new fundamental constant nor a value to be mechanically inserted into every law.

The Googol is a safeguard against realised infinity: beyond any scale that a physical inventory could conceivably carry, the symbol gains no further ontological content. The rule is simple: **an equation does not acquire the right to manufacture magic merely because it knows how to diverge.**

The **Exclusion Interaction** then provides the physical translation of that discipline. When a constitutive channel approaches its admissible capacity, continuing in the same direction becomes progressively impossible: energy, stress and information must redistribute, change variable, channel or state. The limit does not become an object; it closes a direction.

The peaceful black hole

The black hole then changes character. RM retains collapse, the operational horizon, extreme compactness and the violence of gradients. It removes only the last leap: the one that would turn a zero geometric volume into the real content of the object.

If the present strong branch survives its complete audit, the **Black Core** would become a saturated, bounded and organised state. Paradoxically, the object we describe as the most violent in the Universe might, in its completed interior state, become **one of its most peaceful states**: not because its neighbourhood would be gentle, but because it would have ceased seeking a compression that nature no longer allows. The complete strong theory has not yet been derived; this consequence therefore remains conditional.

The Big Bang without a point

The same reversal reaches the cosmological origin. Rewinding the expansion is no longer sufficient to grant physical existence to the point at which an extrapolation makes the volume vanish. RM replaces permission for a singularity with the search for a **finite Cosmic Core**, a collective state of maximal cohesion, bounded density and non-zero volume.

The spectacular nature of this proposal does not exempt it from calculation. The programme's history has produced several estimates of the Cosmic Core radius; none yet has the status of a canonical value derived without debt. The present version therefore retains the strong statement — **the Core is finite** — while keeping its numerical radius as a lock to be closed independently.

The recovered cosmological bomb

An earlier working branch formulated another striking idea: the chronological age and the dynamical maturity of the Universe need not be the same quantity. Taking as an external reference $t_0 \simeq 13.8$ Gyr and a response scale $\tau \simeq 15\text{--}20$ Gyr, it wrote

$$C_{\text{obs}}(t_0) = 1 - e^{-t_0/\tau} \simeq 0.50\text{--}0.60. \quad (4)$$

Then, with an illustrative visible-content factor $f_{\text{vis}} \simeq 0.50$, it obtained

$$C_{\text{tot}}(t_0) \simeq f_{\text{vis}} C_{\text{obs}}(t_0) \simeq 0.26. \quad (5)$$

This is the origin of the image according to which the Universe might have traversed only **about one quarter — roughly thirty percent — of its global energetic cycle**, while having a chronological age of about 13.8 billion years.

STATUS — Status of this cosmological bomb

This 26 % is **not** an active result of present RM. The relation relied on a maturity parametrisation and on an underived factor f_{vis} . It is preserved here as a **conceptual archive and programme question**, not as a revised age of the Universe nor as a prediction. Any reactivation must be rebuilt inside the present global-production sector, without retroactively repairing the old branch.

The distinction nevertheless remains fertile. Standard cosmology can assign a chronological age to the Universe from an expansion history and observed parameters; a gravitational equation alone does not contain that number as a date stamped into nature. RM asks a different question: **has the Universe had time to complete the physical response to its own history?**

RM wants to go further still. Expansion should not remain only a fitted function describing the evolution of a scale. The 16 September 2026 homogeneous-bulk calculation now closes one part of that problem directly from the frozen RM action. At $k_F = 0$, the local cadence-fixing operator loses rank, but the algebraic scalar constraints survive. Their preservation yields the bulk rate law

$$H [3B'(e) + 3\rho_m + 8u_\gamma] = s. \quad (6)$$

This HBR–1 relation imports neither a Friedmann equation nor H_0 into the homogeneous bulk. The result is deliberately narrower than a completed cosmology: boundary production g_∂ , perturbations, distance–redshift observables and structure growth remain separate problems. The earlier provisional HCR–1 branch is retired rather than recalibrated.

If RM were demonstrated, it would not merely ask us to modify a few equations.

It would ask us to remove from reality what equations alone had never had the right to install there.

It would remove elastic time, travel into the past, time loops, realised singularities, zero physical volumes, infinite densities and topological tunnels turned into objects by the sole permission of mathematics.

In their place it would propose something almost brutally simple: a universal date; variable physical cadences; matter with its own prerogatives; a State $\mathcal{A}$ that transmits and relates; physical limits; changes of state; and a Universe that never becomes magical merely because an equation tends to zero.

The Return to the Sphere

I am a Homo sapiens of the year 2026.

Twenty thousand years ago, I imagine one of my distant ancestors looking up at the Moon. He probably did not see only a silver disc fixed to the celestial vault. The movement of light, the slow progression of shadow and that suspended presence in the night may already have revealed depth to him. Behind the appearance of the disc, his physical intuition perhaps sensed a sphere: another material world, tangible and perhaps similar to his own.

He had neither telescope, equation nor theory of gravitation. Yet he possessed the instrument that precedes every discovery: the ability to imagine that reality is deeper than the image it

presents to us.

Every age nevertheless runs the same risk: confusing its representation of reality with reality itself. Mathematics is one of the most extraordinary achievements of human intelligence. It describes, orders, predicts and reveals relations that our senses alone could never reach. But a mathematical representation, however elegant, does not necessarily become a physical object. A geometry may describe the behaviour of reality without constituting its substance. An equation may permit a solution without nature being obliged to realise it.

Contemporary physics has sometimes granted its geometric constructions an ontological sovereignty that they themselves might never have claimed. In my eyes, Hermann Minkowski was Albert Einstein's Rasputin.¹ Einstein was first a physicist of intuition, but he needed the formalism of his former professor to exist mathematically. He did not, as I do, have artificial intelligence to serve as a guardrail. Minkowski cast the spell of four-dimensional spacetime upon him, and mathematics eventually devoured matter.

Matter, space and time then risk disappearing behind their representation. What an equation permits becomes imaginable; what becomes imaginable ends up being described as physically possible.

The "Aladdin Tunnel", which I will later dismantle with deliberate mathematical irony, embodies this confusion. Wormholes may constitute fascinating solutions within certain geometric extensions. But when topology must be cut, folded and stitched back together to manufacture a passage between two regions of the Universe, one elementary question remains: have we discovered a physical object, or merely explored how far our mathematical language can go?

This book was born from that question.

It brings together an architecture of ideas, intuitions, postulates, equations, acknowledged contradictions and calculable paths. Some avenues will survive; others will have to be abandoned. I ask that they be examined for what they reveal rather than rejected because they look at reality from a different starting point.

In RM, time is an open line. Clocks do not measure a substance called time: they count the cadence of physical phenomena. Matter becomes relative to the state of the medium in which it exists. State $\mathcal{A}$ is postulated as the physical continuum through which RM seeks a material origin for manifestations that geometry describes admirably but may not fully explain.

This work is therefore a return to the sphere.

An invitation to look behind the apparent disc; not to confuse the map with the territory, the measurement with the measured object, or the power of an abstraction with the physical existence of what it represents.

*I do not ask the reader to believe.
I ask the reader to look a second time.*

The Relativity of Simplicity

Nothing is more complex than making things simple.

¹A literary image used by the author as a philosophical provocation, not as a historiographical thesis about the personal or scientific relationship between Minkowski and Einstein.

I worked alone, with limited mathematical means, to write this manifesto. Artificial intelligence represents a genuine revolution: I relied on a calculation partner — the one I had waited for all my life — to help me develop an idea that has lived with me since childhood: what becomes of light at the edge of our Universe? If it is not reflected when it meets Silentium, what can it become, if not State $\mathcal{A}$?

My method rested on three pillars: the principle of parsimony, original common sense and the courage of the absurd. Even the simplest minds sometimes possess a small touch of Mozart. My hope is that a true physicist may discover that small something within RM.

I wish to end on the hope that has accompanied me throughout my life: work eventually pays, as Hesiod wrote. Artificial intelligence will never allow the lazy to shine; for them it may even become a handicap. Humanity has entered a new era in which reasoning is beginning to outweigh the mere accumulation of knowledge.

Time is a date. Just a date.

Pierre Benaros

NATURE OF THIS EDITION

One book, four authorities

Book V is neither a fifth Pillar nor a replacement for the four Pillars. It is their narrative reunion in a single volume: the methodological genesis of Pillar I v5.2.0, the technical corpus of Pillar II v4.6.0, the conceptual synthesis of Pillar III v7.4.0 and the constitutional norm of Pillar IV v7.2.0.

STATUS — Reading hierarchy

Pillar I fixes methodological discipline, anti-circularity and the separation of prerogatives between matter and State $\mathcal{A}$.

Pillar II remains the technical authority for derivations, their domains of validity, conditional closures and debts.

Pillar III provides the canonical synthesis: what RM claims, withdraws, forbids or leaves open.

Pillar IV fixes the Constitution: ontology, laws, active postulates and the non-repair discipline.

Book V connects these four authorities without the power to turn a hypothesis into a result or reactivate a withdrawn branch.

This English edition is accompanied by a French twin edition. The published Pillars remain the versioned control sources. The two Book V editions pursue the same aim: to let a reader enter RM through a single thread, from the question of measurement to the debts that remain open.

STATUS — Four epistemic labels

POSTULATE — ontological or constitutive input of the framework.

FORMAL RESULT — consequence derived from the stated action and named assumptions within the declared domain.

CONDITIONAL CLOSURE — result that survives only if the explicitly named debts and regularity conditions hold.

OPEN PROGRAM — calculation, microscopic derivation or observational confrontation not yet closed.

PRINCIPLE — Non-repair discipline

A branch that fails is not saved after the fact by introducing a coefficient fitted to the result it was supposed to derive. It is withdrawn, reopened or explicitly replaced.

Contents

Preface — Measuring a Finite Universe	i
PART I - THE EPISTEMOLOGICAL PURGE	1
01 – When the Map Replaces the Territory	2
02 – The Four Pillars of Physical Reality	3
03 – The Cosmic Rewind Bug	4
04 – Division by Zero is not a Star	5
PART II - THE REFUTATION OF 4D MAGIC	6
05 – The Dimensional Hold-Up	7
06 – Time is not an Elastic Material	8
07 – The Vacuum That Was Not Empty	9
08 – Two Cosmological Ghosts, One Continuum	10
09 – The Boundary Between Manifesto and Demonstration	11
PART III - THE CONSTRUCTIVE TURN	12
10 – The Redshift Ledger	13
11 – The Homogeneous Bulk Closes	14
12 – The Exclusion Interaction Becomes Operational	16
13 – One Scar	17
PART IV - ANTI-CIRCULARITY	19
14 – Mass is not an Input Datum	20
15 – The Triple Identity	21
16 – What $\mathbb{A}$ Transmits — and What It Does Not Manufacture	22
17 – The Definitive Birth of RM	23
Status Register	25
Minimal Lexicon	26
PART V - THE CONCEPTUAL INVERSION	27
18 – What a Clock Actually Measures	28
19 – Universal Time and Physical Cadence	29
20 – The Four States and the Separation of Prerogatives	30
21 – A Physical Continuum Whose Labels Are Not Physical	30
PART VI - THE GRAVITATIONAL SECTOR	32
22 – Who Pays for Gravity?	33

23 – Light and Weak-Field Closure	34
24 – Pure Cadence	36
25 – Universal Matter and the Nonlinear Dirac Audit	37
26 – The Photonic Step: When Cadence Becomes a Cost	38
PART VII - CONSTITUTIVE LENGTH AND EXCLUSION INTERACTION	40
27 – CNL–BI1: a Nonlinear Curvature Response	41
28 – Matter Loads; Geometry Responds	42
29 – The Stellar Fold	43
30 – The Double-Scale Black Core	45
31 – Hawking: a Threshold Identity, Not Yet an RM Mechanism	47
PART VIII - THE HOMOGENEOUS UNIVERSE	49
32 – The Rank Change at $k_F = 0$	50
33 – The bulk budget and the boundary	51
34 – E and the Cosmic Core	52
35 – The Cosmological Numerical Checkpoint	53
36 – The Recovered Cosmological Bomb	54
PART IX - THE THEORY THAT FORBIDS ITSELF TO BE SAVED	56
37 – The Branches RM Killed Itself	57
38 – The Register of Live Debts	57
39 – The Triple Identity	59
40 – How to Kill RM Seriously	59
41 – The Minimal Dictionary of the Treatise	60
42 – Four Pillars, Two Canonical Notes, One Treatise	62
PART X - THE COSMIC BODY AND THE TEST OF THE SKY	64
43 – One physical centre, one sky axis	65
44 – State $\mathcal{A}E$ as an integral cosmic body	66
45 – The Core consists of State E	68
46 – Radial dynamics retains its constraints	69
47 – New volume inherits a reference	71
48 – Creating space has a formation cost	72
49 – From the solved field to the observed signal	73
50 – Three Volumes for a Finite Universe	74
51 – The return programme	76
52 – The active laboratory and its editions	77
PART XI - THE CONSTITUTION	78
Official denominations and rule of discipline	80
Absolute Principles (PA-00 to PA-11)	81
Fundamental Laws (LF-00 to LF-09)	83

Active Postulates	86
Structuring Physical Principles (P.I to P.V)	88
Causal Chains, General Relativity and Auxiliary Hypotheses	90
Canonical Definitions and Consistency Clauses	92
Correspondence with the Eleven Historical Axioms	94
Appendix A — Historical Concordance: Treatise / Foundation-TRD	95
Appendix B — Register of Arbitrations	98
Appendix C — Canonical Concordance of the Four Pillars	102
Appendix D — Register of Live Debts	104
Appendix E — Version Register and Roadmap	105
The Return to the Sphere	108
Edition v9.0.0 — retained results	109
Book V v10.0.0 — The Cosmic Body and the Test of the Sky	110

PART I

THE EPISTEMOLOGICAL PURGE

The failure report: when the symbol lays claim to the territory



Before explaining the Universe, we must first prevent our tools from inventing it.

01

When the Map Replaces the Territory

The first separation: calculation is not constitution

Mathematics is the most powerful instrument of intellectual compression ever produced. A few signs can carry regularities across scales, eras and laboratories. Yet this power creates a temptation: to forget that the map is not the territory, then ask the territory to bend to the conveniences of the map.

The error does not begin when an equation is abstract. All great physics uses abstraction. It begins when a property of the notation is transformed into a property of the world without an intermediate mechanism. A curve diverges: an infinite density is announced. A metric has four coordinates: a fourth physical dimension is announced. A symmetry demands an internal space: hidden dimensions are drawn. A ledger does not close: an invisible component is added. The notation has changed function; it no longer describes, it decrees.

RM is born from a simple refusal: no formal elegance receives an automatic right of passage into ontology. The question is not whether the tool calculates correctly within its domain. The question is what, in reality, pays the physical bill for the construction. An equation may represent curvature; that is not enough to prove that a material time bends. It may extend a density to infinity; that is not enough to produce zero volume. It may stabilise a bubble with a constant term; that is not enough to create the corresponding pressure.

PRINCIPLE — Priority rule

Whenever a mathematical construction and a physical requirement come into conflict, the calculation must be reinterpreted, bounded or abandoned. Reality is never declared at fault because it refuses to extend a formula.

From Mathematical Recasting to Relativity of Matter

The first name of the gesture was a recasting: purge realised infinity, zero volume, reified dimensions and plug-in constants. But a purge is not enough. Once the illusions are removed, what remains must be named. What remains is matter, not as the mere letter m in an energetic identity, but as a physical state possessing cohesion, internal energy, inertial resistance and a relational imprint. Mathematical Recasting then becomes Relativity of Matter: priority is given to real states, their transitions and the relations they impose.

This change of name already contains the end of Pillar I. RM will no longer seek to make matter emerge from an artifice of the continuum. It will seek to understand how real matter manifests in and through State $\mathcal{A}$ without $\mathcal{A}$ usurping matter's prerogatives.

02

The Four Pillars of Physical Reality

The end of realised infinity, endless divisibility, magic constants, and the restoration of universal time

The original manifesto condensed its purge into four pillars. They are not four theories. They are four prohibitions addressed to calculation whenever it claims to cross the boundary between representation and existence.

Pillar I — The Googol ceiling

A physical quantity may grow without reasoning having the right to treat it as a realised infinity. RM replaces operational infinity with a disciplinary bound: the Googol, 10^{100} . This number is not presented as a new constant of nature. It serves as an epistemological guardrail: beyond a domain that no physical inventory could possibly require, the symbol stops acquiring additional ontological content.

$$G = 10^{100}$$

The Googol: a disciplinary ceiling, not the measurement of a cosmic object.

The essential point is not the number one hundred. It is the prohibition against smuggling “unbounded in the notation” into “actually infinite in the Universe.” A diverging density signals that a description has left its domain. It does not prove that an object possesses infinite density.

STATUS — Compatibility with open time

Rejecting realised infinity does not close time. The time line is open: it has no imposed final point. Saying that no physical quantity reaches infinity does not mean that time must receive a terminal bound. Openness is an absence of closure, not an infinite number placed in a box.

Pillar II — The quantum floor

Geometric divisibility can be repeated indefinitely on paper. The symbolic operation does not guarantee that a physical measurement remains meaningful at every scale. RM therefore distinguishes topological continuity — the absence of tearing in the domain — from physical divisibility without end. State $\mathcal{A}$ may be continuous as a relational medium without every segment being a physically exploitable reservoir of infinitely many subsegments.

This pillar forbids two symmetrical abuses. First, it forbids turning zero into a material volume. Second, it forbids confusing a resolution limit with nothingness. Between finite volume and absence, there is no magical ramp that can be descended by simply repeating divisions.

Pillar III — The principle of necessity

A constant is not suspect because it is constant. It becomes a debt when its only role is to bring a result back toward the expected value. RM always asks the same question: is this quantity selected by an action, a conservation law, a boundary condition, a topology or a physical transition? Or was it introduced because the calculation needed it?

The principle of necessity also rejects numerical mysticism. The recurrence of an efficient form in nature proves neither design nor absolute chance; it may simply express a constraint of optimisation, stability or packing. The number is not the cause. It is the trace of a mechanism.

Pillar IV — The thermodynamic inviolability of time

Universal time is an open line. It does not accelerate, slow down, fold back on itself or become an additional spatial dimension. What varies is the cadence of processes: atomic frequency, chemical rate, biological ageing, propagation, dissipation. A clock does not extract a substance called time; it counts repetitions of a mechanism.

“The clock goes round in circles, but time itself never goes backwards.”

This distinction removes the magic from the apparent paradox. Two systems may accumulate different numbers of transitions while belonging to the same universal temporal progression. RM does not deny observable cadence differences; it refuses their automatic conversion into elasticity of time itself.

AXIOM — Temporal postulate

Time is universal and open. Every clock variation must be reformulated as a variation of a local physical process. Cadence belongs to states; time belongs to no state.

03

The Cosmic Rewind Bug

The Big Bang is not a licence for zero volume

When a film of expansion is played backwards, distances shrink. The calculation can then push that shrinkage to the instant at which the volume of the representation vanishes. The illegitimate leap consists in calling that point the “physical origin” and assigning it infinite density. Yet the zero comes from extending the tool, not from observing an object of zero volume.

Pillar I does not deny a hotter, denser or more compact Universe in the past. It rejects a singularity obtained by unlimited rewinding. Real compression must encounter a regime, a transition or a constitutive bound. If the theory contains none, its failure at zero volume reveals what is missing from the theory; it does not reveal an infinitely dense material point.

The calculation machine has left its domain

Every equation has conditions of use. In a fluid, a macroscopic law ceases to be complete when the molecular scale becomes dominant. In a material, a linear elastic law ceases to suffice at rupture or phase change. Why should cosmology be the only discipline allowed to extend its regime all the way to absolute zero volume and then turn the resulting divergence into a founding event?

DEBT / LOCK — Epistemological verdict

The initial singularity is the place where an unbounded description confesses the absence of a transition mechanism. It cannot be used as proof of that mechanism.

RM therefore replaces the image of the point with the search for a real limiting state. It requires a history in which transitions belong to states, energy changes form without suspending causality, and the time line crosses regimes without ever contracting with them.

04

Division by Zero is not a Star

Black hole, Black Core and topological integrity

The same gesture reappears at the heart of black holes: a finite mass is driven toward zero volume, then division produces infinite density. The vocabulary changes; the operation is identical. The calculation has crossed its bound and a physical name has been given to its divergence.

RM retains collapse, extreme compactness, the operational horizon and the violence of gradients. It rejects only the final leap: turning a geometric zero into the real content of the object. The Black Core then denotes a finite-by-principle core of maximal compaction, where continuum and matter enter a constitutive regime no longer described by the weak branch.

The construction bill

A topological structure is not built merely because a diagram allows it to be drawn. Its continuity, curvature, junctions and energy must be paid for. A wormhole, a tear in the continuum or a singularity acquires no reality until that bill is closed by an admissible physical state.

PRINCIPLE — Topological integrity

The physical domain receives no hole, edge or seam without a constitutive term capable of carrying its cost. A geometric possibility is not a material possibility.

This rule became decisive in the historical nuclear audit. The old bubble was not rejected because its shape was unattractive, but because the calculation could not select the required regime without importing what it claimed to derive. The detailed archaeology remains in the archived technical notes; Book V now keeps only the scar and the rule it produced.

PART II

THE REFUTATION OF 4D MAGIC

The end of ghosts: reified dimensions, elastic time and a substantialised vacuum



An internal variable is not a new axis of the world. A cadence is not a deformation of time.

05

The Dimensional Hold-Up

Six degrees of freedom do not make six extra directions

Over the course of a century, the fourth dimension became more than a representational device. It received the status of a medium in which bodies, clocks and causality were said to be physically immersed. Then, when certain formalisms required more variables, the same habit produced additional compactified, hidden or inaccessible dimensions.

RM opposes this inflation with an elementary distinction: the number of variables required to describe the state of an object is not the number of directions available in physical space. An internal matrix may carry several components without opening several geometric axes. A symmetric relational state tensor q_{ij} defined in three-dimensional space has exactly six independent components.

$$q_{ij} = q_{ji} \implies 3 \text{ diagonal components} + 3 \text{ off-diagonal components} = 6$$

The six degrees of freedom of a symmetric 3×3 tensor.

RM's thesis is not that every theory with extra dimensions automatically reduces to q_{ij} . It is more rigorous: before materialising a new dimension, one must demonstrate that the observed degrees of freedom cannot be carried by the internal state of a three-dimensional medium. Until that test is performed, the hidden dimension is a reification, not a discovery.

PRINCIPLE — Anti-reification criterion

Never count the coordinates of a configuration space as directions of the world. First look for the state variable, internal symmetry, constraint or relational mode that carries the degree of freedom.

Spacetime as a map

A four-coordinate description can be extraordinarily effective. RM does not dispute that effectiveness. It disputes the step that turns the fourth locating parameter into an elastic physical substance. The 4D map may remain a map; it simply ceases to be the compulsory ontology of the Universe.

In RM, space is three-dimensional, State $\mathcal{A}$ occupies this domain, material states structure themselves within it, and universal time orders their transformations. Effective geometry may compress cadence differences, trajectories and gradients; it is not therefore the substance that produces them.

06

Time is not an Elastic Material

Local cadence replaces cosmic marshmallow

An atomic clock counts transitions. An organism ages through a sequence of transformations. An oscillator accumulates cycles. When these processes slow relative to another system, the measurements diverge. Nothing compels us to conclude that a temporal substance has stretched. The minimal conclusion is that a process has changed cadence.

The 4D paradigm fuses the universal coordinator with the local behaviour of the mechanism. RM separates them. Time T is shared; cadence ν depends on state, motion, gradient and relational environment. The experimental problem is therefore not to measure a deformation of T , but to derive the law relating ν to physical conditions.

$$T : \text{open universal line}$$

$$\nu = \nu(\text{state, motion, gradient, interaction})$$

Separation between coordinate time and the cadence of a process.

The twin paradox reformulated

The traveller and the stay-at-home never leave the same time line. They do not accumulate the same number of internal transformations. The reunion therefore does not compare two times; it compares two material histories. The age difference, if obtained, belongs to the dynamics of processes and not to an ontological twisting of the fourth dimension.

OPEN PROGRAM — Derivation programme

RM must produce a quantitative cadence law capable of recovering measured differences without using time as a deformable material. Until that law is closed, the distinction remains an ontological postulate and a programme, not a numerical victory.

07

The Vacuum That Was Not Empty

Waves, shiver and differential pressure

The word vacuum may mean absence of detectable matter. It does not prove the absence of every physical state. RM instead postulates that the spatial domain is occupied by State $\mathcal{A}$: a relational continuum capable of transmitting, deforming, carrying gradients and preserving organisation.

This hypothesis changes the vocabulary of waves. A gravitational vibration is no longer the motion of nothingness; it becomes a perturbation propagated in the state of the continuum. Detecting a wave is not, by itself, proof of $\mathcal{A}$. It is nevertheless compatible with a substantial reading whose task is to derive observable speeds, polarisations, couplings and dissipations.

The shiver

At microscopic scale, the source manuscript proposes rereading vacuum fluctuations as a residual mechanical shiver of State $\mathcal{A}$. The proposal is not to replace one word with another. It must explain how admissible modes of the continuum, their boundary conditions and their effective pressure reproduce effects attributed to the quantum vacuum.

Casimir as a cavity experiment

In this reading, two nearby plates are not attracted by fleeting particles emerging from nothingness. They modify the spectrum of modes allowed between them. If the exterior modal pressure exceeds the interior pressure, the net force brings the plates together. The image is that of a mechanical cavity: the medium is not created by the plates; the plates filter its modes.

OPEN PROGRAM — Status of the Casimir reading

A mechanical hypothesis consistent with the presence of a continuum. It requires a complete spectral derivation, the correct boundary conditions and the observed value of the force. Pillar I fixes the intuition, not the final proof.

08

Two Cosmological Ghosts, One Continuum

Local gradient and global decompression

The modern cosmological narrative uses two invisible components to close two different ledgers: additional mass on galactic scales and an accelerating component on global scales. RM proposes a radical economy: seek two behaviours of the same state rather than two additional substances.

Dark matter: the elasticity gradient

Within a galaxy, visible matter loads State $\mathcal{A}$. The response of the continuum need not be strictly local if the state is relational and possesses elasticity. RM therefore proposes that peripheral kinematics record a tension gradient, a distributed supporting structure in the medium, rather than a halo made of a new particle population.

This idea becomes a physical alternative only if a single dynamics can produce rotation curves, gravitational lensing, clusters, collisions and cosmological constraints. Pillar I presents it as a causal direction: look for the response of the support before adding invisible content to the ledger.

The dark-energy question: homogeneous constitutive response

At cosmological scale, RM asks whether the homogeneous response of the same continuum can replace the need to import an additional dynamical reservoir into its own bulk equations. The current answer is no longer a guessed pressure chain. The homogeneous mode is constrained by GHC-1 and GEC-1, and preservation of the latter yields HBR-1. Boundary production remains a distinct inhomogeneous problem.

local relational response $\rightarrow$ galactic programme $H_{\text{bulk}}(T)$ zero-mode constraints $\rightarrow$

Two scales, one continuum, but two different derivation problems.

STATUS — Current cosmological chain

The current RM separation is homogeneous bulk $\rightarrow \{\text{GHC-1}, \text{GEC-1}, \text{HBR-1}\}$ and independently boundary radiation $\rightarrow g_{\partial}$. The total manifested-volume rate is $H_{\mathcal{A}} = H + g_{\partial}$. The bulk law is now derived within its stated assumptions; the boundary and perturbative lift are not.

09

The Boundary Between Manifesto and Demonstration

Scientific lucidity as an editorial weapon

A manifesto has the right to choose its adversary. It does not have the right to erase the difference between an image, a hypothesis and a theorem. Pillar I therefore retains its disruptive tone while recording, at every level, the debt that remains to be paid.

Abandoned construction	Retained RM reading
Additional physical dimensions	Internal degrees of freedom of q_{ij} to be tested before any reification
Dilated time as a substance	Modified local cadence along one universal time line
Infinite-density singularity	Finite Black Core and constitutive compaction regime
Vibration of an abstract vacuum	Perturbation propagated in State $\mathcal{A}$
Particle dark matter by default	Relational gradient of the continuum — hypothesis to confront
Imported dark energy by default	Constitutive homogeneous-bulk response — HBR-1 derived; boundary and observational lift remain open
Fluctuations created by nothingness	Modal shiver of a filled domain — candidate reading

Deconstruction table: what is refused and what still has to be demonstrated.

This discipline prepares the constructive turn of the book. The next part no longer spends six chapters replaying the historical nuclear audit. It places four current objects in the foreground: the redshift ledger, the derived homogeneous bulk closure, the operational Exclusion theorem, and one compressed scar showing why the old nuclear-cement branch was refused.

PART III

THE CONSTRUCTIVE TURN

*The redshift ledger, homogeneous bulk closure, operational Exclusion
and one scar*



A theory becomes faster when it stops replaying every road it abandoned and begins from the laws that survived.

10

The Redshift Ledger

Nothing is lost, everything is transformed — redshift included

RM treats the cosmological redshift as a physical bookkeeping question before treating it as a slogan about geometry. If radiation loses measured energy along the cosmic history, the RM programme asks where that energetic change appears in the complete ledger of the manifested domain.

The guiding sentence is deliberately simple:

PRINCIPLE — The Lavoisier reading

Nothing is lost, everything is transformed — redshift included.

The sentence is a physical reading, not a substitute for an equation. Standard relativistic cosmology preserves local covariant stress–energy conservation; a generic expanding spacetime need not possess a unique global conserved energy of the stationary kind. RM therefore does *not* claim that general relativity commits a first-year violation of local energy conservation. Its narrower challenge is constructive: if RM replaces spacetime ontology by a physical State $\mathcal{A}$, then RM must provide an explicit ledger for the energetic changes it attributes to that state.

The current architecture separates three objects that earlier versions too easily mixed:

- u_γ : radiative energy density in the already manifested bulk;
- $\varepsilon_z(e)$: constitutive energy stored in the homogeneous Exclusion sector;
- Γ_∂ or g_∂ : production of new manifested volume at the boundary.

A transfer law involving redshift may motivate the global picture, but it may not be inserted twice — once into the bulk and again into the boundary — merely because both descriptions sound plausible.

PRINCIPLE — Ledger before interpretation

Every proposed transfer must appear with opposite signs in the sectors that lose and receive it, and bulk storage must remain distinct from boundary formation. A missing term is a debt; a duplicated term is not a solution.

This discipline is exactly why the bulk calculation below matters. HBR–1 is not obtained by forcing the Lavoisier sentence into the equations. It emerges from preservation of the surviving zero-mode constraint once the matter–radiation ledger is specified. The slogan therefore remains a physical interpretation of a derived relation, not its hidden premise.

11

The Homogeneous Bulk Closes

No imported Friedmann equation is needed for the RM zero mode

The old cosmological weakness was precise: the local RM action had a well-defined non-homogeneous sector, but the homogeneous mode still lacked its own rate equation. The solution was not to borrow Friedmann and rename it. It was to audit what survives when the local cadence operator loses rank at $k_F = 0$.

The key point is structural. On the homogeneous isotropic mode,

$$\pi_{\text{TF}}^{ij} = 0, \quad D^2 N_0 = 0. \quad (7)$$

The differential operator that fixes local cadence therefore loses rank. The algebraic scalar constraints do not disappear with it.

STATUS — Domain rule

$k_F = 0$ denotes the homogeneous Fourier mode, not spatial flatness. The homogeneous bulk may have ${}^{(3)}R \neq 0$.

Let the homogeneous element satisfy $\dot{e} = 3H$, and let the constitutive reservoir be $\varepsilon_z(e)$ with the invariant background density u_0 . The surviving Hamiltonian constraint is

$$P^{(3)}R = \rho_m + u_\gamma + \varepsilon_z(e) + u_0.$$

GHC-1: homogeneous Hamiltonian constraint.

The conformal equilibrium constraint gives

$$\rho_m + 2u_\gamma - 2u_0 = 2\varepsilon_z(e) + 3\varepsilon'_z(e).$$

GEC-1: algebraic selection of the homogeneous constitutive state.

Define

$$B(e) = 2\varepsilon_z(e) + 3\varepsilon'_z(e). \quad (8)$$

For the current hyperelastic realization, $B'(e) > 0$ on the regular branch and diverges as the constitutive capacity is approached. The state is therefore selected below the capacity when the algebraic existence condition is satisfied; the limit is not crossed and then clipped after the fact.

Now let s be the local matter-to-radiation conversion rate per unit volume. In the homogeneous bulk,

$$\dot{\rho}_m = -3H\rho_m - s, \quad \dot{u}_\gamma = -4Hu_\gamma + s, \quad \dot{u}_0 = 0, \quad \dot{e} = 3H. \quad (9)$$

Preserving GEC-1 yields

$$H [3B'(e) + 3\rho_m + 8u_\gamma] = s.$$

HBR-1: derived homogeneous bulk rate.

Thus, on the regular branch,

$$H = \frac{s}{3B'(e) + 3\rho_m + 8u_\gamma}, \quad (10)$$

with a strictly positive denominator under the stated assumptions.

FORMAL RESULT — Constitutive bulk closure

Within the frozen RM action and the declared homogeneous ledger, the bulk rate H follows from preservation of the zero-mode constraints. No Friedmann equation, no H_0 , no Ω_m , no external equation of state and no additional fitted dynamical coefficient is imported to close the homogeneous bulk.

The statement has a hard boundary. The total manifested-volume rate remains

$$H_{\mathcal{E}} = H + g_\partial. \quad (11)$$

The boundary term g_∂ belongs to an inhomogeneous production layer with its own transport and formation-cost problem. Perturbations, distance–redshift relations, lensing lift and structure growth are also not supplied by HBR-1 alone.

STATUS — What has — and has not — fallen

RM has removed the need to *import a Friedmann equation into its homogeneous bulk closure*. It has not removed the Friedmann equations from standard cosmology, from external data analyses or from every cosmological calculation. The public technical source is [doi:10.5281/zenodo.22791787](https://doi.org/10.5281/zenodo.22791787).

The earlier HCR-1 pressure relation fails this action-level test and is therefore retired rather than recalibrated. Its useful role was historical: it identified the object that had to be derived. HBR-1 replaces that object.

12

The Exclusion Interaction Becomes Operational

A law, a candidate realization and one theorem that can fail

The Exclusion Interaction is too important to remain scattered among stellar, strong-field and constitutional chapters. On 16 September 2026 it was isolated as an independent technical object: a minimal constitutive principle plus one dependent theorem whose assumptions are explicit and whose failure would force reformulation.

The canonical statement is deliberately more general than any preferred function:

PRINCIPLE — EI-1 — minimal Exclusion statement

Let X be a constitutive load for a specified physical channel with an admissible branch $X < X_{\text{cap}}$. As the branch approaches its finite capacity, the incremental cost of continuing through that same channel increases, and continuation through the channel is excluded at the capacity boundary. The principle selects neither a universal analytic function nor a fitted coefficient.

A current geometric realization may be rescaled to $X_{\text{cap}} = 1$ and represented by an increasingly stiff response with

$$X < 1, \quad F'(X) > 0, \quad F'(X) \longrightarrow +\infty \quad (X \rightarrow 1^-). \quad (12)$$

That realization is a model class. It is not LF-09 itself.

The clean operational test comes from cadence. Hold the material and spatial stochastic process fixed,

$$\mathcal{L}_{\text{loc}} f = \nabla_i (D_{\text{loc}} \nabla^i f), \quad (13)$$

and apply only the positive cadence map

$$d\tau_{\text{cad}} = N(x) dT, \quad N > 0. \quad (14)$$

Then the mean first-passage time measured on the universal parameter T obeys

$$\mathcal{L}_{\text{loc}} \Theta = -\frac{1}{N}, \quad \Theta|_{\partial\Omega} = 0.$$

Equivalently, the time-changed generator is $\mathcal{L}_T = N \mathcal{L}_{\text{loc}}$.

On a frozen spherical background the central first-passage correction is exactly

$$\frac{\Theta_N(0)}{\Theta_1(0)} = \left\langle \frac{1}{N} \right\rangle_{K dV_{\text{prop}}}, \quad (15)$$

a positive weighted average. No optical coefficient is fitted to obtain it.

FORMAL RESULT — EI-D1 — dependent first-passage theorem

If the only new operation is the positive cadence map, matter microphysics remains in D_{loc} , spatial structure remains in g_{ij} , and cadence enters the first-passage problem through the cost $1/N$. Placing N inside the divergence would add an effective drift $D_{\text{loc}} \nabla_i N \nabla^i \Theta$ and therefore describe a different physical model.

The theorem is intentionally modest. At the weak solar benchmark previously used in the audit, the cadence correction is of order 10^{-5} ; it is far too small to make ordinary stellar radiative transport a cadence-dominated phenomenon. That negative scale check is part of the value of the result.

STATUS — Non-claims

EI-1 and EI-D1 do not establish a Black Core, replace standard radiative diffusion, create a new stellar viscosity, derive nuclear fusion, identify Δmc^2 with latent heat, or prove that ITER fails because a continuum refuses to rupture. Those remain separate hypotheses or programmes. The canonical public note is [doi:10.5281/zenodo.22793642](https://doi.org/10.5281/zenodo.22793642).

This distinction is strategic. RM now has a short object that future papers can cite when they use the words *Exclusion Interaction*: first the law, then the realization, then the dependent consequence. Applications no longer have to redefine the engine every time they use it.

13**One Scar**

The nuclear branch RM refused to save

The old Book V spent six chapters proving that RM was willing to kill one of its most seductive ideas. The archive should keep the full autopsy. The Treatise needs only the scar and the rule it produced.

The hypothesis was attractive: make State $\mathcal{A}$ the microscopic cement of matter and let one continuum explain gravitation, inertia and nuclear cohesion. The audit did not justify it. The local selector could not reach the required contrast on the regular branch; the plateau displaced the hierarchy into an unselected product; the shell lost its protecting topology and Derrick scaling drove contraction; the bag-pressure repair either failed to reach the target regime or reintroduced the hierarchy as input.

The decisive point was not aesthetic. A mathematically legal rescue term acquired its value from the phenomenon it was supposed to explain. That is exactly the circularity RM claims to forbid elsewhere.

AXIOM — Separation of prerogatives**STATE $\mathcal{A}$ DOES NOT USURP THE PREROGATIVES OF MATTER.**

Matter keeps its cohesion, internal energy, charges and material transitions. State $\mathcal{A}$ may transmit, relate, carry gradients and condition a passage without becoming the

microscopic substance of matter.

The detailed N-ELAST, N-SHELL and N-JONC calculations remain in the dated archive. Their role in the current Treatise is singular and permanent: they established that an attractive branch is not protected merely because it tells a beautiful story.

“The failure did not tell us that $\mathcal{A}E$ was useless. It told us what $\mathcal{A}E$ was forbidden to pretend to be.”

The constructive programme begins precisely here. Once matter is allowed to remain matter, the continuum can be asked a cleaner question: not *what is matter made of?*, but *what relational imprint does matter impose on the state through which its external manifestations propagate?*

PART IV

ANTI-CIRCULARITY

The final victory: make mass a consequence without making $\mathcal{A}$ its raw material



Mass is not the cause of internal energy. It is the common name of three measurements that must meet.

14

Mass is not an Input Datum

$E = mc^2$ as a ledger, not a mechanism

The equation $E = mc^2$ establishes a quantitative equivalence of extraordinary power. It does not say what produces the internal energy of a material state; it does not say why the same structure resists acceleration; it does not say why its external influence carries the same measure. Used as a starting point, m summarises the phenomenon instead of explaining it.

Circularity appears when the mass of an object is measured, injected into an action or into the parameters of a solution, and then celebrated when the corresponding energy is recovered. The result may be exact without being causal. The datum has simply returned under another name.

PRINCIPLE — Discipline of non-circularity

The observed mass must not select the solution that claims to explain it. Scale, charge, internal energy and boundary conditions must be fixed by the proper dynamics of matter and by independently derived couplings.

After the failure of the $\mathcal{A}E$ drop

The withdrawal of the elastic branch clarifies the programme. Internal energy E_0 must belong to state m . $\mathcal{A}E$ may participate in the transmission of inertia and of the gravitational imprint, but it must not artificially supply E_0 . The question becomes harder and cleaner: a theory of matter must derive its internal state; a relational theory must then show that the two external manifestations carry the same integrated value.

Mass therefore ceases to be a substance without becoming an illusion. It becomes an emergent quantity in a precise sense: the convergence of several independent measurements of the same real structure.

15

The Triple Identity

Internal energy, inertia and relational imprint

The anti-circular target of RM is a Triple Identity. Without using observed mass as an input parameter, three routes must converge on the same quantity: the internal energy of matter, its inertial resistance and its external relational imprint.

$$\frac{E_0}{c_{\mathcal{A}}^2} = M_{\text{in}} = M_{\text{rel}}$$

Triple Identity: a closure target, not a numerical result declared by Pillar I.

First route — internal energy E_0

E_0 is the integral of the proper dynamics of m : constitutive fields, charges, gradients, constraints, transitions and cohesion. Since the new axiom, this energy can no longer be assigned by default to a deformation of $\mathcal{A}$. It must be calculated in the matter sector, with matter's own prerogatives.

Second route — inertia M_{in}

M_{in} measures the response of the structure when its state of motion is changed. In RM this response may engage the relation with $\mathcal{A}$, because no displacement is isolated from the continuum. But the coupling must not create the value from a chosen coefficient; it must externally express energy already carried by m .

Third route — relational mass M_{rel}

M_{rel} is the external imprint of the structure: what the relational domain transmits at a distance and what another body can measure as a gravitational manifestation. Gravity remains fundamental; $\mathcal{A}$ does not manufacture the law. It allows its transmission and observable expression.

FORMAL RESULT — Condition for victory

The Triple Identity is demonstrated only if the three routes are calculated independently from a common action, without inserting the observed m , and then converge to the same value. An equality imposed by definition does not count.

The reach of this target is considerable. $E = mc^2$ ceases to be the first word and becomes the last: the closure of an architecture in which energy, inertia and relation have been derived separately. Mass is neither a magic brick nor a mirage; it is the name given to their identity once that identity has been established.

16

What $\mathcal{A}E$ Transmits — and What It Does Not Manufacture

The constitutional separation of prerogatives

Pillar I ends at a boundary. A good theory does not try to make one word do everything. It distributes roles so that each state can fail in its own domain.

MATTER m	STATE $\mathcal{A}E$
Prerogatives of m	Prerogatives of $\mathcal{A}E$
Nuclear cohesion and internal structure	Transmission of manifestations between domains
Internal energy E_0	Relational organisation and gradients
Charges and transitions proper to matter	Propagation of perturbations and modulation of cadences
Selection of the material configuration	External imprint M_{rel} and support of its measurement
Matter-sector microscopic laws	Relational support of gravitational manifestations

Transmission is not creation

This distinction is central. A medium can carry a wave without creating the law that generates the source. A fibre carries light without manufacturing electromagnetism. A fluid transmits pressure without creating the microscopic cohesion of the wall that contains it. In the same way, RM assigns to $\mathcal{A}E$ a relational and transmissive role without turning it into the universal substance from which every material property is fabricated.

The gain is epistemic as much as physical. An omnipotent continuum would explain everything and therefore almost nothing. A continuum with forbidden prerogatives can be tested and can fail.

PRINCIPLE — Constitutional separation

Matter carries its internal constitution. State $\mathcal{A}E$ carries relation, transmission, cadence and constitutive response of the continuum. No sector is allowed to steal the other’s job merely because doing so would close an attractive equation.

17

The Definitive Birth of RM

Why a theory that refuted itself finally becomes a theory

Relativity of Matter was not born when the first attractive equation appeared. It was born when a successful-looking construction was refused because its closure was circular; and when the theory accepted the loss of a cherished ontological claim rather than repair it with an arbitrary parameter.

The Trojan Horse was therefore internal. The programme admitted an idea strong enough to seduce it: $\mathcal{A}$ as the cement of matter. It then subjected that idea to the same constraints it intended to impose on competing pictures. The branch failed, and the failure separated the physical roles more sharply than the original intuition had done.

The Trojan Horse closes

The result is not that matter and $\mathcal{A}$ are unrelated. It is that relation is not identity. Matter may load the continuum; the continuum may transmit the external imprint; cadence may respond to the relational state; constitutive exclusion may appear in strong fields. None of those statements authorises the conclusion that the continuum is the microscopic substance of matter.

The new architecture is therefore narrower and stronger. Every future extension must pass through the anti-circularity rule, the non-repair discipline and the separation of prerogatives before it earns the right to be called RM.

The programme after Pillar I

From this point, the mathematical programme can proceed without the old ambiguity. Pillar II carries the detailed gravitational action and the technical derivations. Pillar III provides the canonical synthesis and historical audit. Pillar IV fixes the constitutional norm. Book V organises these authorities into one continuous reading and records later technical results without silently rewriting their source.

A theory is not strengthened by the number of things it claims. It is strengthened by the number of claims it is willing to lose without losing its method.

EPILOGUE

The Courage of Reality

There is a simple temptation in theoretical work: when a construction is beautiful, one wants nature to have chosen it. The discipline of RM is the opposite. Beauty is an invitation to test harder, not a licence to protect the result.

The old elastic-nuclear branch was not removed because it was ugly. It was removed because the calculation did not entitle the programme to keep it. The same rule must apply to every

future success: stellar branches, Black Core candidates, cosmological histories, cadence laws and the Triple Identity.

Believe enough to continue. Test hard enough to deserve to believe a little more.

APPENDIX A

Status Register

Object	Status	Meaning in the current corpus
Universal open time T	RM postulate	One temporal line orders physical history; local differences are interpreted through cadence.
State $\mathcal{E}$	RM postulate	Physical relational continuum of the manifested domain; not spacetime renamed.
Matter m	RM postulate	Material state carrying its own internal structure, cohesion and charges.
Exclusion Interaction	Constitutional law / technical realisation	Constitutive refusal of a physical channel as its admissible capacity is approached; not Pauli exclusion and not a fitted fifth force.
Triple Identity	Open target	$E_0/c_{\mathcal{E}}^2 = M_{\text{in}} = M_{\text{rel}}$ must be derived anti-circularly.
Nuclear elastic branch	Withdrawn	The continuum is not retained as nuclear cement.
N-ELAST plateau	Historical conditional result	Exponential contrast appears if mL is selected; selection itself was not derived.
N-SHELL bubble	Refuted in audited class	Zero net charge and Derrick scaling remove static protection.
N-BAG rescue	Rejected	Continuous rescue parameter imports the hierarchy and still misses the target regime.
Non-repair rule	Active method	No coefficient or function may be introduced solely to save a failed branch.

APPENDIX B

Minimal Lexicon

Universal time T

Open ordering parameter of physical history in RM.

Cadence

Local rate of a physical process; clocks count cadence rather than altering universal time.

State $\mathcal{A}$

Physical relational continuum of the manifested Universe.

Matter m

Material state carrying internal cohesion, charges and transitions.

Silentium

Ideal external limit and conceptual reference; not a physical vacuum and not a region of manifested $\mathcal{A}$.

Exclusion Interaction

Canonical name of the constitutive refusal as an admissible channel approaches its limit.

Constitutive length $\ell_\star$

Strong-field scale entering the nonlinear geometric response before any stellar EOS is chosen.

Black Core

Candidate strong-field branch with finite constitutive structure; not identified by decree with a GR singularity or with the stellar Q -fold.

Cosmic Core

Candidate collective state of maximal cohesion compatible with finite volume, bounded density and residual structure.

Non-repair

Rule forbidding rescue by an undeduced free coefficient, function or hidden retuning.

PART V

THE CONCEPTUAL INVERSION

Measurement, universal time, cadence and the division of physical roles



18

What a Clock Actually Measures

Separate observation, measurement and interpretation

RM does not begin by denying a result of relativity. It begins by asking what the instrument actually counted before a theory interprets that count.

Atomic clocks placed in different gravitational potentials accumulate different numbers of oscillations. Relativistic GPS corrections are indispensable. Gravitational frequency shift is observed. Planetary trajectories and light propagation near mass are described with remarkable precision by general relativity in its tested domain. These facts are common ground and are not disputed.

The RM question lies one level upstream. An atomic clock never observes an abstract substance called “time”. It counts an identified physical transition. A mechanical clock counts pendulum oscillations; a quartz clock counts crystal vibrations; an atomic clock counts an atomic transition. The immediate experimental result is therefore a *difference of cadence* between physical processes.

The distinction is methodological:

- **observation:** two clocks reunited after different trajectories do not display the same number of oscillations;
- **measurement:** physical periods have actually been counted;
- **interpretation:** a theory assigns the difference to a mechanism.

General relativity interprets the difference through spacetime geometry. RM explores another reading: material processes change their local cadence relative to a universal temporal line that is not itself deformed.

PRINCIPLE — Never confuse measurement with ontology

A difference in oscillation count is an observation. Saying that “time itself slowed down” is a physical interpretation of that observation. RM keeps the first and submits the second to examination.

19

Universal Time and Physical Cadence

One temporal line, several local rates

“Time is not a space. It is a pulsation — that of State $\mathcal{A}$, τ_* . Matter has but one cadence.”

Pierre’s signature distinguishes time from space. In the equations, T remains the open universal line, τ_* a constitutive scale and $N(x)$ the local cadence factor. One cadence unit does not mean uniform N : processes of the same kind can have different local rates relative to T .

In RM the background physical time is denoted by T . It is an open line ordering transformations and becomes neither a substance, an energy, nor a material dimension that can be compressed or dilated. This position is constitutional; it does not by itself explain clocks. A cadence operator is required.

A field N is therefore introduced to relate the local rate of a process to the universal line T :

$$\boxed{d\tau_{\text{cad}} = N dT}. \quad (16)$$

This notation does not create a second physical time. τ_{cad} is a *proper cadence parameter*: it counts the rate of a local process relative to T .

The distinction became stricter with the **Pure Cadence Principle (PCP)**. The field N is not allowed to become a clandestine fifth energetic state. It converts local rates. At local two-derivative order, RM assigns it neither an autonomous potential energy $V(N)$ nor an autonomous gradient energy $D(N)a_i a^i$.

STATUS — Status of the Pure Cadence Principle

PCP is a **falsifiable constitutive postulate**. It is not an automatic consequence of spatial covariance. If a microscopic matter action, the constraint algebra or observation requires an autonomous gradient or potential term for N , PCP must be reopened or rejected; it must not be repaired.

The Revised Schwarzschild Relation

Pillar II v4.5.0 gives an explicit name to the RM reading of the measurable Schwarzschild factor:

$$\boxed{\mathcal{C}_{\text{RM}}(r) = \sqrt{1 - \frac{2GM}{rc^2}} = \sqrt{1 - C(r)}}. \quad (17)$$

RM retains the observable factor but changes its physical reading: **time does not slow down; matter changes cadence**. This relation is a conceptual signature of the programme, not a completed derivation of the entire strong-field branch.

A candidate cumulative constitutive closure is also carried by Pillar II:

$$\boxed{N_{\text{RM}}(r) = \frac{P\sqrt{f(r)}}{Q(r)} \exp\left[-\int_r^\infty \mathcal{S}(s) ds\right]}. \quad (18)$$

In this expression $\sqrt{f(r)}$ carries the local cadence contribution and the exponential factor represents a cumulative constitutive history associated with the Exclusion Interaction. The independent definition of $\mathcal{S}$, its boundary conditions, admissible domain and strong-field matching remain explicit debts: none is filled by fitting.

20

The Four States and the Separation of Prerogatives

Matter remains matter; $\mathcal{A}$ transmits without usurping

The active ontology of RM distinguishes four states or sectors:

$$\{m, EM, \mathcal{A}, E\}. \quad (19)$$

Their distinction matters more than their symbolic proximity.

Matter m retains its own prerogatives: nuclear cohesion, internal structure, internal energy, charges and specific transitions. **Electromagnetic radiation** EM remains a distinct physical sector. **State** $\mathcal{A}$ is postulated as the physical relational continuum of the manifested Universe: it transmits, relates, carries gradients, modulates cadence and manifests an external imprint. **State** E denotes maximal cohesion and carries a fundamental density bound.

Pillar I imposed the decisive separation: State $\mathcal{A}$ no longer has the right to manufacture matter or replace the interaction responsible for its cohesion. An interface with $\mathcal{A}$ may condition a passage; it may not usurp the internal physics of the matter sector.

PRINCIPLE — Constitutional separation of roles

Cohesion belongs to m . State $\mathcal{A}$ transmits, relates and manifests. A future theory of mass must therefore derive matter's relational imprint without turning $\mathcal{A}$ into matter's hidden raw material.

21

A Physical Continuum Whose Labels Are Not Physical

The conceptual debt $D\text{--}\mathcal{A}\text{--}02$

RM asserts the physical existence of State $\mathcal{A}$, while the local gravitational closure uses a redundancy of spatial labelling. One sentence captures the difficulty:

State $\mathcal{A}$ is physical; its labels are not.

The local relational field is described by a tensor Q_{ij} . Its symmetric part q_{ij} and auxiliary field

B_i transform under a relabelling of space as

$$\delta q_{ij} = \partial_i \xi_j + \partial_j \xi_i, \quad \delta B_i = \partial_T \xi_i. \quad (20)$$

Local physics must therefore not depend on the names assigned to points of the configuration.

This construction is technically effective but creates an ontological debt: how can one speak of a physical continuum without granting physical individuality to each of its labels? RM does not decree the difficulty solved. It is registered as **D-Æ-02**. A complete resolution must show how the physical body persists while its internal coordinates remain redundant in every sector, not merely in the already-calculated local closure.

DEBT / LOCK — D-Æ-02

Fully reconcile the ontology of a physical continuum with the redundancy of its spatial labels. A reinterpretation making the labels themselves observable would destroy the rigidity of the optical coupling and force the degree-of-freedom count to be redone.

PART VI

THE GRAVITATIONAL SECTOR

A local action, one Newtonian normalisation and two polarisations



22

Who Pays for Gravity?

CLG-1: from the invariant scalar to Poisson and pair energy

STATUS — Domain of CLG-1

CLG-1 is a conditional result of a local quadratic action for non-homogeneous modes $k \neq 0$, with $Z > 0$, $\sigma \neq 0$, $B \neq 0$, $\mu_A \neq 0$ and decaying boundary conditions. It derives neither the homogeneous cosmological mode, the complete strong-field theory, nor point self-energies.

Decompose the relational tensor as

$$q_{ij} = Q_{(ij)}, \quad a_{ij} = Q_{[ij]}. \quad (21)$$

The spatial invariant that automatically removes the homogeneous mode is

$$\mathcal{G}[q] = \nabla^2 \text{Tr } q - \partial_i \partial_j q_{ij}. \quad (22)$$

For $k \neq 0$ define the derived scalar

$$\Phi[q] = \frac{1}{2\nabla^2} \mathcal{G}[q], \quad (23)$$

which is not promoted to an independent field.

The retained local action is built from the traceless relational rate, the spatial Fierz–Pauli combination, the multiplier Λ and a constrained antisymmetric sector. Variation of the multiplier gives

$$\mathcal{G}[q] = \sigma \rho_m, \quad \nabla^2 \Phi = \frac{\sigma}{2} \rho_m. \quad (24)$$

Static variation of the symmetric sector gives $\Lambda = Z\Phi$. The RM observable potential is

$$\Psi_{\mathcal{A}} = \sigma \Lambda = Z\sigma \Phi. \quad (25)$$

A single normalisation then fixes the whole Newtonian limit:

$$Z\sigma^2 = 8\pi G. \quad (26)$$

Hence

$$\nabla^2 \Psi_{\mathcal{A}} = 4\pi G \rho_m \quad (27)$$

and, for two separated sources,

$$E_{12}(r) = -\frac{Gm_1 m_2}{r}. \quad (28)$$

The same coefficient fixes both the field equation and the attractive sign. The demonstrated local ledger is

$$d(K + E_{12}) = 0. \quad (29)$$

No local variation of a fundamental homogeneous density u_0 is invoked.

The Dirac count

The configuration variables are q_{ij} (6), a_{ij} (3), B_i (3) and Λ (1): thirteen variables. For $k \neq 0$, six constraints are first-class. The ten second-class constraints have principal determinant

$$\det \Omega_{\text{SC}} = \frac{B^2 \mu_A^6}{16} (k^2)^{10}. \quad (30)$$

When $B\mu_A k \neq 0$, the rank is ten and

$$N_{\text{phys}} = \frac{2 \times 13 - 2 \times 6 - 10}{2} = 2. \quad (31)$$

RM therefore obtains two local tensor polarisations on this branch without introducing a fourth physical dimension. At $k = 0$ the derivative block loses rank: the homogeneous mode belongs to the cosmological problem and must not be counted as a local polarisation.

DEBT / LOCK — What CLG-1 does not yet pay for

The local closure does not derive coupling to the homogeneous mode, the strong-field theory, regularisation of point self-energies or a global bound on the Hamiltonian. If a nonlinear completion changes the rank, releases an extra mode or requires a second Newtonian normalisation, the branch must be reopened.

23

Light and Weak-Field Closure

Eikonal operator, Cassini and the conditional PPN quartet

The optical test is not performed by simply declaring q_{ij} to be “the metric” by analogy. The electromagnetic propagation operator must be derived from admissible variables. Written in local cadence units, the electromagnetic sector is

$$S_{EM} = \frac{1}{2} \int dT d^3x \sqrt{g} \left[\frac{g^{ij} E_i E_j}{N c_{\mathcal{E}}^2} - N g_{ij} B^i B^j \right]. \quad (32)$$

At eikonal order its principal symbol is

$$\mathfrak{P}(\omega, k; x) = \frac{\omega^2}{N^2 c_{\mathcal{E}}^2} - g^{ij} [q] k_i k_j = 0. \quad (33)$$

In the isotropic representative $q_{ij} = \psi \delta_{ij}$, the weak branch gives

$$\psi = -\text{sgn}(\sigma)C, \quad C = \frac{2GM}{rc_{\mathcal{E}}^2}, \quad (34)$$

and the exact optical index in that representative becomes

$$n^2 = \frac{1 + \psi}{1 - C}. \quad (35)$$

The PPN reading then gives

$$\gamma_{\text{PPN}} = \frac{\psi}{C} = -\text{sgn}(\sigma) \in \{-1, +1\}. \quad (36)$$

There is therefore no continuous optical parameter available for tuning. The internally selected branch $\sigma < 0$ gives $\gamma_{\text{PPN}} = 1$; the opposite branch gives optically trivial propagation and is excluded by the existence of solar deflection and delay.

The second-order coefficient requires distinguishing the physical areal radius r_A from the isotropic radius ρ . On the $\gamma_{\text{PPN}} = 1$ branch,

$$r_A = \rho \left(1 + \frac{1}{2}C_\rho + O(C_\rho^2) \right), \quad C_\rho = \frac{2GM}{\rho c_{\mathcal{E}}^2}, \quad (37)$$

so that

$$C_A = C_\rho - \frac{1}{2}C_\rho^2 + O(C_\rho^3). \quad (38)$$

The identity $N^2 = 1 - C_A$ becomes

$$N^2 = 1 - C_\rho + \frac{1}{2}C_\rho^2 + O(C_\rho^3), \quad (39)$$

and imposes

$$\beta_{\text{PPN}} = 1. \quad (40)$$

Minimal universal matter coupling gives, at first order, the vector sector

$$b_i = \frac{7}{2}V_i + \frac{1}{2}W_i, \quad (41)$$

corresponding to

$$\alpha_1 = 0, \quad \alpha_2 = 0. \quad (42)$$

The current RM closure is therefore

$$(\gamma_{\text{PPN}}, \beta_{\text{PPN}}, \alpha_1, \alpha_2) = (1, 1, 0, 0), \quad (43)$$

but its status remains **conditional**: it depends on the gauge reading D-Æ-02, the microscopic matter interface and the nonlinear protection of cadence.

PRINCIPLE — No victory by fitting

Agreement with Cassini, Mercury or preferred-frame parameters is not a licence to add coefficients. If the microscopic action requires an independent coupling, if $\sigma < 0$ is excluded, or if the nonlinear completion changes the result, the closure is withdrawn.

24

Pure Cadence

The field N as converter, not reservoir

Spatial covariance alone allows an infinite family of local two-derivative actions:

$$S_{2D} = \int dT d^3x \sqrt{g} [A(N) \mathcal{K}_{ij} \mathcal{K}^{ij} - B(N) \mathcal{K}^2 + C(N)^{(3)} R + D(N) a_i a^i - V(N)] + S_m. \quad (44)$$

The quadratic sector fixes only a jet around $N = 1$. Debt D-Æ-03 was precisely the remaining functional infinity.

PCP adds a testable physical statement: every local non-dissipative sector governed by the same cadence is first written in proper-cadence units and then translated onto the line T through

$$\mathcal{D}_{\text{cad}} = \frac{1}{N} (\partial_T - \mathcal{L}_B). \quad (45)$$

The field N receives neither autonomous storage nor autonomous gradient energy. The two-derivative branch becomes

$$S_{\mathcal{E}}^{(2)} = P \int dT d^3x \sqrt{g} \left[\frac{1}{4N c_{\mathcal{E}}^2} \left(\mathcal{K}_{ij} \mathcal{K}^{ij} - \frac{1}{3} \mathcal{K}^2 \right) + N^{(3)} R[g] \right]. \quad (46)$$

The full dependence is conditionally fixed:

$$A(N) = \frac{P}{4N c_{\mathcal{E}}^2}, \quad B(N) = \frac{P}{12N c_{\mathcal{E}}^2}, \quad C(N) = PN, \quad D(N) = 0, \quad V(N) = 0. \quad (47)$$

No PPN observable is used to select these functions.

The result is strong precisely because it can fail. A term $D(N) a_i a^i$ would mean that cadence possesses its own gradient energy. A term $V(N)$ would assign stored energy to it even when curvature and relational rates vanish. If microphysics requires either term, PCP is false.

STATUS — D-Æ-03

The functional debt in the N dependence is **conditionally closed by PCP**. The closure is not ontological: it survives only if microscopic and canonical audits require none of the forbidden terms.

25

Universal Matter and the Nonlinear Dirac Audit

N-Æ-06: two modes survive, but conditionally

Local matter χ^A is coupled to the same cadence and relational variables through

$$S_m = \int dT d^3x N \sqrt{g} \mathcal{L}_m(\chi^A, \mathcal{D}_T \chi^A, D_i \chi^A; g_{ij}), \quad (48)$$

with

$$\mathcal{D}_T \chi^A = \frac{1}{N} (\partial_T \chi^A - \mathcal{L}_B \chi^A). \quad (49)$$

After Legendre transformation, the matter Hamiltonian is affine in N and B_i :

$$H_m = \int d^3x (N \mathcal{H}_m + B^i \mathcal{H}_i^m) + H_m^{\text{internal constraints}}. \quad (50)$$

No independent gravitational coefficient g_B or g_Q appears for post-variation tuning.

The PCP-frozen gravitational branch uses

$$P = \frac{c_{\mathcal{E}}^4}{16\pi G}. \quad (51)$$

The canonical momentum is traceless and yields the primary constraint

$$\pi = g_{ij} \pi^{ij} \approx 0, \quad (52)$$

together with $p_N \approx 0$ and $p_i^B \approx 0$. The total Hamiltonian is

$$H_T = \int d^3x [N \mathcal{H}_0 + B^i \mathcal{H}_i + \lambda \pi + u_N p_N + u_B^i p_i^B] + \dots \quad (53)$$

with

$$\mathcal{H}_0 = \frac{c_{\mathcal{E}}^2}{P \sqrt{g}} \pi^{ij} \pi_{ij} - P \sqrt{g} {}^{(3)}R + \mathcal{H}_m, \quad (54)$$

$$\mathcal{H}_i = -2D_j \pi^j_i + \mathcal{H}_i^m. \quad (55)$$

The scalar Dirac block has principal symbol

$$\sigma_{\text{pr}}(\mathfrak{L})(k) = 2P \sqrt{g} g^{ij} k_i k_j, \quad (56)$$

and

$$\det \sigma_{\text{pr}}(\Omega_{\text{sc}})(k) = [2P \sqrt{g} g^{ij} k_i k_j]^4. \quad (57)$$

If the elliptic operator $\mathfrak{L}$ has no kernel on the chosen local problem, the chain terminates. The minimal extension of the antisymmetric sector remains non-propagating and gives three

additional second-class pairs. The complete count is again

$$N_{\text{grav}} = \frac{1}{2}(26 - 2 \times 6 - 10) = 2. \quad (58)$$

STATUS — N-Æ-06 verdict

D-Æ-04A, the local nonlinear gravitational audit, is **conditionally closed** on the regular elliptic branch. D-Æ-04M remains **open**: microscopic matter sectors, especially those involving metric-velocity or triad subtleties, may still modify the canonical structure.

26

The Photonic Step: When Cadence Becomes a Cost

Separating matter microphysics, spatial geometry and universal time

The question of light forced RM to sharpen its own vocabulary. A sentence came before the equation: “Matter determines the length of the photon’s step; State Æ determines the cadence of that step.” Turning that intuition into a calculable result required rejecting two shortcuts: inventing a viscosity with no constitutive origin, and then fusing spatial geometry and process cadence into one coefficient.

In an optically thick medium, radiative transport becomes a random walk. Matter microphysics fixes collisions, opacity, mean free path and, at diffusive order, the local coefficient D_{loc} . RM does not reassign that physics to State Æ. It asks a different question: if the same local process runs with cadence N relative to universal time T , how much universal time accumulates before the photon reaches the boundary?

The initial N-OPT-01 v34 placed spatial structure and cadence together in an optical index inserted into the diffusion coefficient. That form is withdrawn. A first correction then placed N inside the divergence and created a drift term proportional to ∇N ; it too is withdrawn. Version 34.1 keeps the same spatial diffusion process and treats cadence as the temporal cost accumulated along that walk.

Dynkin’s formula: pure cadence

Pillar II encodes cadence as

$$d\tau_{\text{cad}} = N dT, \quad N > 0, \quad (59)$$

where τ_{cad} is a proper cadence parameter of the local process, not a second physical time.

If the local Fick diffusion generator on the proper spatial geometry is

$$\mathcal{L}_{\text{loc}} f \equiv \nabla_i (D_{\text{loc}} \nabla^i f), \quad (60)$$

then the mean universal escape time is the accumulated cost

$$\Theta(x) = \mathbb{E}_x \left[\int_0^{\tau_{\text{exit}}} \frac{d\tau_{\text{cad}}}{N(X_\tau)} \right]. \quad (61)$$

Dynkin's formula gives directly

$$\boxed{\mathcal{L}_{\text{loc}} \Theta = -\frac{1}{N}, \quad \Theta|_{\partial\Omega} = 0.} \quad (62)$$

The cadence change therefore multiplies the generator referred to T outside the spatial operator: $\mathcal{L}_T = N\mathcal{L}_{\text{loc}}$. Placing N inside the divergence would additionally generate $D_{\text{loc}}\nabla N \cdot \nabla\Theta$, a spatial drift that cannot arise from cadence conversion alone.

FORMAL RESULT — N-OPT-01.1 — weighted-cadence theorem

On a frozen background $\{g_{ij}, D_{\text{loc}}\}$, with $D_{\text{loc}} > 0$ and $N > 0$, the cadence contribution to the mean escape time is a positive weighted average of $1/N$. In the spherical reduction,

$$\boxed{\frac{\Theta_N(0)}{\Theta_{N=1}(0)} = \left\langle \frac{1}{N} \right\rangle_{K dV_{\text{prop}}}, \quad K > 0,} \quad (63)$$

and positivity of the weight gives

$$\boxed{\min \frac{1}{N} \leq \frac{\Theta_N(0)}{\Theta_{N=1}(0)} \leq \max \frac{1}{N}.} \quad (64)$$

This compares the same spatial process and the same microphysics with and without cadence modulation; it is not a complete comparison of two different physical stars.

Three prerogatives, no more mixing

The correct separation is not a one-coefficient “matter versus $\mathcal{A}$ ” factorisation. It is sharper:

D_{loc}	matter microphysics of the random walk;
N	local cadence referred to the universal line T ;
g_{ij}	relational spatial structure in which the walk is performed.

The optical index retains its optical role; it is not a synonym for cadence in diffusion.

PRINCIPLE — Geometry is not time

In the RM reading, the space of the process may carry non-trivial relational structure while T remains the universal temporal line. Dynkin's equation does not slow time: it accounts for the fact that the same spatial process accumulates more universal time where its physical cadence is lower. **Time does not slow down. The process changes cadence.**

Matter determines the statistics of the step;
 $\mathcal{A}$ determines its cadence and spatial structure.

PART VII

CONSTITUTIVE LENGTH AND EXCLUSION INTERACTION

Strong field as a response of geometry, not permission to invent a singularity



27

CNL–BI1: a Nonlinear Curvature Response

Protect the weak branch while making the constitutive limit appear

The old raw local exclusion potential used in earlier versions has been withdrawn: it depended on non-invariant components and already modified the quadratic sector. CNL–BI1 starts again from covariant objects of the three-dimensional relational geometry.

Let γ_{ij} denote the nonlinear relational tensor and $\mathcal{R}_{ij}[\gamma]$ its intrinsic curvature. The linearised scalar satisfies

$$\mathcal{R}^{(1)} = -\mathcal{G}[q], \quad (65)$$

which directly links the Poisson closure to the nonlinear candidate.

The chosen curvature measure is

$$X_{\mathcal{R}} = \ell_{\star}^4 \mathcal{R}_{ij} \mathcal{R}^{ij}, \quad 0 \leq X_{\mathcal{R}} < 1. \quad (66)$$

The Born–Infeld-like density is subtracted so that it produces no quadratic term:

$$\mathcal{U}_{\text{BI}}(X) = u_{\star} \left[1 - \sqrt{1 - X} - \frac{X}{2} \right]. \quad (67)$$

Its expansion begins at order X^2 , hence at $O(q^4)$ because $X = O(q^2)$:

$$1 - \sqrt{1 - X} - \frac{X}{2} = \frac{X^2}{8} + \frac{X^3}{16} + O(X^4). \quad (68)$$

The candidate therefore creates neither a tadpole, a quadratic mass, a renormalisation of the tensor cone, nor a modification of the CLG–1 degree count at weak order.

Approaching the barrier,

$$\frac{\partial \mathcal{U}_{\text{BI}}}{\partial X} = \frac{u_{\star}}{2} \left(\frac{1}{\sqrt{1 - X}} - 1 \right) \rightarrow +\infty, \quad (69)$$

while $\mathcal{U}_{\text{BI}} \rightarrow u_{\star}/2$. The marginal cost of further curvature diverges at finite energy: the Exclusion Interaction appears as a constitutive barrier rather than a clipping imposed after the calculation.

In the exterior spherical reduction,

$$\mathcal{S}_{ij} \mathcal{S}^{ij} \simeq 6 \left(\frac{GM}{c_{\mathcal{E}}^2 r^3} \right)^2, \quad (70)$$

which gives the candidate mechanical scale

$$r_c \simeq 6^{1/6} \left(\frac{\ell_{\star}^2 GM}{c_{\mathcal{E}}^2} \right)^{1/3}. \quad (71)$$

This $M^{1/3}$ law must not be confused with the optical radius proportional to M .

OPEN PROGRAM — CNL-BI1

The candidate must still pass a Dirac audit on a non-zero background, provide a regular spherical solution, establish ultraviolet stability and derive the phase junction. Protection of the weak branch is demonstrated; the complete strong-field theory is not.

28**Matter Loads; Geometry Responds**

The constitutive length and the physical meaning of the Exclusion Interaction

*General relativity asks an extraordinarily fruitful question: how does matter curve geometry? RM adds another: **what is geometry itself constitutionally capable of sustaining?***

In the current nonlinear branch this question enters the action before any matter equation of state is chosen. Geometry has a constitutive length ℓ_* . In spherical notation,

$$a \equiv \frac{f'}{r}, \quad b \equiv \frac{1-f}{r^2} - \frac{a}{2}, \quad \boxed{X_{\mathcal{R}} = \ell_*^4(a^2 + 2b^2)}. \quad (72)$$

In general notation,

$$\boxed{X_{\mathcal{R}} = \ell_*^4 \mathcal{R}_{ij} \mathcal{R}^{ij}}. \quad (73)$$

If a local curvature length $L_{\mathcal{R}}$ is defined by $\mathcal{R}_{ij} \mathcal{R}^{ij} = L_{\mathcal{R}}^{-4}$, then

$$\boxed{X_{\mathcal{R}} = \left(\frac{\ell_*}{L_{\mathcal{R}}} \right)^4}. \quad (74)$$

The reading becomes almost visual. When $L_{\mathcal{R}} \gg \ell_*$, geometry is far from its strong constitutive regime. When $L_{\mathcal{R}} \sim \ell_*$, the nonlinear response becomes order unity. No kilometre, solar mass or real star is yet attached to ℓ_* in this reduced sequence.

The retained function is

$$\boxed{F(X) = 1 - \sqrt{1-X} - \frac{X}{2}}, \quad 0 \leq X < 1, \quad (75)$$

with

$$F'(X) = \frac{1}{2\sqrt{1-X}} - \frac{1}{2}, \quad \boxed{X \rightarrow 1^- \Rightarrow F'(X) \rightarrow \infty}. \quad (76)$$

Constitutive energy remains finite while the marginal cost of additional loading diverges. RM gives this response its canonical name: **Exclusion Interaction**.

PRINCIPLE — Exclusion Interaction — LF-09

The name denotes neither Pauli exclusion, a fifth force, nor a new adjustable coefficient. It names the progressive closure of a constitutive channel: the closer geometry comes to its admissible capacity, the harder it becomes to continue loading the same channel. The

load must then redistribute or change channel, variable or state according to the sector under consideration.

MATTER LOADS. GEOMETRY RESPONDS.

29

The Stellar Fold

Two equilibria at the same central pressure — and a numerical singularity that was not one

Here a constitutive idea becomes calculable. In the RM stellar reduction, division by Q had made a branch appear to die. Returning to the undivided equation turns the “singularity” into a fold of parametrisation, and a second hydrostatic branch appears.

For the minimal interface with a perfect fluid,

$$p' = -(\varepsilon + p) \frac{N'}{N}. \quad (77)$$

Define

$$Z(\chi) = \chi^4, \quad G = u_* \ell_*^4 F'(X_{\mathcal{R}}), \quad Q = PZ + G(a - b). \quad (78)$$

The lesson of v28 lies in the equation that must not be divided:

$$Q \frac{N'}{N} = Q \frac{f'}{2f} + \frac{r(\varepsilon + p)}{4f} + \frac{r\kappa_\chi \chi'^2}{4} - Q' - \frac{G(a + b)}{r}. \quad (79)$$

For the Hamiltonian constraint locally solved with respect to $a = f'/r$,

$$\frac{\partial H}{\partial a} = -2Q. \quad (80)$$

Thus $Q = 0$ signals that a ceases to be a good algebraic coordinate. It is not, by itself, the physical endpoint of the star. Division by Q had turned a loss of parametrisation into an artificial wall.

The non-regression test remains simple: when $Z = 1$, $G = 0$, $\chi' = 0$ and $Q = P$, the system recovers the standard TOV closure exactly in the conventions of the action. No RM-specific stellar coefficient is added to obtain that result.

Two solutions, one central pressure

With the validation EOS declared in advance,

$$p = \rho^2, \quad \varepsilon = \rho + p, \quad (81)$$

v28 obtains, at the same central pressure $p_c = 0.5028$, two converged static solutions:

Branch	X_c	Q_c	M	R	$2M/R$
$Q_c > 0$	0.899396	+0.051350	0.832632	2.112721	0.788208
$Q_c < 0$	0.910971	−0.059808	0.850506	2.046754	0.831077

These are reduced units and a toy equation of state. The table means neither kilometres, solar masses, nor a neutron-star prediction.

The local fold reconstruction gives

$$X_{c,*} = 0.9052492489, \quad \varepsilon_{c,*} = 1.2120324954, \quad \left. \frac{d\varepsilon_c}{dX_c} \right|_* = 0. \quad (82)$$

The last accepted frozen v28 point is

$$X_c = 0.9715, \quad M = 0.972448, \quad R = 1.949276, \quad \frac{2M}{R} = 0.997753, \quad f_{\min} = 9.94 \times 10^{-3} > 0. \quad (83)$$

This point demonstrates neither a horizon, an $X = 1$ state, nor a maximum RM mass.

CA-1: cross-method reproduction of the $Q_c < 0$ branch

The sensitive point is no longer left to one implementation. At the same test $p_c = 0.5028$, DOP853 shooting gives

$$\chi_c = 1.201356564122, \quad R = 2.08849775, \quad M = 0.84685706, \quad (84)$$

with a regular $Q = 0$ crossing near $r_Q = 0.5148433$ and a shallow pressure maximum close to the centre.

A two-domain collocation built through a numerically distinct route gives

$$X_c = 0.9109684074, \quad Q_c = -0.0598152950, \quad R = 2.0884976108, \quad M = 0.8468571424, \quad (85)$$

with closure residuals below 8×10^{-14} in both domains. The two post-v28 radii differ by about 1.4×10^{-7} , whereas the dated v28 value at the same p_c was $R = 2.046754$.

FORMAL RESULT — CA-1 — branch-existence verdict

DOP853 shooting and two-domain collocation reproduce the same regular $Q_c < 0$ solution, including the smooth internal crossing of $Q = 0$. Existence and regularity of this branch are therefore reproduced by two distinct numerical formulations inside the declared reduced model. At the test point, the concordant global values are $R \simeq 2.0884976$ and $M \simeq 0.8468571$.

The earlier v28 value is not erased: it remains the chronological record of the calculation

that led to discovery of the branch. It is simply no longer used as the active global value at the test point once the stronger cross-method reproduction exists.

STATUS — What CA-1 closes

CA-1 is no longer a debt concerning the existence of the $Q_c < 0$ branch. It remains a publication interface for diagnostics: surface data, admissibility, surface and asymptotic masses, equation residuals and interior anatomy. The discipline allows future solvers to be compared without artificially reopening the result already cross-reproduced at the test point.

STATUS — What the fold changes — and what it does not

The fold shows that an RM geometry with its own constitutive length can sustain a second hydrostatic branch in the reduced system without a new stellar coefficient. It does not identify that branch with a real astrophysical object, does not close radial stability, does not give a maximum mass and does not replace the Black Core branch. Those questions belong to a different level of claim from numerical branch existence.

30

The Double-Scale Black Core

Two operators, two radii and a wall still open

The DSB-1 branch now distinguishes two surfaces that had previously been conflated too quickly.

The optical and transport threshold is

$$R_S = \frac{2GM}{c_{\mathcal{E}}^2} \propto M. \quad (86)$$

The mechanical exclusion barrier is

$$r_c = 6^{1/6} \left(\frac{\ell_\star^2 GM}{c_{\mathcal{E}}^2} \right)^{1/3} \propto M^{1/3}. \quad (87)$$

For a macroscopic branch with $r_g \gg \ell_\star$, one has $r_c \ll R_S$. The two radii answer different questions.

Zone	Domain	Physical reading
I	$r \geq R_S$	Transmissive exterior: State $\mathcal{A}$ carries the relational field; R_S is the optical and transport threshold.
II	$r_c < r < R_S$	Nonlinear shell: $\mathcal{A}$ remains $\mathcal{A}$; its curvature and relational stress increase. No progressive $\mathcal{A} \rightarrow E$ conversion is retained in this zone.
III	$0 \leq r \leq r_c$	Central E -rich volume: the mechanical barrier is reached at the wall r_c ; the complete phase solution remains to be derived.

The law $r_c^3 \propto M$ immediately implies

$$\boxed{\frac{M}{r_c^3} = \text{constant}} \quad (88)$$

in the declared reduction. This is the signature of an incompressible three-dimensional volume at the level of scaling, not proof of an exact core solution.

For $X_{\mathcal{R}} = (r_c/r)^6$, two volume integrals are exact:

$$\boxed{\int_1^\infty y^2 F(y^{-6}) dy = \frac{\pi - 3}{6}}, \quad (89)$$

$$\boxed{\int_1^\infty y^2 [4XF'(X) - 3F(X)]_{X=y^{-6}} dy = \frac{5 - \pi}{6}}. \quad (90)$$

After volume normalisation, the coefficients $(\pi - 3)/2$ and $(5 - \pi)/2$ sum exactly to one. Both volume contributions scale as $u_\star r_c^3 \propto M$. This identity is a volume result; it does not close the wall.

Source separation and residual fraction

Hypothesis OCH–1 distinguishes the full macroscopic mass M , which sources the exterior and the scale r_c , from the local scalar charge of residual matter in the core,

$$M_{\text{res}} = \varepsilon_M M. \quad (91)$$

If the uniform residual core occupies r_c , its density is

$$\boxed{\rho_{\text{res}} = \frac{3\varepsilon_M c_{\mathcal{A}}^2}{4\pi\sqrt{6} G \ell_\star^2}}, \quad (92)$$

independent of M . In the saturated isotropic limit, identification with the scalar constraint gives conditionally

$$\boxed{\varepsilon_M = \frac{2\sqrt{\pi G Z}}{c_{\mathcal{A}}^2}}. \quad (93)$$

On the independent weak normalisation $|\sigma| = 16\pi G/c_{\mathcal{E}}^2$,

$$\varepsilon_M = \frac{\sqrt{2}}{4} \simeq 0.353553. \quad (94)$$

This number may not be used backwards to choose the weak normalisation.

The wall: what was withdrawn

An older global equation added an energy term to a force term. Dimensional audit removed it. The still-admissible local condition is a pressure jump:

$$[\Pi^r_r]_{r_c^-}^{r_c^+} = \frac{2\tau_\Sigma}{r_c}. \quad (95)$$

The tension τ_Σ must be derived from a finite phase action; it cannot be adjusted after r_c is known.

DEBT / LOCK — A-DSB-1 and OCH-1

The strong closure fails if the wall selects another scale without mechanism, if it requires freely adjustable tension, if E receives the same local scalar charge as residual matter, if the exterior ceases to respond to the full mass M , or if ε_M must become mass-dependent. In those cases DSB-1 is rejected rather than recalibrated.

31

Hawking: a Threshold Identity, Not Yet an RM Mechanism

Separate thermodynamic consistency from microscopic explanation

In the isolated spherical exterior, write

$$C(r) = \frac{R_S}{r}, \quad C(R_S) = 1, \quad (96)$$

and

$$|\nabla C(R_S)| = \frac{1}{R_S} = \frac{c_{\mathcal{E}}^2}{2GM}. \quad (97)$$

The Hawking temperature may then be written

$$T_H = \frac{\hbar c_{\mathcal{E}}}{4\pi k_B} |\nabla C(R_S)|. \quad (98)$$

This identity recovers the standard thermodynamics once the identification $C = -2\Psi_{\mathcal{E}}/c_{\mathcal{E}}^2$ is admitted. It is a consistency check of the optical branch.

An older reading directly associated this radiation with latent heat of the mechanical $\mathcal{E} \rightarrow E$ transition at R_S . That reading is withdrawn: the candidate mechanical transition belongs

to r_c , not to R_S . The physical production mechanism at the optical threshold remains to be derived.

STATUS — Status of Black Core thermodynamics

The temperature identity and recovery of Bekenstein–Hawking entropy are consistency checks. They resolve neither the strong junction, unitarity, nor the microscopic transport mechanism at R_S .

PART VIII

THE HOMOGENEOUS UNIVERSE

The zero mode now closes in the bulk; the boundary remains a separate physical problem



32

The Rank Change at $k_F = 0$

Loss of a local operator does not erase the zero-mode constraints

One of the most important corrections in the RM architecture is the strict separation between the local non-homogeneous sector and the homogeneous mode. The local Dirac count is not extrapolated through $k_F = 0$. Instead the zero mode is re-audited directly.

On a homogeneous isotropic representative,

$$\pi_{\text{TF}}^{ij} = 0, \quad D^2 N_0 = 0. \quad (99)$$

The derivative operator that fixes local cadence therefore loses rank. The earlier mistake was to read this rank loss as if the homogeneous constraints themselves had vanished. They have not.

STATUS — Domain rule

$k_F = 0$ is a Fourier statement, not a claim of spatial flatness. The homogeneous bulk may carry ${}^{(3)}R \neq 0$.

Let

$$g_{ij} = a^2 \gamma_{ij}, \quad H = \frac{\dot{a}}{a}, \quad \dot{e} = 3H, \quad (100)$$

and let the constitutive Exclusion reservoir be $\varepsilon_z(e)$. At fixed material labels its pressure is not a guessed positive compressive load but the derived tensile quantity

$$\rho_z = \varepsilon_z, \quad p_z = -(\varepsilon_z + \varepsilon'_z). \quad (101)$$

This sign result is what retires the provisional HCR–1 interpretation.

With the invariant State- $\mathcal{A}$ background u_0 satisfying $\dot{u}_0 = 0$ and $p_0 = -u_0$, the surviving Hamiltonian constraint is

$$P^{(3)}R = \rho_m + u_\gamma + \varepsilon_z + u_0. \quad (\text{GHC-1})$$

The conformal scalar constraint gives

$$\rho_m + 2u_\gamma - 2u_0 = 2\varepsilon_z + 3\varepsilon'_z. \quad (\text{GEC-1})$$

Define

$$B(e) = 2\varepsilon_z(e) + 3\varepsilon'_z(e). \quad (102)$$

For the current hyperelastic realization, $B'(e) > 0$ and $B(e) \rightarrow +\infty$ as the capacity is approached. GEC–1 therefore selects at most one regular state below the capacity for a given load and ceases to admit the branch if the algebraic existence condition fails.

PRINCIPLE — Exclusion by existence, not clipping

On the homogeneous branch, LF–09 is realised through the algebraic existence of GEC–1. The theory does not integrate through the capacity and then impose a ceiling by hand.

Now preserve GEC–1 under the homogeneous matter–radiation ledger

$$\dot{\rho}_m = -3H\rho_m - s, \quad \dot{u}_\gamma = -4Hu_\gamma + s, \quad \dot{e} = 3H. \quad (103)$$

The result is

$$H [3B'(e) + 3\rho_m + 8u_\gamma] = s. \quad (\text{HBR-1})$$

FORMAL RESULT — Derived homogeneous bulk rate

HBR–1 is obtained by preserving the surviving zero-mode constraint. No independent relaxation time, Friedmann equation, H_0 , Ω_m or fitted homogeneous response coefficient is introduced. The earlier HCR–1 relation is superseded by this action-level calculation.

The full derivation is frozen publicly in [Constitutive Exclusion and Homogeneous Bulk Closure in RM, Version 5](#). The Physical Review D submission uses the same bulk result in journal form; Book V does not enlarge the claim beyond the public technical note.

33

The bulk budget and the boundary

Production is now connected to its reference and its cost

The transition $EM \rightarrow \mathcal{A}E$ remains a constitutive RM postulate. An isotropic homogeneous bulk carries no net outward radiation flux; productive boundary conversion belongs to an inhomogeneous layer. The manifested-volume rate therefore distinguishes

$$H_{\mathcal{A}E} = H + g_\partial, \quad g_\partial = \Gamma_\partial / (3V_{\mathcal{A}E}). \quad (104)$$

In the homogeneous reduction, H concerns the old bulk. The rate g_∂ measures production of new volume. CART V5 establishes their compatibility with the global reference ratio without identifying these two operations.

FORMAL RESULT — Matched birth under the declared balances

For a nonzero uniform front without remodeling of the old reference, simultaneous preservation of GHC–1 and GEC–1 with unchanged balances and $\varepsilon'_z > 0$ requires $J_b = \bar{J}$. Then $\dot{V}_{\text{ref}}/V_{\text{ref}} = 3g_\partial$ and $\dot{e} = 3H$. Chapter 47 supplies the proof and the nonuniform-birth cases.

The earlier target $U_\partial = P/\ell_\star^2$, associated with $\Gamma_\partial = (\ell_\star^2/P)\mathcal{P}_{\gamma,\partial}$ in a minimal unit-efficiency branch, remains a constitutive boundary hypothesis. It is neither a derived residual density nor a density of E . Chapter 48 establishes the balance with layer storage, outgoing products, work and the global-reservoir contribution.

For a transported scalar X , birth contributes $3g_\partial(X_b - \bar{X})$ to the derivative of its mean. Reference matching therefore does not remove a birth-curvature or charge difference. Homogeneous closure for old material and evolution of a mean on the produced domain remain separate operations.

OPEN PROGRAM — From compatibility to a cosmic solution

Reference, cost and matching identities are derived. Microscopic conversion, birth charges, boundary conditions and evolution data must still select a cosmic solution and its transfer to observables. This programme no longer leaves its budget implicit.

34 **E and the Cosmic Core**

Maximal cohesion, bounded density and Ignition

State E denotes maximal cohesion. It must not be confused with the generic symbol for energy. RM assigns it a fundamental density limit $\rho_{E\text{-lim}}$ that cannot be crossed. The density limit permits neither a perfect singularity, infinite compression, nor absolute erasure of information.

The Ignition transition

$$\boxed{E \xrightarrow[\text{Cosmic Core}]{\text{Ignition}} m} \quad (105)$$

is constitutionally distinguished from $EM \rightarrow \mathcal{A}$. The two branches therefore do not form a single symmetric bifurcation $E \rightarrow \{m, \mathcal{A}\}$. Matter comes from an Ignition channel; State $\mathcal{A}$ is fed by the electromagnetic channel.

The Cosmic Core is described as a collective state of maximal cohesion compatible with bounded density, finite volume, residual memory, minimal asymmetry and an evolutionary potential. It is neither a zero-volume point nor a perfect final state. Maximal cohesion does not mean minimal volume.

The Cosmic Core radius: the number must not precede its cause

Finiteness of the Core is an architectural RM statement; its numerical value is not yet one. The old anchoring programme wrote, for total energy E_{NC} and cohesion energy density $u_{E,\max}^{\text{anc}}$,

$$\boxed{R_{NC}^{\text{anc}} = \left(\frac{3E_{NC}}{4\pi u_{E,\max}^{\text{anc}}} \right)^{1/3}} \quad (106)$$

This historical expression is Euclidean. In curved geometry the uniform budget is $E_{NC} = u_E \text{Vol}_g(C)$, with $V_C = 4\pi \int_0^{R_C} S(r)^2 dr$; areal radius and proper distance are not interchangeable. The historical anchor and the tabulated radii are not CART V5 inputs.

This relation predicts a radius only if E_{NC} and $u_{E,\max}^{\text{anc}}$ are obtained independently of the radius being sought.

Historical value	Origin	Current status
500 000 ly	Former curvature-limit scale obtained after imposing the scale $\mathcal{A}_{\max}$.	Working hypothesis; not derived.
250 000 ly	Historical witness used in the anchoring programme and then explicitly masked in blind tests.	Historical calibration/-target; non-predictive.
262 211.6 ly	PF-e-R1 branch, $\lambda = 1$, quadratic response and specification A of the observed energy.	Reproducible and frozen calculation on that branch, but based on an input flagged as inconsistent; non-canonical.

OPEN PROGRAM — R-NC — derive the radius without a hidden witness

The Cosmic Core radius will acquire the status of an RM result only when the total Core energy and cohesion scale have been independently derived and inserted into a closure relation using no old radius as input, calibration or selection criterion. No seductive number is allowed to replace that derivation.

OPEN PROGRAM — Bridge between cosmology and microphysics

The Constitution validates the transition architecture but does not yet provide the complete microscopic phase action linking the E , m and $\mathcal{A}$ regimes. The role of the Cosmic Core in a global cycle must remain distinct from local Black Core solutions, which assume a transmissive exterior absent from the total cosmic budget.

35

The Cosmological Numerical Checkpoint

Viability is not derivation

A radiatively sourced homogeneous model was calculated to test whether a late-time RM-like history is numerically excluded before the constitutive law itself has been derived. The retained checkpoint gives

$$w_{\mathcal{A},\text{eff}} = -0.683953, \quad q_0 = -0.405656, \quad z_t = 0.834140. \quad (107)$$

The Pantheon+ comparison used in the reproducible notebook gives

$$\Delta\chi^2_{\text{Pantheon+}} \simeq +0.244 \quad (108)$$

relative to the optimised flat Λ CDM comparison in the same calculation.

DEBT / LOCK — HBR-1, boundary production and COSMO

The deep homogeneous bulk now has a derived rate law under its stated assumptions. What remains open is the coupled global problem: derive the boundary formation law and formation cost, determine the state carried by newly manifested volume, construct the perturbative lift, and confront the complete background-plus-perturbation system with the radiation era, BAO, CMB, lensing and growth of structure. HBR-1 closes the bulk; it does not by itself produce a complete cosmological history.

The source coefficient $\beta = 0.9865$ used in this checkpoint encodes a constitutive hypothesis and is not a derived fundamental constant. Likewise $w_{\mathcal{A},\text{eff}}$ is a fitted effective coefficient. The result shows that a candidate history can be viable; it does not derive the stress–energy tensor of State $\mathcal{A}$ or the fundamental production law. Since the Version-5 bulk-closure derivation, this checkpoint no longer carries the burden of defining the homogeneous mechanism: HBR-1 is the active bulk law, while the Pantheon+ calculation remains only historical evidence that an earlier effective history was not numerically excluded. Its fitted coefficients are not promoted into the current closure.

36

The Recovered Cosmological Bomb

Chronological age, dynamical maturity and fraction of the cycle

*An older RM working proposal asked a question more precise than “how old is the Universe?”: **what fraction of its global energetic response has it actually completed?** That question produced the “conceptual bomb” of twenty-six percent.*

Age is not maturity

The number $t_0 \simeq 13.8$ Gyr is received here as a chronological reference from standard observational cosmology. It is not derived by RM and does not emerge from general relativity alone as a numerical constant. A cosmological history and observed parameters are required to assign that age to a model of the Universe.

The old RM branch distinguished this chronology from dynamical maturity. It introduced a response scale τ_{SCF} of order 15 to 20 Gyr and wrote

$$C_{\text{obs}}(t) = 1 - e^{-t/\tau_{\text{SCF}}}. \quad (109)$$

For $t_0 = 13.8$ Gyr,

$$C_{\text{obs}}(t_0) \simeq 0.50\text{--}0.60, \quad Y_{\text{obs}}(t_0) = 1 - C_{\text{obs}} \simeq 0.40\text{--}0.50. \quad (110)$$

The reading was therefore that the observable sector could be chronologically old while remaining dynamically incomplete.

Where the “thirty percent” came from

The proposal then introduced an energetic visibility factor

$$f_{\text{vis}} = \frac{\mathcal{E}_{\text{obs}}}{\mathcal{E}_{\text{final}}}, \quad 0 < f_{\text{vis}} \leq 1, \quad (111)$$

and the parametrisation

$$C_{\text{tot}}(t_0) \simeq f_{\text{vis}} C_{\text{obs}}(t_0). \quad (112)$$

With the illustration $C_{\text{obs}} \simeq 0.52$ and $f_{\text{vis}} \simeq 0.50$,

$$C_{\text{tot}}(t_0) \simeq 0.26. \quad (113)$$

The memory of “about 30%” therefore comes from a more precise number: 26% **in the working example**. It did not mean that the Universe possessed only 26% of its age, but that it might have travelled only about one quarter of a hypothetical global energetic cycle.

STATUS — Conceptual archive — not reactivated

This construction was explicitly marked “unvalidated proposal”. Neither τ_{SCF} nor f_{vis} currently has a derivation compatible with the canonical cosmological sector of Pillars II–IV. Non-repair discipline therefore forbids presenting 26% as an active prediction. The calculation is preserved because it formulates a strong and falsifiable question; reactivation requires a new derivation from the global production law of State $\mathcal{A}$ and the homogeneous mode $H(T)$.

What the question preserves

Even without preserving the number, the distinction remains conceptually useful: **chronology, expansion and maturity are not synonyms**. If global production of State $\mathcal{A}$ possesses a response scale comparable to cosmic time, the observable Universe could be a system still organising itself rather than one already asymptotic. If that scale cannot be derived, the idea returns to metaphor and must remain there.

OPEN PROGRAM — MAT-COS — rebuild the bomb under the current corpus

Derive, without using t_0 as a selection parameter, a response scale for the homogeneous sector; independently define the total content relative to which a maturity fraction could be measured; show that the result survives BAO, CMB, growth of structure and the production law $EM \rightarrow \mathcal{A}$. Without those three steps, no percentage of “Universe maturity” becomes an RM result.

PART IX

THE THEORY THAT FORBIDS ITSELF TO BE SAVED

Withdrawn branches, live debts and the next mountain



37

The Branches RM Killed Itself

History is not a reserve from which abandoned results may be recovered

A developing theory naturally accumulates provisional languages. The problem begins when those languages survive the reason that introduced them. The unified version therefore imposes a rule: a withdrawn branch may remain visible as intellectual archive, but it may no longer serve as an active premise.

Among the withdrawn or deeply reclassified branches are:

- the attempt to make $\mathcal{A}$ the cement of material cohesion, rejected by Pillar I;
- the old raw local exclusion potential depending directly on non-invariant components of Q_{ij} ;
- the old tensor imposition that obtained two modes by postulate rather than deriving them from a constraint chain;
- the reading of a continuum locally swelling or stretching to produce expansion;
- the idea of an autonomous vector field adding its own energy to the local sector;
- the identification of mechanical latent heat with the optical threshold R_S ;
- the global DSB–1 junction formula that added quantities of incompatible dimensions;
- clock-drift predictions coming from chains that are no longer canonical.

PRINCIPLE — Archive without resurrection

A historical formula may be preserved to understand the evolution of RM. It does not become active again because it produces an attractive number. Reactivation would require a new derivation compatible with the current Pillars and the Constitution.

38

The Register of Live Debts

What is missing must be as visible as what works

Current RM does not hide incomplete regions behind a general sentence. It names them so that each next step has a condition for success and a condition for failure.

Reference	Question	Status
D– $\mathcal{A}$ –02	Fully reconcile the ontology of a physical continuum with redundancy of its spatial labels in every sector.	Open, conceptual

Reference	Question	Status
D-Æ-03 / N-Æ-05	Does Pure Cadence correctly select the local two-derivative dependence?	Conditionally closed by PCP
D-Æ-04A	Does the local nonlinear gravitational chain preserve two modes on the regular branch?	Conditionally closed
D-Æ-04M	Do microscopic matter sectors preserve the universal interface and constraint algebra?	Open, narrowed
CNL-BI1	Does the constitutive-curvature candidate possess a stable, coherent strong branch?	Open strong programme
A-DSB-1	Does a finite wall action derive flux, tension and junction without fitting?	Open
OCH-1	Can the split between exterior mass and local scalar charge be derived from one action?	Open
HBR-BOUNDARY / F-Æ-03	Reference, cost and traction: CART V5 compatibility identities incorporated. Constitutive conversion laws and cosmic solution still to be selected.	Compatibility derived; physical closure open
R-NC	Derive the Cosmic Core radius from independent inputs, with no old radius as target or calibration.	Open
MAT-COS	Can a cosmic-cycle maturity measure be derived from the current homogeneous sector without reviving the old parametrisation?	Open
COSMO	Does homogeneous closure survive the radiation era, perturbations, BAO, CMB and growth of structure?	Open
MASS	Can the Triple Identity be derived without inserting observed mass?	Open target

The register performs two functions. It prevents a conditional closure from being cited as an absolute result. It also prevents a conceptual difficulty from becoming, by repetition alone, a tacit postulate.

39

The Triple Identity

The next mountain cannot be circular

Pillar I leaves a deliberately severe target for any future theory of mass:

$$\boxed{\frac{E_0}{c_{\mathcal{A}}^2} = M_{\text{in}} = M_{\text{rel}}.} \quad (114)$$

The equality must never be obtained by definition.

The first route begins from internal energy E_0 . The second must make inertia M_{in} emerge as a dynamical response. The third must derive relational mass M_{rel} from the imprint that the matter sector imposes on the relational medium. All three routes must come from a common action, without injecting the observed mass into one route and then celebrating its return in the other two.

DEBT / LOCK — Death clause for the mass theory

Reject a closure if it requires a coefficient separately fitted to each particle, if one mass route is defined from another instead of being independently derived, or if it introduces a stabilising term whose origin lies outside the common action.

The summit is therefore narrower than a numerical relation. RM must explain why internal energy, inertial resistance and relational imprint carry the same quantity without allowing $\mathcal{A}$ to manufacture the cohesion of matter.

40

How to Kill RM Seriously

A theory gains nothing by making its refutation impossible

Weak-field agreements are survival tests; by themselves they are not distinctive proof. If RM reproduces the usual values of γ , β , α_1 and α_2 , it avoids immediate death. It does not thereby demonstrate its ontology.

Truly discriminating tests must come from sectors in which RM structure produces a consequence calculated before the observation:

- a strong-field observable once the Black Core wall and regular solution have actually been derived;
- a microscopic matter sector that tests the universal interface;
- a cosmological history obtained after independent derivation of $H(T)$ rather than by fitting a function to a curve;
- a parameter-free relation arising from the Triple Identity;
- a rank change in the constraint algebra releasing an extra gravitational mode;

- an experimental requirement for a cadence term forbidden by PCP.

Conversely, an attractive anomaly is not adopted because it resembles what RM would like to see. The calculation must exist before the claim.

FORMAL RESULT — The maturity criterion

An RM proposal becomes scientifically interesting when it simultaneously possesses: an origin in the declared action or postulates, a calculable consequence, a rejection condition and an explicit prohibition against repair by post-failure fitting.

41

The Minimal Dictionary of the Treatise

One vocabulary to prevent ontological drift

Universal time T

Unique open line ordering transformations. It is not locally split into multiple physical times.

Cadence

Rate of a physical process relative to T . A clock counts cadence.

State $\mathcal{A}$

Proposed physical relational continuum of the manifested Universe; support for transmission, gradients, cadence and relational imprints.

Matter m

Material state whose cohesion, internal energy, charges and transitions remain its own prerogatives.

EM

Electromagnetic sector and radiation; distinct from State $\mathcal{A}$.

State E

Maximal cohesion, distinct from ordinary matter and State $\mathcal{A}$; subject to a fundamental density limit.

Gravity

Fundamental law in the manifested Universe. RM does not say that $\mathcal{A}$ creates gravity; $\mathcal{A}$ carries its relational manifestations.

Q_{ij}

Local relational state tensor. Its symmetric and antisymmetric sectors have different constraint roles.

$\mathcal{G}$ Invariant scalar $\mathcal{G}[q] = \nabla^2 \text{Tr } q - \partial_i \partial_j q_{ij}$ used in CLG-1.

CLG-1

Local quadratic closure deriving the Poisson limit, pair energy and two local modes under its rank conditions.

Pure Cadence

Constitutive principle according to which N converts local cadence without becoming an autonomous two-derivative energy reservoir.

N-OPT-01.1

Analytical transport result: on a frozen $\{g_{ij}, D_{\text{loc}}\}$ background, cadence enters first passage through $\mathcal{L}_{\text{loc}}\Theta = -1/N$, and $\Theta_N/\Theta_{N=1}$ is a positive weighted average of $1/N$.

CNL-BI1

Nonlinear relational-curvature candidate carrying the constitutive response of the Exclusion Interaction; not yet a complete strong-field theory.

DSB-1

Double-scale Black Core architecture: $R_S \propto M$ for the optical/transport threshold and $r_c \propto M^{1/3}$ for the mechanical barrier.

OCH-1

Hypothesis separating total exterior mass from local residual matter scalar charge.

EI-1

Minimal Exclusion-Interaction statement: finite constitutive capacity progressively raises the cost of continuation through the same channel and excludes continuation at the capacity boundary; no unique analytic function is fixed by the law alone.

GHC-1

Surviving homogeneous Hamiltonian constraint $P^{(3)}R = \rho_m + u_\gamma + \varepsilon_z + u_0$.

GEC-1

Homogeneous conformal-equilibrium constraint $\rho_m + 2u_\gamma - 2u_0 = 2\varepsilon_z + 3\varepsilon'_z$.

HBR-1

Derived homogeneous bulk rate $H[3B'(e) + 3\rho_m + 8u_\gamma] = s$, obtained by preserving GEC-1 under the declared matter-radiation ledger.

Boundary production

Inhomogeneous formation of new manifested State- $\mathcal{E}$ volume at the edge, represented by $g_\partial = \Gamma_\partial/(3V_{\mathcal{E}})$ and kept separate from the deep-bulk rate H ; $H_{\mathcal{E}} = H + g_\partial$.

HCR-1

Retired provisional homogeneous relation. The action-level homogeneous audit did not reproduce it; it remains historical only.

Triple Identity

Target $E_0/c_{\mathcal{E}}^2 = M_{\text{in}} = M_{\text{rel}}$ to be derived independently from a common action.

42

Four Pillars, Two Canonical Notes, One Treatise

The public architecture of RM on 16 September 2026

The RM corpus now has three levels of reading.

The four Pillars remain the specialised authorities:

- **Pillar I — The Missing State of the Universe: The Genesis of RM**, v5.2.0: genesis, anti-circularity, separation of prerogatives, constitutive boundary closure, CA-1 cross-method reproduction and N-OPT-01.1. DOI: [10.5281/zenodo.22674666](https://doi.org/10.5281/zenodo.22674666).
- **Pillar II — Fundamental Energetic Symmetry and the Missing State of the Universe: How State $\mathcal{A}$ Pays for Gravity**, v4.6.0: technical gravitational corpus, Revised Schwarzschild Relation, CA-1 cross-method consolidation, N-OPT-01.1 and the historical provisional HCR branch. DOI: [10.5281/zenodo.22641647](https://doi.org/10.5281/zenodo.22641647). The later homogeneous-bulk note explicitly supersedes HCR-1 for the zero-mode closure.
- **Pillar III — The Heresy of Absolute Time: A Theoretical Manifesto of Relativity of Matter**, v7.4.0: canonical synthesis and manifest-physicality update. Series DOI: [10.5281/zenodo.21341337](https://doi.org/10.5281/zenodo.21341337).
- **Pillar IV — Foundation/TRD Constitution**, v7.2.0: constitutional norm. DOI: [10.5281/zenodo.22655616](https://doi.org/10.5281/zenodo.22655616).

Two standalone technical notes now carry narrow canonical tasks that should not be diluted across the larger books:

- **Constitutive Exclusion and Homogeneous Bulk Closure in RM**, Version 5: GHC-1, GEC-1 and HBR-1; retirement of HCR-1; separation of deep bulk and boundary. DOI: [10.5281/zenodo.22791787](https://doi.org/10.5281/zenodo.22791787).
- **The Exclusion Interaction in Relativity of Matter**, v1.0.0: canonical EI-1 statement and the dependent EI-D1 first-passage theorem. DOI: [10.5281/zenodo.22793642](https://doi.org/10.5281/zenodo.22793642).

Book V — 2036: L'abolition de l'espace-temps / The Abolition of Spacetime remains the continuous reading layer. It does not create a fifth Pillar and it does not outrank a later narrow technical derivation. The English Zenodo lineage remains the existing Book V record rather than a new publication family.

PRINCIPLE — Internal citation rule

Pillar I governs methodological discipline; Pillar II governs the technical gravitational corpus; Pillar III governs synthesis status; Pillar IV governs the constitutional norm. When a later dated standalone technical note explicitly tests and supersedes a provisional branch, that note governs the narrow branch until the corresponding Pillar is updated. Book V organises these authorities; it does not silently overrule them.

STATUS — CART technical reception, 18 September 2026

RM-CART V5.0 extends the homogeneous note with inhomogeneous global elasticity, Core mechanics, radial dynamics and birth and formation balances. CART V4 is the preprint deposited under [10.5281/zenodo.22816160](https://doi.org/10.5281/zenodo.22816160). Chapters 43–52 incorporate V5; no new DOI or deposit of this edition is announced without confirmation of publication.

PART X

THE COSMIC BODY AND THE TEST OF THE SKY

From exact symmetry to mechanical conditions for the Core, bulk and boundary



“The end of the Big Bang singularity meets the abolition of spacetime.”

This signature expresses the author’s programme. The following results specify what its equations establish: an axis under symmetry assumptions, a declared global response, sign criteria and compatibility conditions. A finite Core volume remains distinct from a determination of its physical radius.

STATUS — Sources and scope of the 18 September 2026 consolidation

This part incorporates RM–CART V5.0 in its corrected state of 18 September. The CART V4 preprint is deposited under DOI [10.5281/zenodo.22816160](https://doi.org/10.5281/zenodo.22816160); that DOI is not assigned to V5 here. CART–02 V2.2 remains a frozen geometric reference. The *homogeneous note Version 5* and *CART V5* are separate documents. Algebraic checks, including AI-assisted reviews, are neither a journal decision nor observational validation.

43

One physical centre, one sky axis

Symmetry fixes the axis; mechanics decides whether anything is visible along it

Consider an entire configuration spherically symmetric about O : geometry, fields, interfaces, propagation and the history relevant to observation. The observer M , away from the centre, has no velocity transverse to OM . Rotations about OM then preserve both the configuration and the observer. Their group is $SO(2)$.

For a scalar sky observable $\mathcal{A}$, this invariance gives exactly

$$\mathcal{A}(R_\phi \hat{n}) = \mathcal{A}(\hat{n}), \quad a_{\ell m} = 0 \quad (m \neq 0), \quad (115)$$

in the polar frame with axis OM . Every nonzero dipole arising from this configuration is parallel or antiparallel to that axis. The proof relies neither on shallow depth, flat geometry nor a perturbative order. Vector and tensor fields require the corresponding rotation action; an octupole is not a vector to which one simply assigns an arrow.

FORMAL RESULT — What becomes falsifiable

Two significantly noncollinear dipoles, independently established as nonkinematic and attributed to the same spherical structure, exclude that common origin. The theorem assigns no sky coordinates to O , does not force each photon to follow OM , and does not require a nonzero dipole amplitude.

The local calculation retains its own role. If $\mathcal{O}_F(s, \hat{n}) = \int_0^s F(\gamma_{\hat{n}}(u)) du$, with unit-speed geodesics, equal depths and a sufficiently regular field in a normal neighbourhood, then

$$\mathcal{O}_F^-(s, \hat{n}) = \frac{s^2}{2} DF(M) \cdot \hat{n} + O(s^4). \quad (116)$$

Thus $DF(M) = 0$ removes the leading s^2 term. Odd contributions of order s^4 may remain; this

does not change their symmetry axis. For local counts with effective density ν and $\nu(M) > 0$,

$$\mathcal{D}_N(s) = \frac{3s}{4} |D \ln \nu(M)| + O(s^3). \quad (117)$$

A deep catalogue requires the full selection integral and Jacobian. The axis survives this integration when selection respects the symmetry; the local amplitude formula does not replace that calculation.

The three boundaries remain distinct:

$$R_C < r_o < R_{\text{tr}} \leq R_{\mathcal{E}}. \quad (118)$$

Here R and r are proper radial distances. The areal radius will be denoted $S(r)$, with $d\ell^2 = dr^2 + S(r)^2 d\Omega^2$; scalar curvature will always be $\mathcal{R}$.

44

State $\mathcal{E}$ as an integral cosmic body

A local response can depend on the volume and cadence of the whole domain

Taking the physical unity of State $\mathcal{E}$ seriously leads us to examine global elastic energy. Its character as a body is the guiding intuition; exclusive dependence on total volume is an additional constitutive choice, called the global-elasticity postulate here. It must be written explicitly for its consequences to be calculable.

On the reservoir's physical domain Ω , define

$$V = \int_{\Omega} dV_g, \quad I = \int_{\Omega} N dV_g, \quad \bar{N} = \frac{I}{V}, \quad e = \ln \frac{V}{V_{\text{ref}}}, \quad H_z = \varepsilon_z(e)I. \quad (119)$$

During variation, Ω and $V_{\text{ref}} > 0$ are fixed. This does not make them immutable during evolution. For $\delta g_{ij} = \omega g_{ij}$ in three dimensions,

$$\frac{\delta H_z}{\delta N(x)} = \sqrt{g} \varepsilon_z, \quad (120)$$

$$\frac{\delta H_z}{\delta \omega(x)} = \frac{3}{2} \sqrt{g} [\varepsilon_z N(x) + \varepsilon'_z \bar{N}]. \quad (121)$$

The prime on ε_z denotes differentiation with respect to e . The $\bar{N}$ term comes from varying total volume. It cannot be replaced by $N(x)$ in an inhomogeneous field. A local model depending on $e(x)$ recovers the same homogeneous limit but a different variation: agreement on the zero mode does not select the global extension.

With $P = c_{\mathcal{E}}^4/(16\pi G) > 0$, the background u_0 and its pressure $-u_0$ are retained. In CART's minimal canonical branch,

$$D^2 N = \mathcal{Q}_{\text{loc}} N + \alpha_z (N - \bar{N}), \quad \alpha_z = \frac{3\varepsilon'_z}{4P}, \quad (122)$$

$$\mathcal{Q}_{\text{loc}} = \frac{c_{\mathcal{E}}^2}{P^2 \det g} \pi^{ij} \pi_{ij} + \frac{\rho_{m\gamma} + 3p_{m\gamma} - 2u_0 - 2\varepsilon_z - 3\varepsilon'_z}{4P}. \quad (123)$$

ρ and p are energy densities and pressures in the same units; $3p_{m\gamma}$ is the matter and radiation stress trace. The momentum π^{ij} is a tensor density. The kinetic term disappears only on a branch whose conditions make it vanish.

For $n = N - \bar{N}$, the operator reads

$$(D^2 - \lambda_z^{-2})n = \mathcal{Q}_{\text{loc}}(\bar{N} + n), \quad \lambda_z^2 = \frac{4P}{3\varepsilon'_z}, \quad \int_{\Omega} n dV_g = 0. \quad (124)$$

It is screened when $\varepsilon'_z > 0$. The mean is that of the solution on its actual domain. It is not an independent parameter adjusted to close the equation.

Under GHC-1, GEC-1 and nonnegative homogeneous components, with $f_\gamma = u_\gamma/(\rho_m + u_\gamma) \in [0, 1]$ and $\alpha^2 = 6P/\rho_{\text{tot}}$,

$$\frac{\lambda_z^2}{\alpha^2} = \frac{2\rho_{\text{tot}}}{9\varepsilon'_z} \geq \frac{2}{3(1+f_\gamma)} \geq \frac{1}{3}. \quad (125)$$

This is a lower bound: it proves neither $\lambda_z \sim \alpha$ nor short-range confinement of the Core field. The quoted homogeneous branch has positive curvature; global elasticity does not establish a flat cosmic bulk.

Two tests that prevent a false solution

In a flat annulus with $\mathcal{Q}_{\text{loc}} = 0$, the scalar equation alone has the solution

$$n(r) = \frac{A_- e^{-r/\lambda_z} + A_+ e^{r/\lambda_z}}{r}. \quad (126)$$

A finite body retains both constants until its two boundaries are matched. For prescribed constant-curvature geometry, substituting $u = S_\kappa n$ gives $u'' = (\lambda_z^{-2} - \kappa)u$. These profiles solve the prescribed scalar operator, not automatically the coupled mechanical system.

First test: if $\mathcal{Q}_{\text{loc}} = 0$ throughout a regular compact domain with no normal flux,

$$\int_{\Omega} (|DN|^2 + \lambda_z^{-2}(N - \bar{N})^2) dV_g = 0, \quad (127)$$

hence $N = \bar{N}$. Second test: in a connected static region with zero momentum, isotropic stress and constant scalar curvature, the divergence of the trace-free equation imposes

$$(\alpha_z + \mathcal{R}/2)D_i N = 0 \quad (128)$$

if $\mathcal{Q}_{\text{loc}} = 0$. For a positive coefficient the gradient vanishes. Boundary data cannot make a profile compatible when the tensor equation forbids it. One must solve a branch in which geometry, charges, stresses or evolution actually respond.

45

The Core consists of State E

Density chooses neither its pressure nor the sign of its influence

The Core is a State- E body of maximal cohesion; it is not compressed State $\mathcal{A}E$. The Exclusion Interaction describes constitutive response at a channel capacity. The stretching capacity e_{cap} does not become a compression density for E .

In the active calculation, u_E remains an independent energy density. The historical anchor $u_{E,\text{max}}^2 = u_\star u_\Lambda$ remains a conditional archive. Replacing u_Λ with u_0 does not prove a new law. Nor does saturation of $\ell_\star^4 R_{ij} R^{ij}$ alone give $u_E = P/\ell_\star^2$: it fixes neither the trace-free Ricci part nor the complete constitutive equation at the threshold.

Intrinsic density held fixed in an intensive variation would give $p_E = -u_E$. Constrained saturation instead retains a mechanical reaction. One explicit realization is

$$H_E = \int_C N_E [u_E J - \Pi_E (J - 1)] dV_{\text{ref}}. \quad (129)$$

Variation must precede imposing $J = 1$. It gives $p_E = -u_E + \Pi_E$. In a static isotropic branch with no additional volume force,

$$p'_E = -(u_E + p_E) \frac{N'_E}{N_E}, \quad \Pi_E N_E = C_E, \quad p_E = \frac{C_E}{N_E} - u_E. \quad (130)$$

The constant is selected by the solution and its mechanical boundary data. Even $\Pi_E \geq 0$ does not fix the sign of $-2u_E + 3\Pi_E$.

With calibration $N_\star > 0$, the isotropic volume contribution of E to active mass is

$$\mathfrak{M}_E^{\text{vol}} = \frac{1}{c_{\mathcal{A}E}^2 N_\star} \int_C (u_E + 3p_E) N_E dV_g = \frac{V_C}{c_{\mathcal{A}E}^2 N_\star} [3C_E - 2u_E \langle N_E \rangle_C]. \quad (131)$$

The sign therefore depends on the integrated reaction, cadence field and matching. The background, reservoir and any surface layer have their own contributions.

Three signs in one benchmark family

For a regular minimal interior with constant total density $u > 0$, define $\kappa_C = u/(6P)$, $S = \sin(\sqrt{\kappa_C} r)/\sqrt{\kappa_C}$, $y = S'$, $y_b > 0$ and $w_b = p_b/u$. The classical static family used as a benchmark in CART gives

$$N(r) = \frac{N_b}{2} \left[3(1 + w_b) - (1 + 3w_b) \frac{y(r)}{y_b} \right], \quad (132)$$

$$p(r) = u \left[(1 + w_b) \frac{N_b}{N(r)} - 1 \right], \quad (133)$$

$$N'(r) = \frac{\kappa_C S(r) N_b}{2y_b} (1 + 3w_b). \quad (134)$$

We require $N > 0$ throughout the interior. For $y_b > 1/3$, the cases $w_b = -1, -1/3, 0$ give negative, zero and positive flux, respectively. This family is not a new cosmological solution: it establishes that density alone leaves all three signs possible. A layer-free match to the

minimal vacuum selects $p_b = 0$; the actual bulk with u_0 and ε_z is not that vacuum.

Two reservoir occupations, two sign tests

Define $b_0 = u_0 + \varepsilon_z$ and $a_0 = \varepsilon'_z \bar{N}$. At a static isotropic layer-free interface of areal radius S_b ,

$$N'_{b,A} = \frac{S_b}{12P_{y_b}} \{N_b[u_E + 3p_{m\gamma,b} - 3b_0] - 3a_0\}, \quad (135)$$

$$N'_{b,B} = \frac{S_b}{12P_{y_b}} \{N_b[u_E + 3p_{m\gamma,b} - 2b_0] - 3a_0\}. \quad (136)$$

In A, background and reservoir are excluded from E ; in B, they occupy it with the same law. Total densities, and therefore interior geometries, differ. Each sign is that of its bracket under the admissibility conditions. A small potential at r_o does not justify assuming $\bar{N}/N_b = 1 + O(\epsilon)$ at the Core.

46

Radial dynamics retains its constraints

Current, both pressures and traction must come from the same system

The minimal branch uses $d\ell^2 = A^2 dr^2 + S^2 d\Omega^2$. The shift is varied before being set to zero; the proper-distance gauge $A = 1$ is imposed on a slice after variation. It removes neither $\dot{A}$ nor $\dot{\bar{A}}$. Define

$$\vartheta = \frac{1}{N} \left(\frac{\dot{A}}{A} - \frac{\dot{S}}{S} \right), \quad H_t = \frac{\dot{S}}{NS}, \quad D_\tau = N^{-1} \partial_T, \quad \mathcal{B}_r = D_\tau \vartheta + \frac{\vartheta^2}{2} + 3\vartheta H_t. \quad (137)$$

D_τ measures a rate per local cadence without creating a second time line.

The ordinary tensor associated with canonical momentum is

$$\Pi^j_i = \pi^j_i / \sqrt{g} = P \text{diag}(2\vartheta, -\vartheta, -\vartheta) / (3c_{\mathcal{E}}^2).$$

With $\mathcal{H}_i = -2D_j \pi^j_i + \mathcal{H}_i^m = 0$ and $j_r = \mathcal{H}_r^m / \sqrt{g}$,

$$\boxed{j_r = \frac{4P}{3c_{\mathcal{E}}^2} \left(\vartheta' + 3\frac{S'}{S}\vartheta \right)}. \quad (138)$$

The geometric coefficient is 3. Applying the ordinary-tensor divergence to the density π counts $\sqrt{g}$ twice and produces the erroneous coefficient 5. If $j_r = 0$, $S^3\vartheta$ is constant in an annulus; regularity sets it to zero when the domain contains the centre.

With $y = S'$ and distinct principal pressures p_r, p_t , the equations are

$$P\mathcal{R} = \rho_{\text{tot}} + \frac{2P}{3c_{\mathcal{E}}^2}\vartheta^2, \quad (139)$$

$$\frac{y}{S} \frac{N'}{N} - \frac{1-y^2}{2S^2} - \frac{p_r}{4P} = -\frac{\mathcal{B}_r}{3c_{\mathcal{E}}^2}, \quad (140)$$

$$N'' + \frac{y}{S}N' + N\frac{S''}{S} - \frac{Np_t}{2P} = \frac{N}{3c_{\mathcal{E}}^2}(D_\tau\vartheta + 2\vartheta^2 + 3\vartheta H_t). \quad (141)$$

The tangential equation plus N times the radial equation gives, without an extraneous factor,

$$D^2N = N \left[\frac{\mathcal{R}}{4} + \frac{p_r + 2p_t}{4P} + \frac{\vartheta^2}{2c_{\mathcal{E}}^2} \right] = \mathcal{F}, \quad (142)$$

$$\mathcal{F} = N \left[\frac{\rho_{\text{tot}} + p_r + 2p_t}{4P} + \frac{2\vartheta^2}{3c_{\mathcal{E}}^2} \right]. \quad (143)$$

The second expression uses the Hamiltonian constraint. Setting ϑ to zero at one instant does not set $D_\tau\vartheta$ to zero; the static limit requires both.

The inner boundary viewed from the bulk

The bulk normal at the Core is $\nu_B = -\partial_r$. Its exact traction on the slice is

$$y_b \partial_{\nu_B} N + \left[\frac{1-y_b^2}{2S_b} + \frac{S_b(p_{r,m\gamma,b} - b_0)}{4P} - \frac{S_b \mathcal{B}_{r,b}}{3c_{\mathcal{E}}^2} \right] N_b = \frac{S_b a_0}{4P}. \quad (144)$$

The acceleration term has a minus sign. While the trace N_b , mean, geometry and dynamics remain unresolved, this is a nonlocal Robin relation. For $y_b \neq 0$, those resolved data fix the normal derivative. For $y_b = 0$, the undivided equation must be retained. A moving or converting interface still requires its own balances.

The Neumann identity from the actual interior is

$$\partial_{\nu_B} N|_b = -\frac{1}{S_b^2} \int_0^{R_C} S^2 \mathcal{F}_C dr - j_\Sigma. \quad (145)$$

For a strictly static layer with surface density σ and tangential pressure p_Σ , no radial delta stress and the same P on both sides,

$$[S'] = -\frac{\sigma S_b}{4P}, \quad [N'] = \frac{N_b(\sigma + 2p_\Sigma)}{4P}, \quad j_\Sigma = \frac{N_b(\sigma + 2p_\Sigma)}{4P}. \quad (146)$$

Here $[X] = X_B - X_C$. Positive tension γ corresponds to $p_\Sigma = -\gamma$. These static jumps are not promoted to a complete law for a moving boundary.

47

New volume inherits a reference

The birth law is constrained by two simultaneous balances

Measure all velocities per unit T . With q the normal production velocity relative to old material and θ its volume-dilation rate,

$$3H_V = \frac{1}{V} \int_{\Omega} \theta dV_g, \quad \Gamma_{\partial} = \int_{\partial\Omega} q dA_g, \quad \dot{V} = 3H_V V + \Gamma_{\partial}, \quad 3g_{\partial} = \Gamma_{\partial}/V. \quad (147)$$

The birth ratio is $J_b = dV_{\text{new}}/dV_{\text{ref,new}} > 0$. Without remodeling of the old reference,

$$\dot{V}_{\text{ref}} = \int_{\partial\Omega} \frac{q}{J_b} dA_g. \quad (148)$$

For a uniform front and $\bar{J} = V/V_{\text{ref}}$,

$$\dot{e} = 3H_V + 3g_{\partial}(1 - \bar{J}/J_b). \quad (149)$$

With nonzero production, the equivalence is

$$\dot{e} = 3H_V \iff \frac{\dot{V}_{\text{ref}}}{V_{\text{ref}}} = 3g_{\partial} \iff J_b = \bar{J}. \quad (150)$$

Transport establishes this equivalence; it does not select matched birth by itself.

Selection by GHC-1 and GEC-1

In the homogeneous old-material reduction, retain $H = H_V$ and the balances

$$\dot{\rho}_m = -3H\rho_m - s_{\text{ex}}, \quad \dot{u}_{\gamma} = -4Hu_{\gamma} + s_{\text{ex}}, \quad \dot{u}_0 = 0, \quad \dot{\mathcal{R}} = -2H\mathcal{R}. \quad (151)$$

With $B = 2\varepsilon_z + 3\varepsilon'_z$, $\delta = \dot{e} - 3H$ and $C_H = P\mathcal{R} - \rho_m - u_{\gamma} - u_0 - \varepsilon_z$, differentiation on the surface of both constraints gives

$$\boxed{\dot{C}_H = -\varepsilon'_z \delta, \quad H(3B' + 3\rho_m + 8u_{\gamma}) = s_{\text{ex}} - B' \delta.} \quad (152)$$

For $\varepsilon'_z > 0$, preserving both constraints with these balances requires $\delta = 0$. A nonzero uniform front without remodeling then has $J_b = \bar{J}$. Modifying only HBR-1 otherwise leaves a defect in GHC-1.

If transfers Q_m, Q_{γ} and a curvature departure Ξ are added to the balances, compatibility becomes

$$\dot{C}_H = P\Xi - Q_m - Q_{\gamma} - \varepsilon'_z \delta. \quad (153)$$

A different birth state therefore requires the corresponding physical compensations. Matched birth is necessary in the declared reduction; it is not an already derived microscopic conversion law.

On a growing domain, the birth contribution to a mean obeys

$$\left. \frac{d\bar{X}}{dT} \right|_{\text{birth}} = 3g_{\partial}(X_b - \bar{X}). \quad (154)$$

A matched reference does not cancel these charge or curvature differences. For nonuniform birth, the condition is on $\Gamma_{\partial}^{-1} \int q/J_b dA_g = 1/\bar{J}$, not on each J_b separately. Multiple fronts or remodeling add their own terms.

48

Creating space has a formation cost

That cost is not the density left in the new volume

For background and reservoir, $\mathcal{H}_A = b_0 I$. Add δV at cadence N_b , with $\delta V_{\text{ref}} = \delta V/J_b$, holding old fields fixed. Variation gives

$$\mu_{\text{add}}^{(T)} = N_b b_0 + a_0(1 - \bar{J}/J_b), \quad \left. \frac{\partial \mathcal{H}_A}{\partial V_{\text{ref}}} \right|_{V,I} = -\frac{I\varepsilon'_z}{V_{\text{ref}}}. \quad (155)$$

The second term in $\mu_{\text{add}}^{(T)}$ changes the existing global store. It is not a new density deposited locally. For matched birth, this sector's marginal cost is $N_b(u_0 + \varepsilon_z)$.

Full transport also retains cadence work and dilation work:

$$\begin{aligned} \dot{\mathcal{H}}_A &= \int_{\Omega} b_0 \mathcal{L}_T^{\text{mat}} N dV_g + \int_{\Omega} (b_0 N + a_0) \theta dV_g \\ &\quad + \int_{\partial\Omega} (b_0 N_b + a_0) q dA_g - I\varepsilon'_z \frac{\dot{V}_{\text{ref}}}{V_{\text{ref}}}. \end{aligned} \quad (156)$$

$\mathcal{L}_T^{\text{mat}}$ follows old material. The surface and reference terms combine into $\int \mu_{\text{add}}^{(T)} q dA_g$; the other exchanges do not disappear.

After separating old-bulk work, the first law at a uniform boundary reads, in a common energy and time convention,

$$\mathcal{P}_{\gamma} + \mathcal{P}_{\text{mec,in}} = \Gamma_{\partial} \mu_{\text{add}}^{(T)} + \dot{\mathcal{E}}_{\Sigma} + \mathcal{P}_{\text{out}}. \quad (157)$$

Hence

$$U_{\text{form}}^{(T)} = \frac{\mathcal{P}_{\gamma}}{\Gamma_{\partial}} = \mu_{\text{add}}^{(T)} + \frac{\dot{\mathcal{E}}_{\Sigma} + \mathcal{P}_{\text{out}} - \mathcal{P}_{\text{mec,in}}}{\Gamma_{\partial}}. \quad (158)$$

The layer can store energy, emit products and receive work. Internal transfers are counted once. Energy per volume has the units of density, but these units do not make the physical objects identical. The constitutive target P/ℓ_*^2 therefore fixes neither residual birth density nor u_E . Local energy and energy weighted by N_b must also be converted correctly.

With $F_{\text{cv}} = E_{\text{cv}} - \Theta S_{\text{cv}}$ at constant reference temperature $\Theta > 0$, the entropy balance gives

$$\mathcal{P}_{\text{in}} - \mathcal{P}_{\text{out}} - \Theta(\mathcal{J}_{S,\text{in}} - \mathcal{J}_{S,\text{out}}) - \dot{F}_{\text{cv}} = \Theta \dot{S}_{\text{prod}} \geq 0. \quad (159)$$

An energy flux does not determine its entropy flux. The balance bounds admissible conversion; it does not yet supply yield, spectrum or kinetics.

49

From the solved field to the observed signal

A cadence potential, a scalar kernel and a temperature are different objects

Gauss's identity survives. What fails in the globally loaded bulk is reduction of the gradient to the Core mass alone:

$$S(r_o)^2 N'(r_o) = \frac{GN_\star}{c_\mathcal{E}^2} \mathfrak{M}_C^{\text{flux}} + \int_{R_C}^{r_o} S^2 [\mathcal{Q}_{\text{loc}} N + \alpha_z (N - \bar{N})] dr. \quad (160)$$

Any layer contributions are included in the initial flux datum. The volume contribution of E to mass, outward Core flux and the observer's gradient are thus connected without being identified.

In a stationary medium at zero shift, for stationary emitters and receivers sharing the same cadence calibration, the eikonal gives

$$\mathcal{Z}_{\text{cad}} = \ln(1 + z_{\text{cad}}) = \ln \frac{N(M)}{N(x_{\text{em}})}, \quad \mathcal{Z}_{\text{cad}}^- = -sD \ln N(M) \cdot \hat{n} + O(s^3). \quad (161)$$

If the solved field gives $N'(r_o) > 0$, redshift increases toward the centre; the sign reverses for $N'(r_o) < 0$. The carrier here is the potential $\ln N$. Its order- s dipole is not the order- s^2 dipole of an integrated scalar in Eq. (116). No direction-independent kernel $K_\mathcal{E}(r)$ is obtained by merely renaming it.

FORMAL RESULT — The temperature counterexample

A centred, stationary, isothermal spherical emitting surface at radius R_s , observed in every direction with collisionless transport preserving phase-space occupation, gives

$$T_{\text{obs}}(\hat{n}) = T_s \frac{N(R_s)}{N(M)}.$$

This temperature is independent of direction even for an off-centre observer with $DN(M) \neq 0$. A cadence gradient alone therefore does not require a temperature dipole.

Counts also require intrinsic density, a luminosity function, optical transfer and selection. Three dipoles of the same sign do not follow from one redshift sign. The slice-defined proxy $c_\mathcal{E} \mathcal{Z}/s$ does not become an observational H_0 estimator without the complete propagation and source problem.

PRINCIPLE — Prediction contract

Fix constitutive and boundary physics; solve compatible geometry and cadence; calculate the local gradient; derive transfer and selection for each observable; only then compare with the sky. No CatWISE, CMB, DESI or H_0 amplitude or direction enters profile selection. A direction in Pisces is not a prediction obtained in this calculation.

50

Three Volumes for a Finite Universe

Cosmic Core, present Universe and terminal extent

RM does not need a new unit to describe a finite Universe. The domains must be defined, their phases distinguished, and their volumes calculated. This chapter replaces the named counting device of previous editions with three spatial quantities and their explicit assumptions.

The quantity before its numerical value

On a slice of universal time T , the volume of a spatial domain Ω_T is

$$V(T) = \int_{\Omega_T} dV_g = \int_{\Omega_T} \sqrt{\det g_{ij}(T, \mathbf{x})} d^3x. \quad (162)$$

We distinguish V_{NC} , the volume of the Cosmic-Core state under consideration; V_{now} , the volume of the present state of the cosmic body; and V_t , the volume at the terminal extent of the scenario. The expression *Absolute Volume of the Universe* (AVU) may designate the latter: it introduces neither a quantity different from V_t nor a measured constant. The existence and value of that terminal state belong to the physical branch still to be constructed.

The light-year, written ly, is a length. The unit ly^3 is the volume of a cube whose side is one light-year. The name of the unit does not turn a length into a duration and does not alter RM's distinction between universal time T , cadences and spatial geometry. Velocities retain units of length per duration.

In a Euclidean spherical domain of diameter D , the reduction is

$$V^{\text{flat}} = \frac{4\pi}{3} R^3 = \frac{\pi}{6} D^3, \quad D = 2R. \quad (163)$$

This formula carries the three conversions below. It does not replace Eq. (162) in a curved solution.

Inputs of the example

The Core diameter is set to 500 000 ly for this illustration. This is an older working value, reused as a *diameter*, not as a radius. Chapter 34 keeps the historical anchors outside CART's predictive inputs and preserves the R–NC debt. The present conversion selects no physical solution and does not reinstate that anchor.

The present reference is set to $D_{\text{now}} = 93 \times 10^9 \text{ ly}$ and the radial fraction to $f_R = D_{\text{now}}/D_t = 0.30$, as in the example retained in v11.3.1. These two inputs are not established RM results. The conventional observational diameter invoked as a comparison does not demonstrate the diameter of the whole Universe or that of an RM cosmic body. Under these choices,

$$D_t = \frac{D_{\text{now}}}{f_R} = \frac{93 \times 10^9}{0.30} \text{ ly} = 310 \times 10^9 \text{ ly}. \quad (164)$$

Three reproducible conversions

$$V_{\text{NC}}^{\text{flat}} = \frac{\pi}{6} (5 \times 10^5)^3 \text{ ly}^3 \simeq 6.545 \times 10^{16} \text{ ly}^3, \quad (165)$$

$$V_{\text{now}}^{\text{flat}} = \frac{\pi}{6} (93 \times 10^9)^3 \text{ ly}^3 \simeq 4.212 \times 10^{32} \text{ ly}^3, \quad (166)$$

$$V_t^{\text{flat}} = \frac{\pi}{6} (310 \times 10^9)^3 \text{ ly}^3 \simeq 1.560 \times 10^{34} \text{ ly}^3. \quad (167)$$

The exact values of the calculation are the expressions containing π ; the decimal numbers are rounded. Their displayed precision is not observational precision.

Reference	Assumed diameter	Physical status of the inputs
Cosmic Core	$5 \times 10^5 \text{ ly}$	Historical hypothesis used only for the illustration; R-NC remains open.
Present Universe	$93 \times 10^9 \text{ ly}$	Illustrative value; no demonstrated identification with the total volume of the Universe.
Terminal extent	$310 \times 10^9 \text{ ly}$	Conditional deduction from D_{now} and $f_R = 0.30$.

The conversions are calculated; the physical dimensions of the scenario are not thereby measured.

Thirty percent of the diameter is not thirty percent of the volume

In the same Euclidean geometry,

$$\boxed{\frac{V_{\text{now}}^{\text{flat}}}{V_t^{\text{flat}}} = f_R^3 = (0.30)^3 = 0.027 = 2.7\%}. \quad (168)$$

The terminal volume of this example is therefore about 37.04 times the present volume. This is a ratio of volumes, not a percentage of elapsed time. Neither $f_R = 0.30$ nor $f_R^3 = 0.027$ gives the date of maximum expansion.

The differential sensitivities of the flat examples are

$$\frac{dV_{\text{NC}}^{\text{flat}}}{V_{\text{NC}}^{\text{flat}}} = 3 \frac{dD_{\text{NC}}}{D_{\text{NC}}}, \quad \frac{dV_{\text{now}}^{\text{flat}}}{V_{\text{now}}^{\text{flat}}} = 3 \frac{dD_{\text{now}}}{D_{\text{now}}}, \quad \frac{dV_t^{\text{flat}}}{V_t^{\text{flat}}} = 3 \frac{dD_{\text{now}}}{D_{\text{now}}} - 3 \frac{df_R}{f_R}.$$

These are sensitivity identities, not statistical error bars: no uncertainty distribution for the inputs is supplied.

The physical geometry has the final word

On a spherical geometry of constant curvature,

$$V_\kappa(R) = 4\pi \int_0^R S_\kappa(u)^2 du, \quad S_\kappa(u) = \begin{cases} \sin(\sqrt{\kappa}u)/\sqrt{\kappa}, & \kappa > 0, \\ u, & \kappa = 0, \\ \sinh(\sqrt{-\kappa}u)/\sqrt{-\kappa}, & \kappa < 0. \end{cases} \quad (169)$$

The proper radius R , the areal radius $S_\kappa(R)$ and an optically inferred diameter must be distinguished. The law $V \propto R^3$ and the 2.7% ratio cannot be transferred to a curved geometry

without calculation. Nor can the maximal-cohesion Core be identified with the present central remnant after a partial Ignition: their volumes require distinct budgets.

Two extremes, one intermediate state

In the cyclic scenario under consideration, the Core may form the hinge between a contraction and a new expansion. The terminal extent is the other extreme reference. The present Universe lies between them in the chosen representation. This diagram is not yet a dynamical trajectory: Chapter 51 preserves the Ignition fraction, the collective approach of State- E bodies and the return conversion as three laws still to be established. The succession of states does not turn universal time T into a loop.

FORMAL RESULT — Three volumes under declared assumptions

The formulas and conversions in ly^3 are established for the diameters assumed in the flat example. Their ratios are independent of the common unit chosen. No numerical exponent, large or small, is evidence of finitude: finitude remains a physical proposition whose realization requires a cosmological solution.

OPEN PROGRAM — Physical dimensions and evolution

Still to be derived are the geometry of the domains, the Core budget, the total present volume, the fraction f_R , the terminal extent and the dynamics of its possible attainment. This representation calibrates neither ℓ_* , nor the cosmological gradient, nor the Maria thermometer.

51

The return programme

Three laws to write before declaring the cycle necessary

The state architecture makes a cycle conceivable: collapse can lead to E and Ignition to m . It does not prove that all bodies eventually reunite or that the same budget is reconstituted. The return programme retains three separate questions.

The Ignition fraction. A function $f_{\text{ign}}(T)$ must specify what fraction of the initial E budget has left the Core. Instantaneous total conversion and partial or extended conversion do not leave the same present remnant. The initial Core radius and the radius of the body gravitating today cannot be interchanged.

The approach of State- E bodies. Dynamics must decide whether interactions between these bodies outweigh bulk evolution and boundary production. The field sign must come from the compatible solution; bound (125) does not permit replacing λ_z with an assumed short scale. The word “gravitation” alone does not guarantee return.

The channel $\mathcal{A}E \rightarrow E$. The chain $E \rightarrow m$, then $m \rightarrow EM$, then $EM \rightarrow \mathcal{A}E$ does not close its budget without a return law or another explicit global balance. PA-10 retains transitions toward E as derivations to be supplied. A trapped trace of $\mathcal{A}E$ is not a conversion equation.

OPEN PROGRAM — A possible cycle, a necessity still to calculate

Determine $f_{\text{ign}}(T)$, collective State- E dynamics and the conversion law $\mathcal{A}E \rightarrow E$ with budget conservation. A succession of states is not yet a periodic solution or proof of recurrence.

Two proposals from Pierre retained with their status

A front moving at local speed $c_{\mathcal{A}E}$ is a kinetic hypothesis. In the universal T convention, with zero shift and locally stationary material, it gives $q = N_b c_{\mathcal{A}E}$; writing $q = c_{\mathcal{A}E}$ requires the local convention or $N_b = 1$. This speed selects neither J_b , yield nor surface stress.

The historical CMB hypothesis concerns a radiative fraction surviving $EM \rightarrow \mathcal{A}E$ conversion. It is not recast as frictional heat from an $E \rightarrow \mathcal{A}E$ channel at Ignition. The non-perfection principle derives neither a yield, blackbody spectrum nor temperature from it. The constitutional hierarchy and the non-universal status of the autonomous residual clause are retained.

52**The active laboratory and its editions**

Consolidation without erasing stages or multiplying publications

The Book V dossier receives results, corrections and proposals daily. Each entry records its date, origin and status. This edition incorporates the work of 17 and 18 September at Pierre's explicit request; it is a coordinated consolidation, with a French twin edition and the N11 update of the French Codex.

Public editions follow the monthly cycle chosen by the author. Standalone preprints retain their own schedule. A published PDF is a dated state of the dossier; it does not claim to update itself automatically each day. This consolidation does not alter the standalone files of CART V2.2 or published V4.

STATUS — What is incorporated as a result

The exact axis under symmetry; variations of the global functional; the declared bounds and obstructions; conditional mass and sign criteria; dynamical, reference, formation and matching identities. A unique physical cosmic profile, numerical Core mass and sky amplitudes are not claimed as calculated. Their problem now has explicit mechanical constraints that every solution must satisfy.

CART's detailed derivations and scripts remain the technical verification sources. Book V connects their physical objects and domains of application; the Codex retains the memory of formulas, including those withdrawn from active use. The English edition preserves the same equations, hypotheses and statuses.

PART XI

THE CONSTITUTION

What the Treatise is not allowed to rewrite silently



This final part restates the active constitutional body of Pillar IV v7.2.0 in the language of Book V and preserves its dated technical receptions. Book V v10.0.0 additionally records, outside the autonomous Pillar IV authority, that the later Version-5 bulk-closure note supersedes provisional HCR-1 for the homogeneous zero mode and that the independent Exclusion note fixes the canonical EI-1 wording. This does not retroactively modify the autonomous Pillar IV PDF.

STATUS — Register update, without changing the principles

The constitutional body below remains that of Pillar IV v7.2.0. Its dated registers record earlier states. For HBR-BOUNDARY, CART-RAD, E-SIGN, MARIA and RETURN, Chapters 43–52 provide the 18 September reception: mechanical identities derived under assumptions, constitutive laws and a global solution still open. No transition principle or residual clause is silently changed.

Official denominations and rule of discipline

Denominations (arbitrations A2 and A13, closed).

- **RM — Relativity of Matter** designates the complete theoretical architecture (arbitration A13);
- **State $\mathcal{A}$** designates the physical relational continuum of the manifested Universe. The former denomination of the continuum is withdrawn from all new work; it survives only in dated archives, with no active terminological value;
- **Silentium** designates exclusively the ideal limit external to the manifested domain. It is neither the name of State $\mathcal{A}$, nor the name of the model, nor a physical region of the Universe;
- **Foundation** designates the present Constitution;
- **TRD — Thermodynamics of the Continuum** designates the theoretical reference framework;
- **Foundation/TRD** designates the normative whole (Constitution, Analysis Constitution, laws, postulates and canonical definitions).

Terminological note.

The capitalised term “Absolute Principles” is reserved for constitutional level PA-00 to PA-11 (Title I). The five principles of V5, formerly called “five absolute principles”, carry the labels **P.I** to **P.V** and the name *structuring physical principles* (Title IV).

Rule of discipline (scope of application).

A physical principle of Title IV must produce an equation, an observable consequence and a possible test. This rule remains complete and sovereign over Title IV.

Titles I to III are ontological or postulatory in nature: their function is to define the domain of admissible states, the structural laws and the working foundations. A constitutional Absolute Principle may fix the domain of admissibility of reality without itself constituting a dynamical equation; it must nevertheless produce precise constraints on permitted or forbidden states, admissible mechanisms, acceptable solutions and the logical consequences of the framework.

Testability remains sovereign (Axiom XI). Confrontation with reality remains sovereign.

Absolute Principles (PA-00 to PA-11)

The highest level of the RM normative reference framework. No law, postulate, definition, hypothesis, mechanism or equation may contradict them or silently rewrite them. Any challenge to an Absolute Principle must be explicitly announced, justified by internal reasoning, confronted with its consequences and then with observations, and submitted to the explicit agreement of the author. A contradiction with an external theory does not, by itself, invalidate an Absolute Principle.

PA-00 — Domain and authority. *The Absolute Principles constitute the highest level of Foundation/TRD. Nothing modifies them implicitly.*

PA-01 — Prohibition of accomplished perfect states. *No manifested real state reaches absolute perfection. The following are forbidden as accomplished physical states: perfect singularity; absolute vacuum; perfect symmetry; absolute equilibrium; perfect immobility; infinite compression; total erasure of information; a perfectly closed final state. These objects remain ideal limits.*

*PA-01 fixes a **domain of admissibility**, in the explicit sense of the Rule of discipline: a constitutional Absolute Principle may fix the domain of admissibility of reality without itself constituting a dynamical equation. It states **no universal causal law**.*

*Residual transition clause (non-universal). Beyond the minimal persistence of information governed separately by LF-05, a real state may retain an **autonomous dynamical trace**: gradient, tension, continuum-memory variable or evolutionary potential. The existence of such a dynamical trace is an **architectural avenue**, not a law: it does not necessarily apply to every transition. The rank of “First Law of the Universal Exception” is withdrawn by arbitration A15; the “residual stock” remains withdrawn since A12.*

PA-02 — Open universal time. *Time is an open, non-geometrical universal coordinate, without memory and without energy, $t \in (-\infty, +\infty)$. It orders the direction of irreversible energetic transformations without being produced by them. The manifested physical domain is three-dimensional and evolves along this coordinate; RM does not identify time ontologically with a fourth geometrical dimension.*

PA-03 — Status of Silentium. *Silentium is an ideal limit and a conceptual reference external to the Universe manifested in State $\mathcal{A}$. No law specific to our Universe exists in Silentium. PA-01 does not apply there: Silentium is not a manifested real state and lies outside its domain of admissibility.*

PA-04 — Existence and transmissive necessity of State $\mathcal{A}$. *State $\mathcal{A}$ exists as a fundamental state and physical continuum of the manifested Universe. Without State $\mathcal{A}$, neither light nor gravitational manifestations can be transmitted.*

PA-05 — Founding transition of radiation. *The change of electromagnetic radiation into State $\mathcal{A}$ is validated: $EM \rightarrow \mathcal{A}$. This transition modifies and energises the continuum; it*

constitutes the boundary property between the absence of transmissive structure in Silentium and the energised state of the continuum, whose ontological existence falls under PA-04.

PA-06 — Maximal cohesion and the limit of E . E represents the state of maximal cohesion. It possesses a fundamental and impassable density limit that forbids perfect singularity, infinite compression and absolute erasure of information.

PA-07 — Ignition transition. The change of state from E into matter by Ignition in the Cosmic Core is validated: $E \xrightarrow[\text{Cosmic Core}]{\text{Ignition}} m$. This transition is distinct from the transition $EM \rightarrow \mathcal{A}$.

PA-08 — Fundamental gravity. Gravity is fundamental and without exception in the manifested Universe. Nothing real is outside gravity. State $\mathcal{A}$ does not create gravity; it makes possible its transmission, its structured gradients and its observable manifestations.

PA-09 — Global production and expansion. The conversion $EM \rightarrow \mathcal{A}$ feeds the global state of the continuum. Expansion is not postulated as an autonomous axiom: it must emerge from a global production and balance law relating this feeding to the homogeneous mode $H(T)$. The local sector $k \neq 0$ does not provide this law. Lock: $Q_{EM \rightarrow \mathcal{A}}$, the effective energy–stress tensor of the global sector and $H(T)$ must be derived independently; no function may be selected solely to reproduce in advance an external cosmological history.

PA-10 — Stability domains and critical transitions. Every real energetic state possesses a stability domain. A critical boundary may open a change of channel or state; the case $E \xrightarrow[\text{Cosmic Core}]{\text{Ignition}} m$ remains constitutionally validated. Passages involving $m \rightarrow E$ or $\mathcal{A} \rightarrow E$ hold only in sectors where an action or phase law derives them explicitly: they may never be invoked to attribute the ordinary nuclear cohesion of matter to $\mathcal{A}$. No real transition is perfectly homogeneous, total or devoid of trace. The symmetric bifurcation $E \rightarrow \{m, \mathcal{A}\}$ as a single process is forbidden without explicit amendment.

PA-11 — Separation of the prerogatives of matter and State $\mathcal{A}$. Nuclear cohesion, internal structure, internal energy, charges and matter-specific transitions belong to m . State $\mathcal{A}$ transmits, relates, carries gradients, modulates cadences and manifests the external imprint; it does not manufacture matter and does not replace matter's own interaction. An interface with $\mathcal{A}$ may condition a passage without usurping the prerogatives of the material sector.

Fundamental Laws (LF-00 to LF-09)

Each law of this title falls under LF-00: the law receives no exception; its manifestations always do.

LF-00 — Non-exception of fundamental laws. *A fundamental law never receives an exception. The exception applies to states, transitions, manifestations and real forms, never to the fundamental law itself. A fundamental law may generate imperfect, asymmetric or variable forms without itself becoming imperfect.*

LF-01 — Fundamental gravity. *Gravity is a fundamental law without exception. Nothing real is outside gravity. Its intensity, form, direction, distribution or local manifestation may vary; the gravitational law itself never vanishes.*

Manifestation clause. With State $\mathcal{A}$ appear the *structured* manifestations of gravity: transmissible gradients, observable forms, lensing, halo dynamics. What “arises” with the continuum are the transmitted manifestations of gravity, never the law.

LF-02 — Open time. *Time is an open line, $t \in (-\infty; +\infty)$. It does not loop, vanish or close into a perfect final state.*

Manifestation clause. Time has neither thickness, memory nor energy; it is neither a geometrical container, a medium, nor an energy. Memory does not produce time: it produces observable history and the orientation of transformations within open time. Clocks count the local cadence of physical phenomena (FCPL), never time itself.

Dimensional clause. RM distinguishes the three-dimensional manifested domain from the open coordinate T . Four-dimensional spacetime may remain an empirically successful external representation; it is not granted ontological primacy inside RM.

Cosmic-state clause. Expansion and contraction, if both are ultimately derived, are changes of the global state along T . A cyclic or oscillatory cosmic history therefore does not imply a cyclic time: what may oscillate is the Universe, not the open line that orders its history.

LF-03 — Existence and transmissive function of State $\mathcal{A}$. *State $\mathcal{A}$ exists as a fundamental state and physical continuum. In the RM framework, it constitutes the condition for transmission of light, gravitational manifestations, energetic gradients, information and structured dynamics. It may transport information and correlations; the existence of an autonomous continuum-memory variable remains an open question.*

Manifestation clause. The existence of the continuum is a structural law; its local states (density, gradients, correlations) belong to the domain of admissibility defined by PA-01 and to the transition laws of PA-10 and LF-09.

LF-04 — Non-perfection of real states. *No manifested real state reaches absolute perfection. LF-04 is the expression as a fundamental law of **the prohibition established by PA-01** (arbitration A15). It does not reproduce the Residual Transition Clause, which is not universal.*

LF-05 — Minimal persistence of information. *No real transformation completely erases memory, information or asymmetry. A minimal trace always remains. This statement does not yet imply the existence of an autonomous continuum-memory variable $\mathcal{M}_E$.*

Manifestation clause. This law does not produce open time, which independently falls under LF-02. It only forbids perfect physical erasure and permits the persistence of information, correlations or asymmetries in resulting states. Any autonomous continuum-memory variable remains to be derived.

LF-06 — Non-realisation of absolute perfection. *Perfect singularity, absolute vacuum, perfect symmetry, absolute equilibrium and perfect immobility are ideal limits, not attained physical states.*

LF-07 — Dynamical gradient. *In a dynamical manifestation, the local departure from equilibrium or the approach to a stability limit is expressed as a gradient, tension or evolutionary potential. The gradient characterises the out-of-equilibrium state; when the corresponding capacity is saturated, LF-09 imposes a change of channel, variable or state.*

Manifestation clause. In Title IV, LF-07 articulates the **domain of admissibility** delimited by PA-01, the stability domains of PA-10 and the exclusion mechanism of LF-09; P.IV ($P \rightarrow H(z)$, PA-09) is its quantitative cosmological expression.

It is the limits of the continuum that transform the delimited domain into a source of dynamics. A domain of admissibility forbids states; it does not produce them. It is the *approach* to a limit that produces dynamics, by constraining energy to change channel — the mechanism stated by LF-09. The bridge therefore no longer passes through a universal causal law of Exception (arbitration A15) but through the Exclusion Interaction (arbitrations A16 and A19).

LF-08 — Density limit of E . *E possesses a fundamental, impassable density limit without exception, denoted $\rho_{E\text{-lim}}$. It forbids perfect singularity and infinite compression. In RM, Black Cores constitute the candidate branch for manifestation of the approach to this limit.*

Manifestation clause. No real Black Core reaches $\rho_{E\text{-lim}}$: the approach to the limit is real; the limit itself is without exception and beyond reach.

LF-09 — Exclusion Interaction. *When a physical or constitutive degree approaches the maximum capacity admissible in its state, further evolution in the same channel becomes progressively inadmissible. Energy, constraint and information do not disappear and do not cross the forbidden limit: they must **redistribute, change channel, change variable or change state**. The limit is never “repaired” by allowing the forbidden direction to continue.*

Manifestation clause. LF-09 is the structural law of which LF-08 is the density case: LF-08 states that the density limit of E is impassable; LF-09 states the generic response when a

constitutive channel closes. In the current strong-field geometry, the relevant manifestation is *geometrical exclusion*: continued loading is opposed by an increasingly stiff constitutive response. Other sectors may realise LF-09 differently and must derive their own channel change.

Name and scope clause. “Exclusion Interaction” is the canonical RM name adopted after v7.0.0. It is unrelated to the Pauli exclusion principle, is not a fifth force and introduces no new fitted coefficient by itself. The former name *Principle of Saturation* survives only in dated historical entries.

Non-import clause. Every quantitative realisation of LF-09 remains **outside the Constitution**. Historical ansatzes such as PS-0 and current nonlinear candidates such as CNL–BI1 must earn their status in the technical Pillars. LF-09 fixes neither their functional form nor a numerical coefficient.

Active Postulates

Working foundations of the internal framework. A postulate may be abandoned by explicit amendment; it does not become a law because it is useful, and it does not become a result because a technical branch reproduces it.

P-01 — Internal framework. *TRD (Thermodynamics of the Continuum) is the internal reference framework of Foundation/TRD.*

P-02 — Radiative transition. *The transition $EM \rightarrow \mathcal{A}E$ is validated as an internal transition principle. Its microscopic law, global source and coupling to the cosmological sector must be derived independently; no former de Sitter-type parameterisation or w_{eff} is constitutionalised.*

P-03 — State E . *E represents the state of maximal cohesion. It is neither a particle, a classical field, an ordinary fluid, nor a perfect final state.*

P-04 — Cosmic Ignition. *The change of state $E \rightarrow m$ by Ignition in the Cosmic Core is validated. It is distinct from $EM \rightarrow \mathcal{A}E$ and must never be represented as the other branch of a single symmetric bifurcation.*

P-05 — Existence of State $\mathcal{A}E$. *State $\mathcal{A}E$ exists within the internal framework as the physical relational continuum of the manifested Universe.*

P-06 — Open time. *Time is an open universal line; clocks measure the cadence of physical processes, not a deformation of time itself.*

P-07 — Pure Cadence Principle (PCP). *The cadence field N is a universal converter of local cadence relative to time T , not an autonomous local energy reservoir. At the local two-derivative level, PCP conditionally fixes the cadence dependence of the CNL-2D branch. If the microscopic audit, constraint algebra or observation requires a term forbidden by PCP, the postulate is reopened or rejected; it is not repaired by adjustment.*

Constitutional reception of Pillar II results.

The former tensorial postulates P-07 to P-09 of the August 2026 edition are **withdrawn from the active register**. Their historical role was to impose the reduction to two modes. Pillar II v4.5.0 retains and extends the replacement of this imposed closure by an explicitly calculated constraint chain: CLG-1 gives six first-class and ten second-class constraints at quadratic level; $N\text{--}\mathcal{A}E\text{--}06$ conditionally recovers the same count on the regular local elliptic branch. The result $N_{\text{grav}} = 2$ is therefore a *conditional technical result*, not a constitutional postulate. $D\text{--}\mathcal{A}E\text{--}04A$ is conditionally closed; $D\text{--}\mathcal{A}E\text{--}04M$ remains open for microscopic matter sectors capable of modifying the canonical structure.

Labelling and gauge.

The Constitution maintains the distinction: *State $\mathcal{A}E$ is physical; its labels are not.* The complete

technical realisation of this distinction in all sectors remains associated with conceptual debt D-Æ-02; Pillar IV does not turn its resolution into a theorem by decree.

Constitutional reception of the constitutive length and stellar fold.

Pillar II v4.5.0 carries a nonlinear strong-field candidate in which geometry possesses a constitutive length $\ell_\star$ entering the action before any matter equation of state. In the full spatial notation,

$$X_{\mathcal{R}} = \ell_\star^4 \mathcal{R}_{ij} \mathcal{R}^{ij},$$

with the retained constitutive response

$$F(X) = 1 - \sqrt{1 - X} - \frac{X}{2}, \quad F'(X) \rightarrow \infty \quad (X \rightarrow 1^-).$$

Pillar IV receives the *role* of $\ell_\star$ and its connection to LF-09, not a physical neutron-star calibration, a uniqueness theorem or a new Fundamental Law.

The frozen N-EMPR v28 spherical calculation exhibits a stellar Q -fold and a second hydrostatic branch in reduced units for the declared toy equation of state. The undivided Euler–Lagrange form establishes that $Q = 0$ need not be a physical endpoint. The result is technically significant but constitutionally bounded: it establishes neither an observed compact object, nor a radial-stability theorem, nor an RM maximum mass, nor the completed Black-Core branch. The CA-1 numerical protocol and the unresolved cross-solver discrepancy remain part of the public audit burden.

Structuring Physical Principles (P.I to P.V)

The five principles of V5 are retained in their text and order, under the labels P.I to P.V. They are the first quantitative expressions of the ontological foundation; their content is carried at constitutional level by PA-02, PA-04, PA-05, PA-09 and PA-10; the present title remains the layer in which this content carries the burden of proof, under the rule of discipline.

P.I — Time.

Time is not a physical quantity; it is an open universal coordinate, without thickness, memory or energy; clocks count the cadence of physical phenomena, never time. The physical domain is three-dimensional and evolves along T ; RM therefore does not require time to become a fourth geometrical dimension. Physical expression of LF-02 and PA-02; FCPL remains its operational translation.

P.II — The continuum.

The continuum physically exists; observed geometry is an effect of the state of the medium, not the medium itself. Physical expression of LF-03 and PA-04; its burden of testing is carried by P.III and P.IV.

P.III — The founding conversion.

$EM \rightarrow \mathcal{A}E$ is a fundamental transition of the internal framework. Its external scientific scope depends on a microscopic derivation and discriminating observables. A branch that requires this transition and fails to produce it is rejected; no transfer function is protected by the Constitution.

P.IV — Global production and expansion.

Radiative conversion feeds the global state of the continuum; the cosmological law must connect this boundary production to the homogeneous mode $H(T)$. The local sector $k \neq 0$ does not determine $H(T)$. Until the global production law and its energy–stress tensor are derived independently of cosmological data, the expansion history remains an open programme and any numerical adjustment remains a viability test, not a fundamental prediction.

Current minimal boundary coefficient.

In the unit-normalised constitutive branch received from Pillar I v5.2.0, the marginal work required to form new boundary volume is

$$\mathcal{U}_\partial = \frac{P}{\ell_\star^2}, \quad P = \frac{c_\mathcal{A}^4}{16\pi G},$$

so that

$$\boxed{K_{\text{cryst}} = \frac{\ell_\star^2}{P} = \frac{16\pi G \ell_\star^2}{c_\mathcal{A}^4}}, \quad \Gamma_\partial = K_{\text{cryst}} \mathcal{P}_{\gamma, \partial}.$$

This closes absorbed boundary power into boundary volume production within the stated branch. It does not identify boundary growth with homogeneous interior dilation, does not determine $H(T)$ and introduces no coefficient fitted to H_0 .

P.V — Changes of state.

All states possess a stability domain. Under the Exclusion Interaction, LF-09 permits a change of channel, variable or state; PA-10 forbids automatically inferring a particular transition without a phase action. $E \rightarrow m$ by Ignition remains validated in the Cosmic Core. The transitions $m \rightarrow E$ or $\mathcal{A} \rightarrow E$ must be derived sector by sector and may never be used to reassign the internal cohesion of m to $\mathcal{A}$.

Causal Chains, General Relativity and Auxiliary Hypotheses

The two chains, strictly separated

Constitutional level (ontological).

PA-01: perfect states forbidden → *PA-10: stability domains*
→ *LF-09: Exclusion Interaction*
→ *change of channel / state.*

Cosmological level (phenomenological).

E → *Ignition / matter (Cosmic Core)* → *radiation* → *State Æ*
→ *structured gradients* → *gravitational manifestations.*

Neither gravity nor time appears as a produced link: gravity is a law (LF-01, PA-08) whose manifestations are produced by the chain; time is the coordinate (LF-02, PA-02) within which the chain unfolds. The former chain *Exception* → *Ignition* → *State Æ* → *Gravity* → *Memory* → *Time* is definitively abrogated, both in the Constitution and in all Books.

Status of General Relativity

General Relativity remains the experimentally successful macroscopic language against which every relevant RM branch must be confronted in its tested domain. RM does not dispute that four-dimensional spacetime is an extraordinarily successful representation; it disputes the need to make that representation the final physical ontology. RM adopts a different internal ontology and seeks to physically reconstruct gravitational manifestations from the relational state of the continuum. The local sector of Pillar II conditionally reproduces the Poisson limit and the PPN tuple (1, 1, 0, 0) on the selected branch; this does not constitute proof of the complete theory. The homogeneous mode $H(T)$ is **not** derived by the current local equations and remains assigned to the independent global-production sector. Any external comparison remains non-normative for the Constitution, but sovereign for scientific evaluation.

STATUS — v9 reception — dated constitutional wording

The preceding sentence records the state of Pillar IV v7.2.0 and is preserved here as constitutional history. The later Version–5 homogeneous-bulk audit derives the deep-bulk rate H through HBR–1 from the surviving zero-mode constraints; what remains open is the separate boundary contribution g_{∂} and the perturbative/observational lift. Book V v10.0.0 records that later technical reception without rewriting the autonomous Pillar IV PDF.

Auxiliary hypothesis Λ_{SCF} (arbitration A6, closed)

The reformulation $\Lambda_{SCF} \sim (R_{NC} \cdot D_{\mathcal{E}})^{-2}$ (residual curvature of the Cosmic Core after dilution) has the rank of an *auxiliary hypothesis with a numerical point of contact*. The circularity warning is constitutionally enforceable: predictive content is zero until $D_{\mathcal{E}}$ has received a definition independent of Λ . **Decision A6:** none of the non-circular readings (B energetic, C cohesive, D memorial) is privileged at this stage; reading A (geometrical) is declared non-predictive by construction; choosing a reading is an act of research programme, not of constitution.

Canonical Definitions and Consistency Clauses

Time.

Open universal coordinate, without internal structure, thickness, memory or energy. It does not contain events: it makes it possible to order them. The memory of transformations belongs to states, matter and State $\mathcal{A}$, never to time (clause C-03). RM does not identify this coordinate ontologically with a fourth geometrical dimension.

E.

E designates exclusively the state of maximal cohesion. E must not be used as an ambiguous symbol for generic energy: when a generic energy must be denoted within Foundation/TRD, use $\mathcal{E}$. The reading of the symbol E in the mathematical corpus is governed by Appendix A.

State $\mathcal{A}$.

Physical relational, dynamical and transmissive continuum of the framework. It may carry gradients, tensions, information, correlations and persistent structures. The persistence of information does not authorise the postulation, without derivation, of an autonomous continuum-memory variable.

Light and electromagnetic radiation.

Radiation possesses its natural variables (λ, ν, c) , which describe real propagation only in a domain containing State $\mathcal{A}$. Light does not propagate in Silentium: radiation encountering the absence of transmissive structure changes state, $EM \rightarrow \mathcal{A}$. **Decision A7:** E is the *cohesion* root of the state map (a limit, P-03); the equality asserted by Axiom VII (“no regime more fundamental than the others”) is read as equality of *ontological dignity* among energetic regimes, not as equality of position in the cohesion map. The two statements are thus simultaneously true.

Gravity (clause C-02).

Gravity is fundamental; nothing real in the manifested Universe is outside gravity. State $\mathcal{A}$ does not engender the existence of gravity: in RM, it provides the relational support for its transmissible and measurable manifestations. The local calculations of Pillar II constitute a candidate and conditional realisation of this.

Silentium (clause C-01).

Ideal limit and conceptual reference external to the Universe manifested in State $\mathcal{A}$: neither physical vacuum, diluted region, geometrical space nor manifested energetic state. No perfectly realised Silentium physically exists. PA-01 does not apply there, not because Silentium

would be exempt from it as a state, but because it is not a manifested real state: the “boundary” of Silentium is a domain boundary, not a place. Silentium does not transport radiation: it causes its change into State $\mathcal{A}$.

Exclusion Interaction.

Canonical name of LF-09. It designates the constitutive closure of a physical channel as its admissible capacity is approached. It is not Pauli exclusion, not an added force and not a fitted coefficient. Its detailed mathematical realisation belongs to the relevant technical sector. In the current geometric candidate, the compact signature is $X_{\mathcal{R}} = \ell_{\star}^4 \mathcal{R}_{ij} \mathcal{R}^{ij}$ with $F'(X) \rightarrow \infty$ as $X \rightarrow 1^-$; this is a technical manifestation of LF-09, not the definition of the law itself.

Constitutive length $\ell_{\star}$.

Technical strong-field scale entering the nonlinear RM geometry before the matter equation of state. In Pillar II it forms the dimensionless curvature load $X_{\mathcal{R}} = \ell_{\star}^4 \mathcal{R}_{ij} \mathcal{R}^{ij}$. The Constitution recognises its physical role but does not fix its calibration in kilometres, femtometres or any astrophysical unit unless independently derived.

Global-sector notation.

In new work, Γ_{∂} is reserved exclusively for the boundary production process/rate of State $\mathcal{A}$, while ε_z designates stored elastic energy associated with photon propagation/redshift. They are distinct physical roles and may not be silently interchanged or added without dimensional compatibility. Earlier uses of an unqualified Γ as an internal swelling variable are historical only.

Black Cores (clause C-04).

Candidate strong-field branch, never constitutionally equated with a perfect singularity and never identified by decree with the separate N-EMPR stellar Q -fold. The current architecture has two scales: $R_S \propto M$ is the optical and transport threshold; $r_c \propto M^{1/3}$ is the mechanical phase boundary defined by curvature saturation. The intermediate zone retains State $\mathcal{A}$ and carries a growing nonlinear relational stress; it is no longer described as a progressive conversion $\mathcal{A} \rightarrow E$. OCH-1 is an open constitutive hypothesis: the total macroscopic mass governs the external imprint, while the local scalar charge of the core is attributed to the material residue on the tested branch. The wall junction and complete regular spherical solution remain to be derived.

Cosmic Core (clause C-05).

Collective state of maximal cohesion compatible with bounded density, finite volume, residual memory, minimal asymmetry and an evolutionary potential. Maximal cohesion does not imply minimal volume. The Cosmic Core is neither a perfect final state nor a zero-volume singularity.

Correspondence with the Eleven Historical Axioms

The eleven historical axioms remain preserved as an archive of genesis. They no longer all possess autonomous normative rank: the following table gives their reading under the current Constitution.

Axiom	V6 Connection	Status
I — Energetic circulation	General reading of the framework	Unchanged.
II — Open line	LF-02; P.I; PA-02	Strengthened: fundamental law without exception.
III — First Law	PA-01 (prohibition); LF-04 ; Residual Transition Clause	The rank of “First Law” is withdrawn (A15). The prohibition of accomplished perfect states is retained at the rank of Absolute Principle as a domain of admissibility. The residual part becomes the Residual Transition Clause , non-universal and architectural in status.
IV — Silentium	P.II; C-01; PA-03	Amended: “unique zero state” is read as an ideal limit; “in Silentium, the exception does not exist” is reformulated as outside-domain.
V — E	P-03; LF-08; PA-06	Clarified: incompressibility becomes LF-08 ($\rho_{E\text{-lim}}$).
VI — former denomination of the continuum, now State $\mathcal{A}E$	LF-03; P.II; PA-04	Strengthened: existence postulated as a fundamental law; current denomination fixed by A14.
VII — Radiation	P.III; P-02; PA-05; decision A7	Unchanged in content; equality read as ontological dignity.
VIII — Cosmic Core	P-04; C-04, C-05; PA-07	Clarified: distinction between the processes of the branches.
IX — Cosmological time	LF-02; P.I; PA-02	Unchanged (already strengthened in V5).
X — Cosmological memory	LF-05; C-03	Strengthened: minimal persistence becomes a fundamental law.
XI — Testability	Rule of discipline (Title IV)	Unchanged and sovereign.

Appendix A — Historical Concordance between the Mathematical Treatise and Foundation/TRD

Historical status. *The mathematical Treatise (Principles of Cosmological Dynamics, Volume I, v1.3) and the former White Papers belong to the genealogy of RM. This appendix is retained for traceability; it no longer has the power to import into the Constitution a closure withdrawn by Pillar I, II or III. In the event of conflict, the nomenclature and statuses of the four current Pillars prevail.*

Object	Treatise (v1.3)	Current RM reading	Cross-reading rule
Fundamental / generic energy	Symbol E (Axiom II: “energy E is the only fundamental reality”)	Symbol $\mathcal{E}$ (E being reserved for maximal cohesion)	Every occurrence of E in the Treatise is read as $\mathcal{E}$ in Foundation/TRD. The E of Foundation (maximal cohesion, P-03, PA-06) has no symbol in the Treatise: the concept lies outside the scope of Volume I.
Dual deployment of energy	$E \rightarrow \{m, \mathcal{A}E\}$ (Axiom II)	Symmetric bifurcation forbidden (PA-10); distinct processes (P-04)	The notation of the Treatise is a <i>map of states</i> (energy deploys into two states), not a claim of a symmetric process. Read within Foundation/TRD, it necessarily unfolds as: $E \xrightarrow{\text{Ignition}} m \text{ (Cosmic Core) and } \mathcal{A}E \text{ fed by } \gamma_{EM} \rightarrow \mathcal{A}E.$
Continuum	former denomination and former associated density	State $\mathcal{A}E$ (LF-03, PA-04)	Identity of the physical referent; every cross-reading uses exclusively the current nomenclature according to A14.

Object	Treatise (v1.3)	Current RM reading	Cross-reading rule
Time	Axiom I: universal co-ordinate, “date”; local cadences	PA-02, LF-02; FCPL	Identical content; “cadence of local processes” in the Treatise $\leftrightarrow$ FCPL of Foundation/TRD.
Radiative-transfer law	$\Gamma_{\text{SCF}} = \varepsilon H \rho_r$ (former capture law)	Boundary-production sector; Γ_{∂} reserved for its process/rate	The former $Q_{\text{EM} \rightarrow \mathcal{A}}^{\text{sat}}/\text{PS-0}$ closure is retained as historical technical genealogy, not as a constitutional law. Current notation reserves Γ_{∂} for boundary production and ε_z for stored elastic energy; the global production equation of state and $H(T)$ remain open debts of the cosmological sector.
Historical equation of state	former closure $w = -1$; $w_{\text{eff}} = -1 - \chi/3$	No current constitutional import	Former closure retained for archive. The current cosmological checkpoint of Pillar II uses a fitted effective coefficient only as a viability test; no microscopic equation of state is constitutionalised.
Activation	$z_{\text{on}} \simeq 24\text{--}30$, $\varepsilon_{\text{eff}}(a)$ (switch-on of radiative capture)	<i>No equivalent</i>	Never confuse with Ignition ($E \rightarrow m$, PA-07). The Treatise explicitly renamed “ignition” as “activation” (v1.2.1) to preserve this distinction. Two events, two concepts, two epochs.
Cosmological constant	historical de Sitter attractor generated by transfer (exact solution in the Treatise)	$\Lambda_{\text{SCF}} \sim (R_{\text{NC}} \cdot D_{\mathcal{A}})^{-2}$: auxiliary hypothesis	Two distinct reformulations of Λ , not identified with each other at this stage . Their possible junction is a point of the common programme. The circularity warning applies only to Λ_{SCF} ; the historical attractor is derived in the Treatise under its postulates.

Object	Treatise (v1.3)	Current RM reading	Cross-reading rule
Silentium	Absent	PA-03, C-01	The Treatise operates entirely inside the manifested Universe; its former continuum vocabulary is now read as State $\mathbb{A}$ according to A14. The absence of Silentium is therefore consistent, not lacunary.
Matter	Spectator sector, $\rho_m = \rho_{m0}a^{-3}$	m branch (P-04)	The genesis of matter (Ignition) lies outside the scope of Volume I; the Treatise takes it as a background condition.
Gravity	Not treated (Volume II announced)	LF-01, PA-08	The future Volume II must be read under PA-08: what it derives is the form of transmitted manifestations, not the existence of the law.
Falsification observables	$T(z_{\text{spec}}), \eta(z_{\text{spec}}), w_{\text{eff}}(z)$	Axiom XI; channels outside $H(z)$	Common test channels of the corpus; consistent with the clause “falsifiability lives outside $H(z)$ ”.

Extension of concordance to the White Paper corpus (July 2026 revision).

The White Paper *The Heresy of Absolute Time* (v6.8.7) constitutes a third branch of the corpus, autonomous in its writing in the sense of decision A8. Minimal cross-reading lines: the field Γ there designates an *unbounded* collective variable of internal deformation (volumetric deformation, White Paper dictionary) — no constitutional symbol is reserved for it; its cadence law is relative to the ambient background (source criterion, arbitration A9); its constitutive coupling is strictly universal (arbitration A10). Every cross-reading between the Treatise, the White Paper and the Books passes through the present appendix. In new work, the unqualified historical swelling variable Γ has no active canonical role: Γ_∂ is reserved for boundary production and ε_z for stored elastic energy.

Maintenance clause.

This appendix is versioned with the Constitution. Every new version of the Treatise (v1.4 and later) or of the Foundation/TRD corpus checks these lines before publication; a line that has become false invalidates publication until the concordance is updated.

Appendix B — Register of Arbitrations (A1–A18 historical register; A19–A22 recorded on 8 September 2026; A23 recorded on 9 September 2026)

Arbitration	Status	Decision
A1 — Title of Book IV	Closed	Book IV is renamed “ <i>Gravitational Manifestations of the Continuum</i> ”; body of the Book amended according to roadmap V6.1.
A2 — Denomination of the framework	Closed	Historical nomenclature decision, now superseded for the continuum by A14: Silentium is reserved for the ideal limit, State $\mathcal{A}$ for the physical continuum; Foundation = the Constitution; TRD = Thermodynamics of the Continuum, the theoretical framework; Foundation/TRD = the normative whole.
A3 — Status of Silentium	Closed (v0.5)	PA-03: ideal limit and external conceptual reference; domain boundary, not a place.
A4 — Scope of LF-01	Closed (v0.5)	PA-08: fundamental gravity without exception; State $\mathcal{A}$ transmits and structures its manifestations.
A5 — Rule of discipline	Closed (v0.5)	Re-scoped to physical principles; ontological levels fix the domain without producing an equation.
A6 — Reading of $D_{\mathcal{A}}$	Closed	Research-programme status: no reading (B, C, D) privileged at this stage; reading A declared non-predictive; circularity warning constitutionally enforceable.
A7 — Radiation / root E	Closed	E = cohesion root (limit); the equality of Axiom VII is read as equality of ontological dignity among regimes.
A8 — Inter-corpus harmonisation	Closed	Option (ii): corpora autonomous in their writing, linked by Appendix A (official concordance authoritative for every cross-reading).

A9 — Background/deviation criterion	Closed (July 2026)	Bound systems read the local deviation from the instantaneous ambient background ($\nu = \nu_0(t) e^{\delta\varphi_{\text{loc}}}$); a <i>deviation</i> is any component with a non-zero source term in its local balance, while the <i>background</i> is homogeneous evolution without source. Enacted on the clock front (White Paper v6.8.7, Appendix D).
A10 — Strict universality of coupling	Closed (July 2026)	The constitutive coupling $E = E_0 e^\varphi$ applies to all matter energies without sectoral exception; dimensionless laboratory ratios (μ , clock ratios) are exactly protected.
A11 — Nature of Γ and reading law	Closed (July 2026)	Γ is the logarithm of an internal isotropic volumetric swelling ($Q = Q_{\text{geom}} + \frac{\Gamma}{3}\mathbf{I}$); atomic cadence reads an <i>energetic invariant</i> of the Γ sector — insensitive to its free phase, modified by radiative pumping (energetic primacy over the kinematic reading of the trace).
A12 — Transition memory	Closed (July 2026)	The “residual stock” is withdrawn (too strong, not derived); the trace required by LF-05 is an <i>organisational memory</i> $\mathcal{M}$ inscribed in the structure of the resulting state (Pillar I v3.3.4), whose material realisation (thermonuclear memory of the cycle) is demonstrated and whose continuum version remains an open hypothesis.
A14 — Denomination of the continuum	Closed (18 August 2026)	The former denomination of the continuum is withdrawn from all new work and replaced by State $\mathcal{A}$. The change is <i>ontological, not cosmetic</i> : $\mathcal{A}$ is not a substance but a fundamental state of energy , on the same ontological level as matter and radiation; it is neither the nineteenth-century luminiferous ether, an invisible gas, nor a privileged rest frame. Silentium remains unchanged and designates the ideal limit external to the manifested Universe; the two notions must never be confused. Scope: the earlier A2 and A13 clauses that equated the denomination of the continuum with the name of the model are superseded on this point. Earlier documents and published DOIs retain their historical titles.
A15 — Status of PA-01	Closed (18 August 2026)	The rank of “First Law of the Universal Exception” is withdrawn : PA-01 no longer states a universal causal law. It retains at the rank of Absolute Principle only the prohibition of accomplished perfect states , which fixes a domain of admissibility in the sense of the Rule of discipline. The residual intuition survives under the name Residual Transition Clause , non-universal and architectural in status. This arbitration completes A12 , which had withdrawn the content (“residual stock”, too strong and not derived) without touching the rank; it concerns rank rather than vocabulary, and therefore operates in the domain that A13 had expressly left outside its scope . Consequence: LF-04 now expresses only the prohibition.

A16 — Constitutionalisation of saturation	Closed (18 August 2026)	The Principle of Saturation enters Title II under the label LF-09 : at the maximum capacity allowed by its state, energy does not disappear and does not cross the limit; it changes channel, variable or state. LF-09 is the structural law of which LF-08 is the density case. It restores the bridge broken by A15 : the limits of the continuum transform the delimited domain into a source of dynamics, with the manifestation clause of LF-07 amended accordingly. <i>Non-import clause</i> : the quantitative realisation (PS-0 ansatz, single coefficient, calibration) remains outside the Constitution.
A17 — Former clauses of the tensor sector	Technically superseded (1 September 2026)	The 18 August 2026 edition imposed P-07 to P-09 in order to reduce nine modes to two. Pillar II v4.2.1 replaces this imposed closure with the CLG-1 constraint calculation followed by N-Æ-06. The regular local elliptic branch leaves six first-class and ten second-class constraints (determinant $\propto (k^2)^{10}$), confirming $N_{\text{grav}} = 2$. The former P-08 and P-09 are withdrawn from the active register; the labelling statement is retained as a constitutional reading under debt D-Æ-02. The two-mode count is now a conditional result, not a postulate.
A13 — General denomination of the architecture	Closed (July 2026)	The complete theoretical architecture now bears the name RM — Relativity of Matter (matter is relative to the state of the medium; time remains universal). Scope: name of the architecture and of the future unified Treatise. The historical denominations of A2 survive only as archive; current usage strictly distinguishes Silentium (ideal limit), State Æ (physical continuum), Foundation (Constitution) and TRD (framework). Published DOIs retain their titles. The vocabulary of the Laws (notably “Exception”, PA-01) is expressly outside the scope of this renaming.
A18 — DSB-1 model and Ontological Decoupling	Revised, conditional branch (1 September 2026)	The double-scale architecture is retained, but its reading is corrected: R_S is the optical/transport threshold and r_c the mechanical saturation boundary. Zone II is no longer a progressive conversion layer. OCH-1 remains a constitutive hypothesis to be derived from a common action; the residual fraction and the junction do not become constitutional by decree.
A19 — Canonical denomination of LF-09	Closed (8 September 2026)	The active name Exclusion Interaction replaces <i>Principle of Saturation</i> . The older denomination remains visible in historical entries. LF-09 is explicitly distinguished from Pauli exclusion and from a fifth force; no new fitted coefficient is created by the renaming.

A20 — Constitutive length and strong-field reception	Closed as constitutional reception (8 September 2026)	Pillar IV receives the Pillar II constitutive length ℓ_* and the curvature load $X_{\mathcal{R}} = \ell_*^4 \mathcal{R}_{ij} \mathcal{R}^{ij}$ as the current technical realisation of geometrical exclusion. The frozen v28 stellar Q -fold and CA-1 audit protocol are recognised under Pillar II authority. Physical calibration, radial stability, maximum mass and identification with the Black-Core branch remain open.
A21 — Dimensional status of time and cyclic cosmic states	Closed clarification (8 September 2026)	RM explicitly distinguishes the three-dimensional manifested physical domain from the open coordinate T . Four-dimensional spacetime remains an external representation, not the RM ontology of time. A future cyclic or oscillatory global history would describe the state of the Universe evolving along T and would not close time into a loop. No particular cyclic cosmology is constitutionalised by this clarification.
A22 — Global-sector notation discipline	Closed (8 September 2026)	In new work, Γ_{∂} designates exclusively the boundary production process/rate and ε_z exclusively stored elastic energy associated with photon propagation/redshift. Earlier unqualified Γ swelling language remains historical and may not be reactivated by notation drift.
A23 — Derived boundary constitutive coefficient	Closed as technical reception (9 September 2026)	In the minimal unit constitutive boundary branch, $\mathcal{U}_{\partial} = P/\ell_*^2$ with $P = c_{\mathcal{E}}^4/(16\pi G)$, hence $K_{\text{cryst}} = 1/\mathcal{U}_{\partial} = \ell_*^2/P = 16\pi G \ell_*^2/c_{\mathcal{E}}^4$ and $\Gamma_{\partial} = K_{\text{cryst}} \mathcal{P}_{\gamma, \partial}$. No new independent dimensional constant is introduced and no calibration from H_0 is permitted. Scope: absorbed boundary power $\rightarrow$ boundary-volume production only; the response $\Gamma_{\partial} \rightarrow \Theta_{\mathcal{E}} \rightarrow 3H(T)$ remains open.
A24 — Reception of CA-1 and N-OPT-01.1	Closed as technical reception (11 September 2026)	Book V receives the cross-method reproduction of the regular stellar $Q_c < 0$ branch by DOP853 shooting and two-domain collocation: CA-1 ceases to be a branch-existence debt and remains a certification interface. It also receives N-OPT-01.1: on a frozen $\{g_{ij}, D_{\text{loc}}\}$ background, cadence conversion to universal time obeys $\mathcal{L}_{\text{loc}} \Theta = -1/N$ and the first-passage ratio is a positive weighted average of $1/N$. No free optical coefficient is introduced. This reception is neither an astrophysical calibration nor an experimental validation of RM ontology.

Appendix C — Canonical Concordance of the Four Pillars

Pillar	Function	Authority and status as of 16 September 2026
Pillar I	Epistemological genesis and anti-circularity	Current public edition v5.2.0 (DOI 10.5281/zenodo.22674666). Receives the constitutive boundary closure, the cross-method $Q_c < 0$ branch reproduction and N-OPT-01.1; the Triple Identity remains a distinct open target.
Pillar II	Technical gravitational sector	Current public edition v4.6.0 (DOI 10.5281/zenodo.22641647). CLG-1, conditional PPN, Pure Cadence, N-Æ-06, Revised Schwarzschild Relation, constitutive length, CNL-BI1, v28 stellar Q -fold, CA-1 and N-OPT-01.1. Its provisional HCR branch is historical for the zero mode: the later Version-5 bulk note derives GHC-1, GEC-1 and HBR-1 and retires HCR-1. The strong wall, OCH-1, boundary coupling, perturbations and physical calibration remain open.
Pillar III	Canonical synthesis and historical audit	Current public edition v7.4.0 (series DOI 10.5281/zenodo.21341337). Brings together the active architecture, Revised Schwarzschild Relation, constitutive-length / Exclusion-Interaction reading, the manifest-physicality update and withdrawn branches; it cannot reactivate a branch rejected by Pillar I or technically abandoned by Pillar II.

Pillar	Function	Authority and status as of 16 September 2026	
Pillar IV	Foundation/TRD Constitution	Constitu-	Present edition v7.2.0. Fixes the ontology, laws, active postulates, Exclusion Interaction, dimensional status of time, discipline of non-repair, separation of prerogatives and rules for reading technical statuses.

Appendix D — Register of Live Debts

Reference	Question	Status
D-Æ-02	Fully reconcile the ontology of a physical continuum with the redundancy of its spatial labels in all sectors.	Open, conceptual
D-Æ-03 N-Æ-05	/ Does Pure Cadence correctly select the local two-derivative dependence?	Conditionally closed by PCP
D-Æ-04A	Does the local nonlinear gravitational chain retain two modes on the regular branch?	Conditionally closed
D-Æ-04M	Do microscopic matter sectors preserve the universal interface and constraint algebra?	Open, narrowed
CNL-BI1	Does the constitutive-curvature candidate remain coherent beyond the reduced spherical branch, preserve the intended constraint structure on non-zero backgrounds and admit physical calibration?	Open, narrowed strong-field programme
N-EMPR / CA-1	Is the regular $Q_c < 0$ branch reproduced by two distinct numerical formulations at the declared test point, and are future surface/exterior diagnostics published under a common interface?	Closed for branch existence at the test point; certification interface retained
A-DSB-1	Does a finite-wall action derive flux, tension and junction without adjustment?	Open
OCH-1	Is the separation between external mass and local scalar charge derived from a single action?	Open
HBR-BOUNDARY F-Æ-03	/ Can the boundary action derive formation cost, new-volume state and the coupled map from Γ_∂ to the global average while preserving HBR-1 without a hidden H input?	Open after bulk closure
COSMO	Does the homogeneous closure survive the radiation era, perturbations, BAO, CMB and structure growth?	Open
MASS	Can the Triple Identity be derived without inserting the observed mass?	Open target

Appendix E — Version Register and Roadmap

- **V4** — Eleven founding axioms; First Law as “generating engine” (9 June 2026).
- **V5** — Five principles; First Law downgraded to qualitative statement; rule of discipline; maturity levels.
- **V6 (file of 19 July 2026)** — Restoration of the First Law at the top; hierarchy Levels 0–4; clauses C-01 to C-05; diagnosis D1–D8; seven arbitrations.
- **V6.1 (20 July 2026)** — Reindexing on Analysis Constitution v0.5 (PA-00–PA-10, LF-00–LF-08); terminological resolution P.I–P.V; eight prohibitions; labelling of P-02; arbitration register; A8 open.
- **V6 — final text (present document)** — Approval of V6.1 by the author; formal closure of A1, A2, A6, A7; A8 closed under option (ii); Appendix A of official concordance; definitive abrogation of the former single chain.
- **V6 — final text, Appendices A–C revised (July 2026)** — Constitutional body (Titles I to VII) unchanged byte for byte. Appendix A: radiative-transfer line completed (conservative closure of White Paper v6.8.5 and articulation question recorded); extension of concordance to the White Paper corpus. Appendix B: registration of arbitrations A9–A12 (background/deviation criterion; strict universality; nature of Γ and energetic reading law; transition memory), enacted by the author during the July sessions and recorded here. Appendix C: present entry. Arbitration A13: general denomination **RM — Relativity of Matter** for the complete architecture, scope and limits fixed in Appendix B.
- **V6 — RM Book edition (3 August 2026)** — Amendments to the body enacted by the author, item by item, on the basis of the audit report of proposal V6.2 (category 2): (1) denominations A2/A13 (RM added, Silentium retained as an internal denomination); (2) prudential safeguards on memory (PA-10, LF-05: no autonomous variable $\mathcal{M}_E$ implied at this stage; LF-03: transport of correlations, memory variable open), with nothing removed from the texts; (3) PA-05: the transition modifies and energises the continuum, ontological existence falling under PA-04 (“validated” status retained); (4) historical sentence added to the frontispiece. Red lines checked byte for byte: PA-00, PA-04, PA-09, LF-06, author’s note of 20 July, mention of Paul’s addition. Building block intended for the unified book RM — Relativity of Matter. Revision of appendices within the meaning of the maintenance clause of Appendix A; no co-modification of Analysis Constitution v0.5 is required by a register revision, subject to the author’s reading.
- **V6 — RM Book edition (August 2026 update)** — Appendices A and B brought into conformity to reference White Paper v6.8.7, following the cross-audit of the clock front (suspension

of the simple proportional template and requirement for the RM multi-channel template). The constitutional body remains unchanged.

- **V6 — RM Book edition (18 August 2026)** — Amendments to the body enacted by the author: **A14** (withdrawal of the former denomination of the continuum in favour of State $\mathcal{A}$); **A15** (status of PA-01: rank of First Law withdrawn, prohibition of accomplished perfect states retained at PA rank as a domain of admissibility, residual part becoming the Residual Transition Clause); **A16** (constitutionalisation of the Principle of Saturation as LF-09, and restoration through it of the bridge in the manifestation clause of LF-07); **A17** (tensorial clauses P-07 to P-09 then active). Amended sites: chapter on denominations; PA-01; LF-04; manifestation clause of LF-07; addition of LF-09; historical addition of P-07 to P-09; line III of Appendix A. Register of Appendix B completed append-only: **A1 to A13 unchanged byte for byte. Open locks recorded:** (1) derive P-07 to P-09 from the constitutive action instead of postulating them — the debt to General Relativity remains entire; (2) the form of the PS-0 ansatz and the value of its coefficients remain outside the Constitution; (3) the saturation potential must be made convex in both sectors, requiring quadratic coefficients of opposite signs. Red lines checked: PA-00, PA-04, PA-09, LF-06, author's note of 20 July, mention of Paul's addition.
- **V6 — RM Book edition (19 August 2026)** — Amendments to the body enacted by the author: **A18** (adoption of the DSB-1 model and Ontological Decoupling Hypothesis OCH-1). Update of clause C-04 (Black Cores) to integrate the double spatial scale and ontological separation of masses.
- **v7.0.0 — RM Pillar IV (1 September 2026)** — First constitutional edition aligned with the three published Pillars. Addition of PA-11 (separation of the prerogatives $m/\mathcal{A}$), integration of the discipline of non-repair, withdrawal of former tensorial postulates P-08/P-09, replacement by P-07 Pure Cadence, reception of the conditional $N\text{--}\mathcal{A}\text{--}06$ count, correction of the cosmological status of $H(T)$, update of the double-scale Black Core, historical classification of former White Paper closures and creation of an explicit register of live debts.
- **v7.1.0 — RM Pillar IV (8 September 2026)** — Constitutional-alignment edition after Pillar I v4.1.0, Pillar II v4.3.0 and Pillar III v7.2.0. LF-09 receives the canonical name **Exclusion Interaction**; the constitutive length ℓ_* and frozen v28 stellar Q -fold are received without physical over-interpretation; the three-dimensional-domain/open-time distinction is made explicit; a cyclic cosmic state is separated from cyclic time; Γ_∂ and ε_z are assigned non-interchangeable global-sector roles; CA-1 enters the live debt register. No post-v28 laboratory continuation is constitutionalised in this edition.
- **v7.2.0 — RM Pillar IV (9 September 2026)** — Daily constitutional update. The current geometric realisation of the Exclusion Interaction is displayed explicitly through $X_{\mathcal{R}}$, $F(X)$ and the divergence $F'(X) \rightarrow \infty$ without promoting the candidate function to Fundamental Law. The minimal unit boundary branch receives the derived coefficient $K_{\text{cryst}} = \ell_*^2/P = 16\pi G\ell_*^2/c_{\mathcal{A}}^4$ and $\Gamma_\partial = K_{\text{cryst}}\mathcal{P}_{\gamma,\partial}$, with no new dimensional constant and no H_0 fit. Pillar I concordance is updated to v5.0.0 (DOI 10.5281/zenodo.22674666); the boundary-to-interior determination of $H(T)$ remains an explicit live debt.
- **Book V v8.0.0 — 2036 / Manifest Physicality edition (14 September 2026)** — Twin French and English editions. Adds the Marie test and the visible-consequence triptych, fixes the methodological rule “start from the phenomenon, not from its interpretation”, receives Pillar II v4.5.0 and Pillar III v7.4.0, and keeps the distinction between pedagogical manifestation and discriminating empirical proof.

- **Book V v8.1.0 — Exclusion-Attractor Concordance edition (14 September 2026)** — English technical concordance update. Receives Pillar II v4.6.0 without rewriting the constitutional body of Pillar IV v7.2.0. Adds HCR-1/HCR-2 as the active homogeneous candidate, the conditional sub-capacity attractor $e_* < e_{\text{cap}}$, its stability and finite tracking lag, and the exact stationary identity $H_{\mathcal{E}} = g_{\partial}$. The complete global action remains the decisive derivation/rejection lock.
- **Book V v9.0.0 — Constructive Turn edition (16 September 2026)** — Rebuilds Part III around the redshift ledger, the derived homogeneous bulk closure, the independent Exclusion-Interaction note and one compressed historical scar. Receives Version-5 GHC-1/GEC-1/HBR-1, retires HCR-1 from active Book V use, and separates the now-closed deep-bulk rate problem from the still-open boundary and perturbative cosmology. Canonical Exclusion note: DOI 10.5281/zenodo.22793642; bulk-closure note: DOI 10.5281/zenodo.22791787.

Maintenance rule.

Every new RM publication must verify its compatibility with PA-11, LF-09 under its canonical Exclusion-Interaction name, the dimensional status of open time, the discipline of non-repair, the technical statuses of Pillar II and the register of live debts. An old formula may be retained in the historical archive, but it cannot become active again without a new amendment and a new derivation.

Simplex sigillum veri.

CONCLUSION

The Return to the Sphere

RM began with a simple question: what does a clock actually measure? It became interesting on the day that question acquired the power to destroy the answers RM itself had made too easy.

The Unified Treatise does not present a closed edifice. It presents an order of work. Time is an open universal line; cadence becomes a local property of physical processes. State $\mathcal{A}$ is proposed as a physical relational continuum, but it is no longer allowed to perform every task. Matter keeps its cohesion. Local gravity is carried by a constrained chain that recovers Poisson and two local modes under declared conditions. Pure Cadence converts a functional ambiguity into a falsifiable principle. EI-1 now gives the Exclusion Interaction a short canonical statement, while EI-D1 turns the cadence map into a first-passage theorem without adding viscosity or a free coefficient. Strong-field theory remains a programme because the Black Core wall and full regular solution are not yet derived. Cosmology remains separate from local gravity because $k_F = 0$ is not the $k_F \neq 0$ sector; but the deep homogeneous bulk is no longer missing its rate law. GHC-1 and GEC-1 survive the rank change, and HBR-1 closes the bulk without importing Friedmann. The remaining cosmological mountain is boundary production plus the perturbative and observational lift. The theory of mass remains an open mountain because the Triple Identity is forbidden to be circular.

The 2036 edition adds one further discipline: **State $\mathcal{A}$ must become more concrete than the spacetime abstraction it seeks to replace.** The reader is therefore not asked to imagine an invisible fourth-dimensional object under a new name. The reader is asked to begin with phenomena, retain the simplest tested law where it works, and introduce $\mathcal{A}$ only where RM makes a new physical claim.

Geometry describes. $\mathcal{A}$ must explain.

What this consolidation adds to the Treatise

Sky geometry and cosmic-body mechanics now connect through defined quantities: $SO(2)$, $\bar{N}$, J_b , $\mu_{\text{add}}^{(T)}$, $\mathcal{F}$ and Core flux. The volume reference must preserve two constraints; formation pays a complete budget; pressure and matching participate in selecting the sign. These are this edition's results. The Maria Number retains its tribute to Marie and its status as a proposed capacity. The return programme retains its three laws to establish. State $\mathcal{A}$ is the physical postulate around which these calculations are organized; the universal line T and local cadences remain distinct.

VERSION NOTE

Edition v9.0.0 — retained results

- Preserves the public title 2036 — *The Abolition of Spacetime*, the Marie test and the rule “start from the phenomenon, not from its interpretation”.
- Rebuilds Part III: Redshift Ledger → Homogeneous Bulk Closure → Operational Exclusion → One Scar.
- Receives the public Version-5 bulk closure: GHC–1, GEC–1 and HBR–1; HCR–1 is retired from active Book V use rather than recalibrated.
- Receives the independent canonical Exclusion note, DOI [10.5281/zenodo.22793642](https://doi.org/10.5281/zenodo.22793642), including EI–1 and the dependent EI–D1 first-passage theorem.
- Bulk-closure source: DOI [10.5281/zenodo.22791787](https://doi.org/10.5281/zenodo.22791787). The precise claim is removal of the need to import Friedmann into the RM homogeneous bulk, not abolition of Friedmann from standard cosmology.
- Moves the cosmological debt from “derive H in the bulk” to boundary production, formation cost, perturbations and observables.
- Compresses the historical nuclear-cement audit into one chapter while preserving the separation-of-prerogatives verdict and the full archive trail.
- Current concordance: Pillar I v5.2.0, Pillar II v4.6.0, Pillar III v7.4.0, Pillar IV v7.2.0, Bulk Closure V5 and Exclusion Interaction v1.0.0.

“Start from the phenomenon, not from its interpretation.”

Simplex sigillum veri.

18 SEPTEMBER 2026 CONSOLIDATION

Book V v10.0.0 — The Cosmic Body and the Test of the Sky

- Adds the preface “The Test of the Sky” and ten Chapters 43–52; retains Chapters 01–42 and the constitutional body with dated technical receptions.
- Incorporates Pierre’s two signatures, the Maria Number and the return programme with their respective statuses.
- Updates the boundary chapter, curved Core volume, work register and CART cross-references.
- Retains dynamical coefficient 3, distinct principal stresses, the negative traction term and the complete kinetic source.
- Excludes the historical density anchor from predictive inputs; distinguishes axis, amplitude, sign and transfer to each observable.
- English twin of French v10.0.0, coordinated with French Codex N11. No changes to frozen CART V2.2 or published V4.

Preparation methods and responsibility

Pierre Benaros is the author and takes responsibility for the text, its assumptions and conclusions. ChatGPT/Codex, Claude and Gemini assisted research, derivations, checking, drafting or preparation at different stages of the dossier. This consolidation and its translation were prepared with ChatGPT/Codex. Compilation, equation-concordance and layout checks are not external scientific review. The CART verification scripts are included in the source package.