← ALL PAPERS · CORE — DERIVATION · V8.1 — ARCHIVED

The Selective Transient Field from First Principles — The Two-Clock Theory

A two-clock, capacity-limited curvature-response theory: what is proved, what is derived, what is calibrated, and what is open

Z. Paz · ORCID 0009-0003-1690-3669 V8.1 2026

DOWNLOAD PDF

ARCHIVE NOTICE — 28 August 2026. This is Version 8.1 (August 2026), retained in full as a record. It is superseded by Version 9.0, the current edition, which carries the v8.2 gravitational-candidate revision byte-intact together with the five-gate audit layer (§X and Appendices W–AA there). Where this text conflicts with the current record, V9.0 governs. The version history on the current page lists all editions.

The Two-Clock Theory

Version 8.1 — August 2026; revised 18 August 2026 after first adversarial review (abstract status alignment, Appendix O Kähler synchronization, Appendix B August theorem additions, §V falsifier repair, §VI galactic status); revised 19 August 2026 (2π-Provenance Rule adopted in §II.C; cup-product normalization precision in B.6/Q.3; §VI a_0 identity-vs-selection wording); revised 20 August 2026 (anchor provenance corrected — Lagrangian-forced 54-yr anchor, observed 3.3-yr/71-d anchors, Peters as translator; Appendix A.6 closure theorem with the declared τ_- boundary and the 71-day circularity flag; §VI production-operator gap declared; Appendix Q.5–Q.6 threshold-bridge candidate and world-tube sensitivity)

Z. Paz

The Hague, Netherlands

Email: zevpaz@gmail.com

ORCID: https://orcid.org/0009-0003-1690-3669

Abstract

The Selective Transient Field (STF) is a scalar coupled to the *rate of change* of spacetime curvature, first found in the timing structure of ultra-high-energy cosmic rays, gamma-ray bursts and compact-binary mergers, and later reconstructed from General Relativity, topology and compactification. This paper presents the framework in the form the reconstruction has now reached: a **two-clock theory**. Its founding structural distinction — universal time as an ontologically real shared background, against local time that each closed system creates and that references the universal background — was stated in the framework's *Theory of Time* (§10.3) as ontology. Version 8.1 shows it is a theorem: an oscillatory scalar amplitude cannot also serve as a continuous global clock through its normalized gradient, so STF necessarily carries two temporal objects: a universal ordering T_U with unit vector $N^\mu = -\nabla^\mu T_U/\sqrt{(-\nabla T_U \cdot \nabla T_U)}$, and an internal cyclic phase $\Theta_I \in S^1$ with $\varphi = A \cos \Theta_I$. Universal time supplies orientation and the direction of every curvature derivative; the internal phase supplies the field's cycle. The distinction is forced, not posited, and the completed action must respect it.

Three results give the two-clock theory its physical content. **First**, the curvature variable is derived up to one named completion rather than assumed outright: the compactified parent supplies the quadratic invariant I_4 with a coupling ζ/Λ of mass dimension −2, and a channel of *finite response capacity* L^{-2} *— the same compactification scale that already normalizes the cosmological calculation — saturates and aligns with the curvature state, so that its universal-time response is the rate of the curvature* magnitude*, $\kappa\varphi N^\mu\nabla_\mu\sqrt{I_4}$ with $\kappa = (\zeta/\Lambda)/L^2$ *dimensionless and no new scale; that the compactification* produces* this capacity bound is the saturation theorem, stated in the paper as an open target, and without it the bounded-response construction is a constitutive assumption with no adjustable parameter. The magnitude itself is made positive and clock-relative — $\mathcal{R}_{STF}(N) = \sqrt{(R^2 + 8\mathscr{W}_N)}$, with $\mathscr{W}_N$ the Bel–Robinson superenergy relative to N^μ — reproducing the Schwarzschild $\sqrt{C^2}$ and the FLRW $|R|$ exactly where the framework's calculations live. **Second**, the numerical structure survives, with its provenance now stated exactly: observation supplied the 3.32-year and 71-day anchors; **the STF Lagrangian's emission-window closure supplied the 54-year outer anchor** (a genuine theoretical output, conditional on one named boundary input); and the Peters a^4 law is the *translator* that maps the three times to 1466, 730 and 360 R_S — successive near-halvings of separation, which is the unexpected convergence. The separations are the GR images of the temporal anchors, not independent theoretical selections; the blind $n = 11/8$ likelihood ($\langle T \rangle = 3.31$ yr) and the direct timing (3.32 ± 0.89 yr) converge on the central value, and $m_s = h/(c^2T) = 3.94 \times 10^{-23}$ eV/c^2. The threshold's normalization bridge from natural units to SI is stated as open, and the sharpened open question is stated as such: why the Lagrangian forces the 54-year outer anchor onto which two independently observed times fall at near-exact successive halvings. **Third — the result this paper is built around** — the flyby anomaly is treated as a measurement, not a force, and the structural components of that treatment are theorems. The original STF interaction pulled back to a worldline is a connection one-form, $\mathscr{A} = \gamma\varphi\, d\mathcal{R}$, whose curvature $\gamma\, d\varphi \wedge d\mathcal{R}$ is antisymmetric: it therefore does no work, $F \cdot u = 0$, *and* possesses a closed-loop holonomy $\oint \mathscr{A} = \int \gamma\, d\varphi \wedge d\mathcal{R}$ that a coherent radio transaction can register. The interaction that was thought to fail at the flyby carries precisely the structure — zero work, nonzero holonomy — that the observation requires, while forbidding its misinterpretation as energy transfer. Anderson's coefficient's structure follows: its factor of two is the vorticity $\nabla \times (\omega \times r) = 2\omega$ of the Earth-fixed internal-clock congruence relative to universal time; its equatorial R and declination-only dependence are the operator norm of the rotational clock channel over the closed carrier; its absence of G and M is the signature of an observer-clock map, not a curvature-sourced force. The bridge from this structure to the realized Doppler observable — a constitutive clock–link coupling of unit normalization — is stated as the open target it is. Earth flybys are source–observer degenerate — Earth is at once the rotating source and the rotating clock carrier — so the later planetary and continuously tracked nulls do not falsify the framework; they falsify the source-force reading and favor the observer-clock reading, with the realized anomaly given by clock-carrier capacity times a utilization coefficient computable from each tracking configuration.

Withdrawn, once and here: the former mechanical derivation of $K = 2\omega R/c$, the claimed exact factor of two from inbound–outbound addition, the asserted transfer of planetary rotational energy, the flyby calibration of ζ/Λ and everything downstream of it, and the Horndeski route to ghost-freedom (ghost-freedom is established on exterior-vacuum and Kerr backgrounds through the Gauss–Bonnet parent, and open in general — including for the local rate operator as such). The tensor speed on the Gauss–Bonnet route is calculated, not assumed: $|c_T/c - 1| \lesssim 10^{-30}$. Every claim in the paper carries a status — theorem, derived, conditional, numerical, commitment, open — and every derivation is given in full in Appendices A–R. What remains open is stated as a theorem program with named targets. The framework that results is not weaker for the corrections. It is a two-clock, capacity-limited, curvature-response theory with a precise theorem core, a testable fixed-clock action, a derived measurement channel, and an explicit account of what would settle it.

Keywords: Selective Transient Field, two-clock theory, universal time, internal phase, curvature-rate response, capacity saturation, Bel–Robinson norm, Peters inspiral, UHECR, GRB, flyby anomaly, No-Work Holonomy, source–observer degeneracy, clock-carrier capacity, 10D compactification, Bell compatibility, derivation record

---

I. Introduction

I.A What this paper is

The Selective Transient Field was not invented; it was found. An observational program correlating ultra-high-energy cosmic rays, gamma-ray bursts and compact-binary merger events returned a temporal structure — a 3.32-year period, a 71-day window, a 54-year activation horizon — and a curvature exponent, and the first STF Lagrangian was written to express what those data contained. That discovery record is the observational manuscript at uhecrtoday.com. This paper is the other half of the project: the theoretical reconstruction, which asks whether the observationally found anchors and phenomenological coefficients can be *removed* from the Lagrangian's input list and recovered from General Relativity, topology, compactification and causal response. Version 7.9 answered that question with a single-clock scalar theory and a claim of completeness. Version 8.1 answers it with a two-clock theory and a claim of *structure*: what is proved, what is derived, what is calibrated, what is open — each stated as such, each with its derivation.

The order matters. Observation discovered the pattern; theory later reconstructed parts of it; a theoretical path does not become independent by erasing its discovery history, and an observation does not become an input merely because it came first. Independence is a property of the dependency graph of each calculation, and Appendix E gives that graph.

I.B Why two clocks

Every scalar-tensor theory that couples a field to a *rate* needs a direction along which to differentiate. Version 7.9 took that direction from the field itself, $n^\mu = \nabla^\mu\varphi/\sqrt{2X}$, on the assumption $X > 0$. That assumption is true in the tracking regime — the quasi-static response $\varphi \simeq J/m_s^2$ is monotone whenever its source is — and false in the regime the framework's cosmological sector requires, where the same field oscillates as dark matter, $\varphi = A\cos(m_s t)$, and $X = \tfrac{1}{2}\dot{\varphi}^2$ vanishes twice per period. Along the integral curves of any normalized-gradient clock the generating scalar is strictly monotone; a periodic scalar cannot generate a global ordering through its gradient. This is the **gradient-clock obstruction**, and it is a theorem (Appendix B).

Its content is not that the framework is inconsistent. It is that a distinction the framework already held is not a preference but a mathematical necessity. *Theory of Time* §10.3 states the two-clock ontology in full: universal time is "ontologically real from the moment of first global activation… a physically real, globally coherent temporal background"; local systems "CREATE their own time" through local temporal loops that generate a local "now"; and local systems "REFERENCE universal time" as the shared background for coordination — universal / local / convention, three levels, in a table. What that paper posited as ontology and as a claim about experience, the gradient-clock obstruction proves at the level of the field equations: the internal cyclic phase and the universal ordering cannot be the same object, because the field's own amplitude cannot carry the global ordering through its gradient. Version 7.9 had collapsed both into one symbol, n^μ_φ; the theorem is what forces them apart in the Lagrangian, and *Theory of Time* is where the framework had already kept them apart in the ontology. Two clocks are forced. The universal clock N^μ orients every curvature derivative and, as this paper will show, defines the positive curvature norm the field responds to; the internal phase Θ_I records where the field is in its cycle. Conditional on a global phase lift and dynamical synchronization, universal time may be represented by the unwrapped phase and the internal phase by its cyclic projection — the covering map $\mathbb{R} \to S^1$ — but that is a completion, not the theorem, and the choice of dynamical carrier for T_U is the framework's principal open construction (§VIII, Appendix B).

A corollary shapes everything downstream. Because N^μ depends on T_U only through its normalized gradient, it is invariant under any monotone relabelling $T_U \to f(T_U)$: the action knows which way is future, but not the rate $dT_U/d\tau_O$ at which universal time advances against any operational clock (the **Clock-Rate Invisibility Lemma**, Appendix B). Two clocks are necessary; their relative rate is not fixed by the field equations. That is precisely why the framework needs — and now has — a theory of measurement.

I.C The four layers

The two-clock theory is organized in four layers, and confusing them was the source of most of what V7.9 got wrong.

1. **The parent.** A ten-dimensional curvature-squared action reduced on the breathing mode, yielding a scalar–Gauss–Bonnet interaction $A(\sigma)\mathscr{G}$ with coupling of dimension M^{-1} (Appendix O). Ghost-controlled; regime-tested; the framework's UV ancestor.
2. **The fixed-clock effective action.** The four-dimensional working theory: a scalar φ, a prescribed universal clock N^μ, and the rate interaction $\kappa\varphi N^\mu\nabla_\mu\mathcal{R}_{STF}$, with the response kernel zero-mode-subtracted so that static curvature is annihilated (Appendix C). This is where the framework's calculations are done. It is well-defined. It is not yet a complete dynamical action, because N^μ is prescribed, not varied.
3. **The two-clock completion.** The dynamical carrier for T_U, its constraint structure, and the multi-field degeneracy analysis (Appendix B, §VIII). Open.
4. **The observation map.** How a completed transaction — a radio link, a tracking arc, a record — reads the universal history through internal clocks; the layer where the flyby lives (Appendices I–M).

I.D The flyby, restated

The empirical Earth-flyby relation, $\Delta V_\infty = (2\omega R/c)V_\infty(\cos\delta_{in} - \cos\delta_{out})$, emerged from the STF interaction when it was applied to a regime the UHECR/GRB Lagrangian had never seen. That emergence was, and remains, structurally significant. What V7.9 did with it was wrong in one specific way: it read ΔV_∞ as a real transfer of kinetic energy and constructed a mechanism to deliver it. Three independent no-gos close that reading (Appendix F): the minimal velocity coupling gives an antisymmetric, Coriolis-type force with $F\cdot v = 0$ identically; a stationary asymptotically flat effective metric conserves Killing energy, so $V_{\infty,out} = V_{\infty,in}$; and every scalar curvature magnitude — $\sqrt{C^2}$, the Bel–Robinson norm, any of them — is even in the spin to $O(a^2)$, so no scalar channel can produce a term linear in ω, which Anderson's K is. A fourth (Appendix F.4) closes the repaired universal-rate interaction itself on the stationary Earth background: stationary axisymmetry gives $k^\mu\nabla_\mu\mathcal{R} = 0$. The signal, if it is STF's, lives in curvature *orientation* and in the *clocks*, not in a scalar magnitude and a force.

The two-clock theory then does something V7.9 could not: it derives the anomaly's observational *structure* as a measurement effect. The original interaction is a connection; its antisymmetric curvature is exactly the object that does no work and carries holonomy (Appendix K). The factor of two is the vorticity of the Earth-fixed clock congruence relative to universal time (Appendix I). The equatorial radius and the declination-only angular dependence are the operator norm of the rotational clock channel over the closed Earth carrier (Appendix L). And Earth flybys cannot locate the coefficient — the rotating source and the rotating observer-clock are the same body — so the later planetary and continuously tracked nulls fall on the observer side of a degeneracy Earth data could never resolve (Appendix M). What remains open is stated exactly: the constitutive law that couples operational clocks to the STF connection with unit normalization, and the utilization coefficient of each real tracking configuration, computable from the orbit-determination design matrix and to be computed for every historical detection and null. §V and Appendix R.

I.E Claim taxonomy and reading guide

Every result in this paper carries one of six labels: **theorem** (proved, no dynamics assumed); **derived** (follows from stated premises and the fixed-clock action); **conditional** (follows if a named open item closes); **numerical** (a calculation whose inputs are calibrated); **commitment** (a declared identification the reader may refuse while checking everything beneath it); **open** (a named target). Where a result is inherited from a companion paper it is cited by section. Where V7.9 asserted something this paper withdraws, the withdrawal is stated once, in the appendix that supersedes it, and not repeated. Readers who want the theorem core should read §II.E, §III.B, §V.C and Appendices B, D, K, L. Readers who want the numbers should read §III.D, §IV and Appendices A, N, Q. Readers auditing the corrections should read Appendix P and the V7.9 derivation record, which remains published at papers/first-principles-v7-9/ and governs where this paper is silent.

II. Inputs, Definitions and Dependency Boundaries

II.A The four inputs

The framework is built from four inputs, and this paper does not add a fifth: General Relativity (through the Peters inspiral map and the curvature tensor); the empirical discovery record (the UHECR/GRB/GW timing structure — used for convergence, not as a Lagrangian parameter, §III.D); the cosmological/topological threshold (the $4\pi^2$ Hopf/anti-Hopf cup product of Topological Closure, whose SI normalization is treated in §III.D and Appendix Q); and stability, which enters as a *requirement* on any completion — Ostrogradsky-freedom, well-posedness — and not as an operator-selection theorem. Version 7.9 presented ghost-freedom as selecting the STF operator uniquely and then as proved by a Horndeski embedding; both statements are corrected here (Appendix P). Ghost-freedom is a constraint the operator must satisfy; it is satisfied on the exterior-vacuum and Kerr backgrounds where the framework's predictions are tested; its general status is open.

II.B The empirical record

The observational program at uhecrtoday.com is the discovery record. Its temporal quantities — $T_I \simeq 3.32$ yr, $T_{II} \simeq 71$ d, the 54-yr window — enter this paper as the observational leg of a three-path convergence (§III.D). They are not free parameters of the action. One statistical caution belongs on the record here rather than buried: the 10,117 UHECR–GRB pairs are generated from 75 triple events and are not independent trials, so pair-level significances should be read alongside an event-level or block-permutation significance. That affects the strength of the statistical wording, not the chronology, and not the theorem that Earth-only flyby data are source–observer degenerate.

II.C Curvature and clock definitions

Curvature. The framework's curvature objects are, in order of generality: the Kretschmann invariant $I_4 = R_{\mu\nu\rho\sigma}R^{\mu\nu\rho\sigma}$, which the parent supplies; the Weyl-squared C^2 and Pontryagin $C\cdot C$*, which govern the vacuum sector; and — the object the two-clock theory introduces — the clock-relative electric and magnetic Weyl tensors* $E_{\mu\nu} = C_{\mu\alpha\nu\beta}N^{\alpha N}\beta$ *and* $B_{\mu\nu} = C_{\mu\alpha\nu\beta}N^{\alpha N}\beta$, whose superenergy $\mathscr{W}_N = E_{\mu\nu}E^{\mu\nu} + B_{\mu\nu}B^{\mu\nu}$ is positive because the spatial metric orthogonal to N^μ is. The **STF curvature** is

$$\mathcal{R}_{\mathrm{STF}}(N) \equiv \sqrt{R^2 + 8\,\mathcal{W}_N},$$

a selective, positive, clock-relative seminorm containing the scalar (volume) curvature and the free tidal curvature and no trace-free Ricci channel. It equals $\sqrt{C^2}$ in Schwarzschild ($B = 0$), $|R|$ in FLRW ($C = 0$), remains real and positive in Kerr and radiative geometries where C^2 crosses zero, and vanishes for exact radiation-dominated FLRW ($R = 0$, $C = 0$) — a physical selection rule the framework accepts. Why this and not $\sqrt{\mathscr{G}}$: $\mathscr{G} = C^2 - 2S_{\mu\nu}S^{\mu\nu} + R^2/6$ is indefinite, and $\sqrt{\mathscr{G}}$ is imaginary through matter and radiation domination ($\mathscr{G} = -12(1+3w)H^4$). Appendix E.

Universal clock. T_U a scalar with timelike gradient on the domain of the response; $N^\mu = -\nabla^\mu T_U/\sqrt{(-\nabla T_U\cdot\nabla T_U)}$, future-directed, unit, hypersurface-orthogonal (Frobenius: its own vorticity vanishes — the universal clock supplies ordering, not rotation, Appendix I). $D_U \equiv N^\mu\nabla_\mu$.

Internal phase and amplitude. $\varphi = A\cos\Theta_I$; in the fixed-amplitude limit $(\varphi, v_\varphi/m_s)$ with $v_\varphi = \dot{\varphi}$ moves on a circle of radius A and $\Theta_I = \mathrm{atan2}(-v_\varphi/(Am_s), \varphi/A)$ is well defined everywhere away from zero amplitude, turning points included. The amplitude is a local half-cycle chart of the clock, never its global coordinate.

Probe derivative. For a system with four-velocity $u^\mu = \Gamma(N^\mu + v^\mu)$, $N\cdot v = 0$,

$$D_I q \equiv u^\mu\nabla_\mu q = \Gamma\big(D_U q + v^\mu\nabla_\mu q\big).$$

This exact kinematic identity separates curvature *evolution* (D_U) from curvature *sampling* ($v\cdot\nabla$): a stationary planetary field has $D_U\,\mathcal{R} = 0$ while a spacecraft crossing its gradient has $D_I\,\mathcal{R} \neq 0$. Version 7.9 moved among $n_\varphi\cdot\nabla$, $N\cdot\nabla$ and $u\cdot\nabla$ as if they were one derivative; they are not (Appendix K).

The 2π-Provenance Rule (house rule, adopted August 2026). The internal phase is a compact U(1) coordinate, so one primitive recurrence spans 2π in canonical radian coordinates; the invariant statement is winding number one. Every 2π in this framework must therefore carry a provenance label, and a 2π factor is legitimate only when its source is stated: **(i)** conversion between an angular frequency and a full phase recurrence ($T_s = 2\pi/\omega_s$); **(ii)** conversion between normalized integral cohomology and canonical angular representatives (the $4\pi^2$ of Appendix B.6 and Q); or **(iii)** a physical law deliberately pairing a *reduced* correlation scale with a *full* cycle. Cases (i) and (ii) follow from the normalization of a derived cycle or winding; **case (iii) requires an independent constitutive derivation** — a mixed reduced/full pairing is not forbidden, but it cannot be presented as a causal identity (the General Theory's corrected §15.6 error was exactly that), and its two roles must be proved where it is used (the a_0 route's open obligation, §VI).

II.D The higher-dimensional parent and coefficient conventions

The parent is the ten-dimensional curvature-squared action reduced on $ds^2 = e^{-6\sigma}g_{\mu\nu}\, dx^{\mu} dx^{\nu} + e^{2\sigma}\hat{g}_{mn}\, dy^{m} dy^{n}$, block-diagonal, yielding four-dimensional $g_{\mu\nu}$ and σ, no vector, and the scalar–Gauss–Bonnet interaction $A(\sigma)\mathscr{G}$ with $[\gamma] = M^{-1}$ (Appendix O). The Kähler potential is written with **Re T ≡ $e^{4\sigma}$**, so that $-3 \ln(T + \bar{T}) = -12\sigma - 3 \ln 2$ with σ the logarithmic breathing coordinate, distinct from the linear modulus. The exponent is fixed by canonical normalization, not chosen: with $K = -3 \ln(T + \bar{T})$ the kinetic term is $K_{T\bar{T}}|\partial T|^2 = (3/4)(\partial \ln \mathrm{Re}\, T)^2$ — explicitly, $\mathrm{Re}\, T = e^{n\sigma}$ gives $K_{T\bar{T}}|\partial T|^2 = (3n^2/4)(\partial\sigma)^2$ and hence a canonical field $\varphi_c = \sqrt{3n^2/2}\cdot M_{Pl}\, \sigma$. The ten-dimensional reduction gives $\varphi_c = \sqrt{24}\, M_{Pl}\, \sigma$, which requires $n = 4$; the choice $n = 2$ would give $\sqrt{6}$ and is inconsistent with the reduction. *(An earlier version of this paper wrote Re T ≡ $e^{2\sigma}$, introduced to repair a log-versus-linear collision in V7.9; it fixed that collision and introduced a factor-2 error in the field normalization. Corrected August 2026.)* The compactification scale is $L^* = 3.64 \times 10^{-30}$ m. The photon sector is written in the standard normalization $-\tfrac{1}{4} g_{\varphi\gamma}\delta\varphi F_{\mu\nu}F^{\mu\nu}$ with $g_{\varphi\gamma} = \partial_\varphi \ln \mathrm{Re}\, f_\gamma$; the visible-sector gauge kinetic function depends on the local cycle, not the bulk modulus, so $g^{tree}_{\varphi\gamma} = 0$ with a volume-suppressed residual (Appendix O).

II.E Input status summary

INPUT	ROLE	STATUS
GR / Peters map	generates the late-inspiral time hierarchy from separations	theorem (GR)
Empirical record	convergence leg; discovery history	not a Lagrangian parameter
$4\pi^2$ cup product	closure normalization	project theorem; SI bridge open
Stability	requirement on any completion	constraint, not selection
Two clocks	forced by the gradient-clock obstruction	theorem
Curvature norm $\mathcal{R}_{STF}(N)$	positive clock-relative response variable	derived; Euclideanization map to $\mathscr{G}$ open

III. Construction of the Two-Clock Theory

III.A The fixed-clock action

The working action is

$$S_{\text{work}} = \int d^4x \sqrt{-g} \left[\frac{M_{\text{Pl}}^2}{2} R - \frac{1}{2} (\nabla\phi)^2 - \frac{1}{2} m_s^2 \phi^2 + \kappa\, \phi\, N^\mu \nabla_\mu \mathcal{R}_{\text{STF}}(N) - \frac{1}{4} \big(1 + g_{\phi\gamma} \delta\phi\big) F_{\mu\nu} F^{\mu\nu} \right] + S$$

with N^μ prescribed (the fixed-clock theory), κ dimensionless (§III.C), and the interaction understood as the low-frequency limit of a causal, zero-mode-subtracted response (Appendix C). Three things this action does *not* contain, deliberately: a normalized-gradient clock built from φ; a cross-disformal matter metric (an additional structural input whose coefficient was fixed by matching, and which the ten-dimensional matter reduction does not generate, $\hat{B}_{KK} = 0$ — Appendices G, O); and any claim that the response to *static* curvature is nonzero. A fourth omission is *not* deliberate and is declared (August 2026): the action contains **no production operator for the observational channels** — V7.9's phenomenological fermion vertex $g_\psi \phi \bar{\psi}\psi$ was dropped in the V7.9 → V8.1 triage, and the Maxwell equation $\nabla_\mu[Z(\phi)F^{\mu\nu}] = j^\nu$ is homogeneous in F. Consequences and status in §VI. Variation with respect to φ on a prescribed background gives the fixed-clock scalar equation; the metric variation and constraint algebra of the *completed* theory, with N^μ dynamical, are open (Appendix G′, §VIII). **Status: derived** as an effective theory; **open** as a dynamical completion.

III.B The curvature response: from the parent to the observed operator

This section derives the operator V7.9 assumed. Three steps.

Step 1 — the dimensional obstruction (theorem). The parent supplies I_4 and a coupling $\zeta/\Lambda = \gamma\tau_{\text{eff}}$ of mass dimension −2. For a canonically normalized scalar, $\phi N\cdot\nabla I_4$ has dimension 6 and needs an M^{-2} coefficient — consistent — while $\phi N\cdot\nabla\sqrt{I_4}$ has dimension 4 and needs a *dimensionless* coefficient. Version 7.9's boxed action attached ζ/Λ to the rate of $\sqrt{I_4}$; that cannot stand. Nor is $g(\mathfrak{R}) = 2\mathfrak{R}$ a third option: $2\mathfrak{R}N\cdot\nabla\mathfrak{R} = N\cdot\nabla(\mathfrak{R}^2) = N\cdot\nabla I_4$ collapses back to the quadratic rate. So there are two branches — **A**, respond to the rate of the quadratic invariant (UV-faithful, dimensions correct, but the phenomenology written in $\dot{\mathfrak{R}}$ must be redone and the response acquires an extra power of curvature magnitude); **B**, respond to the rate of the magnitude $\sqrt{I_4}$ (phenomenology-faithful, but the coefficient must be dimensionless and derived). Appendix C.

Step 2 — Branch B is capacity-saturated Branch A (derived, conditional on the saturation theorem). Represent the clock-resolved curvature by components $\mathscr{C}^A$ with the positive clock-relative metric $h_{AB}(N)$, and $q_N = \sqrt{h_{AB}\mathscr{C}^A\mathscr{C}^B}$. Let the channel's response covector P_A be bounded — one closure cell holds finite capacity, $\|P\| \leq M^2$, *$M = L^{-1}$. The maximum projection of a bounded response onto the curvature state is the support function $Q(\mathscr{C}) = \max_{\|P\|\leq M^2} P_A\mathscr{C}^A = M^2 q_N$ by Cauchy–Schwarz, attained at $P_A = M^2 h_{AB}\mathscr{C}^B/q_N$ — saturated and aligned. Then $D_U Q = P_A D_U\mathscr{C}^A = M^2 D_U q_N$.*

Finite capacity plus saturation gives the rate of the magnitude*; an unsaturated linear susceptibility $P\_A \propto \mathscr{C}\_A$ gives instead $½\alpha D\_U I_4$, the rate of the* power*. So Branch A is the unsaturated linear channel and Branch B the capacity-saturated closure channel — and STF is by construction a thresholded, finite-bandwidth closure channel, not an unrestricted linear curvature detector. Multiplying the parent coefficient through, $\kappa = \gamma\tau\_\mathrm{eff} M^2 = (\zeta/\Lambda)/L^2 \approx 1.0 \times 10^{70}$, dimensionless: exactly the conversion the cosmological calculation already used, now assigned to the operator that needs it. No new scale. Appendix D. The* ***Curvature-Polarization Saturation Theorem*** *— that compactification and causal closure* produce* a nonpropagating response polarization of fixed magnitude L^{*-2} aligned with the curvature state — is stated there as the completion that would make this a derivation rather than a constitutive assumption; it is open.

Step 3 — the norm (derived). The parent's $I_4 \supset \mathscr{G}$ is indefinite; the universal clock supplies the decomposition into E and B whose superenergy is positive; the STF curvature $\mathcal{R}\_\mathrm{STF}(N) = \sqrt{R^2 + 8\mathscr{W}\_N}$ is the resulting selective norm, reproducing every existing Schwarzschild and FLRW calculation exactly and remaining real where $\mathscr{G}$ and C^2 do not (Appendix E). The map from the parent's indefinite bilinear to this positive trace–tidal subspace — a "clock Euclideanization" — is the second named completion; open. Once $\mathcal{R}$ depends on N^μ, the Gauss–Bonnet auxiliary-field argument no longer establishes ghost-freedom on its own and the completed action requires its own ADM analysis (Appendix P).

What the three steps establish. The observed operator $\kappa\varphi D\_U\mathcal{R}\_\mathrm{STF}$ is the capacity-saturated, clock-normalized, positive-norm response of the ten-dimensional curvature parent — with the square root, the L^{*-2} normalization, the curvature alignment and the choice of Branch B all falling out of one bounded-response construction. Version 7.9 was right about the operator's form and wrong about its coefficient's dimension and its provenance; the two-clock theory supplies both.

The response kernel. The rate operator is the $\omega \ll \omega\_c$ limit of a causal high-pass kernel $K^R\_\mathrm{sel}(t) = \delta(t) - \omega\_c e^{-\omega\_c t}\Theta(t)$, with $\int K = 0$ (static curvature annihilated) and $K(\omega) = -i\omega/(\omega\_c - i\omega)$. At $\omega \sim \omega\_c \sim m\_s$ — the field's own 3.32-year timescale — the derivative expansion is not controlled and the full memory kernel governs; the framework thereby gains a definite frequency-dependent transfer function in place of an unbounded local derivative. Appendix C.

III.C The coupling normalization

$\kappa = (\zeta/\Lambda)/L^{*2}$, with $(\zeta/\Lambda)\_\mathrm{SI} = 1.35 \times 10^{11}\ \mathrm{m}^2$ and $L^* = 3.64 \times 10^{-30}$ m. The ζ/Λ that the parent and the retarded matching supply is the coefficient of the *quadratic-rate* level; κ is the coefficient of the *observed norm-rate* level; the action must keep them distinct, and now does. **Status: derived** (the identification of L^{*-2} with the capacity radius is the content of the saturation theorem, open).

III.D Mass, special separations and the three paths

The Peters hierarchy and its provenance (corrected, August 2026). The three temporal anchors have three distinct origins. Observation supplied 3.32 yr (UHECR–GW timing) and 71 d (GRB channel). **The 54-year outer anchor is a theoretical output of the STF Lagrangian**: the emission-window closure theorem (Appendix A.6) — the source scaling $M\_c^{5/3}\tau^{-11/8}$ against a threshold with the same chirp-mass power forces a *universal, chirp-mass-independent* outer time (theorem), and the observed 3.31-yr centroid with the 11/8 profile and an inner boundary $\tau_- = 0.1$ yr fixes it at $\tau_+ = 53.88 \approx 54$ yr (derived conditional on τ_-). Peters' $t \propto a^4$ is then the **translator**: the Lagrangian-forced 54-yr anchor sits at ≈1466 R_S, and the two observed times project to a(3.3 yr) = 1466(3.3/54)^{1/4} ≈ 729 R_S and a(71 d) ≈ 359 R_S — *that is where 730 and 360 came from*. Evaluating Peters at the rounded separations returns t(1466 R_S) = 54.07 yr, t(730 R_S) = 3.324 yr, t(360 R_S) = 71.82 d, with halving ratios $(1466/730)^4$ = 16.26 and $(730/360)^4$ = 16.91 against the observed 16.36 and 16.98. Two consequences, both stated: the convergence is *stronger* than an observation-first story — a Lagrangian output organizes two independently observed numbers onto one inspiral trajectory at near-exact successive halvings — and *weaker* in one specific place: 730 R_S is the GR image of the observed 3.3-yr anchor relative to the Lagrangian-forced branch, not an independent theoretical selection. The sharpened open question: **why does the STF Lagrangian force the 54-year outer anchor, which then causes two independently observed times to land near the successive 1466:730:360 hierarchy?** Appendix A.

The mass. The central period gives $m_s = h/(c^2 T_s) = 3.94 \times 10^{-23}$ eV/c^2, a standard quantum phase conversion. The reduced response time $\hbar/(m_s c^2)$ = 0.529 yr and the full period $h/(m_s c^2)$ = 3.324 yr must not be interchanged. **Status: derived conditional on the selection of the 730 R_S separation.**

The threshold and its normalization — stated honestly. The framework's threshold $\mathscr{D}$_crit = $m_s M_{Pl} H_0/(4\pi^2)$ is a natural-unit expression whose $4\pi^2$ is the Hopf/anti-Hopf cup product (theorem). Converted to SI it gives 0.76 $m^{-2}s^{-1}$ (unreduced Planck mass) or 0.15 (reduced) — not the 1.07×10^{-27} $m^{-2}s^{-1}$ that V7.9 and the Framework Guide quote. That number is $\mathscr{D}$_GR at 730 R_S — the curvature rate of the binary at the selected separation, $\approx 2 \times 10^{-27}$ from Peters and Kretschmann directly. The natural-unit threshold was *matched* to the GR curvature rate, not converted into it; the ~27 orders between them are an unwritten constitutive normalization. This does not touch the cup product; it refutes the naive identification of the cup-product-normalized *mass scale* with the SI curvature-rate *observable*, and it means 730 R_S is selected by the observational timing and the likelihood convergence, not by the threshold as written. The missing bridge is specified in Appendix Q. **Status: open**, and the single most consequential thing this revision states plainly.

The three paths. First-principles (compactification, topology, M_Pl, H_0, GR → the phase structure and m_s); direct observation (UHECR–GW timing → 3.32 ± 0.89 yr); blind statistics (arrival-time likelihood → n = 11/8, ⟨T⟩ = 3.31 yr). Paths two and three share observational information and are methodologically distinct rather than statistically independent; path one is the non-observational leg, and it is the leg whose normalization is open. The convergence is real; the paper reports it as convergence, not as three independent derivations.

III.E Parameter and structural-choice ledger

QUANTITY	VALUE	SOURCE	STATUS
m_s	3.94×10^{-23} eV/c^2	observed/converged T = 3.32 yr + h/T (730 R_S	derived conditional on the anchor selection

QUANTITY	VALUE	SOURCE	STATUS
		is the Peters image of that anchor)	
T_s	3.324 yr	$h/(m_s c^2)$	derived (given m_s)
ζ/Λ	1.35×10^{11} m²	parent + retarded matching	conditional (τ_{eff}, C_{match})
L^*	3.64×10^{-30} m	compactification	derived; identification with capacity radius open
κ	$(\zeta/\Lambda)/L^{*2} \approx 10^{70}$	III.B–C	derived (dimensionless)
$4\pi^2$	cup product	Topological Closure	theorem
$\mathscr{D}_{crit}$ (SI)	—	III.D	**open** (bridge unwritten)
Branch B over A	capacity saturation	III.B	derived, conditional on saturation theorem
$\mathcal{R}_{STF}(N)$	$\sqrt{R^2+8\mathscr{W}_N}$	II.C, III.B	derived; Euclideanization open
Universal clock carrier	—	§VIII	**open**

The parent–response chain contains no continuously fitted parameter *in the Peters arithmetic*; the framework as a whole contains structural choices, conditional UV data and open normalizations. “No fit in this calculation” is accurate; “zero free parameters in the complete theory” is not, and this paper does not say it.

III.F Response regimes after clock separation

Cosmology: comoving systems have $u^\mu = N^\mu$, so $D_I\mathcal{R} = D_U\mathcal{R} = |R|^\cdot$ — evolution and sampling coincide. Late inspiral: tidal magnitude grows along N^μ — $D_U \mathcal{R} \neq 0$, radial channel. Stationary planetary field: an Earth-adapted universal slicing has $D_U \mathcal{R} = 0$ — the universal field sees no changing curvature — while a moving spacecraft has $D_I \mathcal{R} = \Gamma\, v\cdot\nabla\mathcal{R} \neq 0$. Rotation adds curvature *orientation* (the Pontryagin sector, $\vartheta_C = \frac{1}{2} \arg(C^2 + iP) \simeq 3a \cos\theta/r$) with no universal rate; the flyby lives there and in the clocks, §V. Early universe: the I_4-based parent enhances the response strongly at high curvature; the inflationary regime is a recalculation target (Appendix J). ## IV. Discovery, Calibration, Validation and Prediction

IV.A Dependency discipline

A quantity is a *prediction* only if the calculation producing it does not use the observation it is compared with. A quantity is a *calibration* if it does. A quantity is a *validation* if an independent calculation reproduces an observation it did not use. Version 7.9 counted several calibrations as validations; this section reassigns them, and Appendix E gives the full dependency matrix.

IV.B The timing convergence

The dependency structure of the timing convergence, stated exactly (per the corrected provenance, §III.D): the observed 3.32 ± 0.89 yr and the blind ⟨T⟩ = 3.31 yr are measurements; the 54-yr outer anchor is the Lagrangian's closure-theorem output (conditional on τ_-, A.6); and the separations 730 and 360 R_S were obtained by projecting the two observed times through Peters relative to that anchor — so the radii are *downstream* of the observations, not independent of them. The genuine convergence is therefore not "GR predicted the observed times at pre-selected radii"; it is that a theoretical outer anchor and two observed times land on one inspiral trajectory at near-exact successive halvings — which none of the three inputs guaranteed. The threshold that would select the separations independently remains open (§III.D, Appendix Q).

IV.C Removed from the validation ledger

Removed, with the reason: the "98%" validation of $(\zeta/\Lambda)_{SI}$ by flyby amplitude (the amplitude was calibrated to Anderson, and the mechanism is withdrawn); $K = 2\omega R/c$ as derived from the minimal STF force (it rests on an endpoint difference of a non-gradient force); the Earth/Jupiter/Venus reconstruction after fixing $\hat{B}$ by the Anderson match (an identity, not a prediction); the Ulysses ephemeris discrepancy read as a direct 955.6 mm/s velocity detection; the balance of spacecraft energy gain against planetary rotational energy loss (there is no work); the single-field DHOST calculation as proof that the two-clock theory is ghost-free; and the binary-dephasing bounds 10^{-20}–10^{-14} rad, which were calibrated from the flyby amplitude. These removals correct logical status; they do not delete the numerical coincidences, and the corrected flyby record in Appendix R shows why the Earth coincidence remains significant.

IV.D Present theorem and derivation core

RESULT	STATUS	DEPENDENCY
gradient-clock obstruction	theorem	differentiable scalar, timelike nonzero gradient
two clocks forced in STF	entailment	scalar universal-time representation
Clock-Rate Invisibility	lemma	N^μ built from ∇T_U
$D_I q = \Gamma(D_U q + v\cdot\nabla q)$	exact identity	velocity decomposition
Branch A/B dimensional obstruction	theorem	dimensional analysis
capacity saturation ⇒ $M^{*2} D_U \sqrt{I_4}$	derived conditional (saturation thm)	bounded response + Cauchy–Schwarz

RESULT	STATUS	DEPENDENCY
$\mathcal{R}$_STF(N) positive; $\sqrt{\mathcal{G}}$ fails	derived	Bel–Robinson positivity; FLRW sign table
$F\cdot v = 0$ for the minimal coupling	derived	antisymmetric force
Killing-energy conservation ⇒ V_∞ unchanged	theorem	stationary common-asymptotic effective metric
spin parity: no scalar magnitude is odd in ω	theorem	slow-Kerr Weyl decomposition
No-Work Holonomy Correspondence	derived	$\mathscr{A} = \gamma\varphi d\mathcal{R}$ is a connection
$\nabla\times(\omega\times r) = 2\omega$	identity	rigid rotation
operator norm = $(\Omega R/c)\cos\delta$	theorem	supremum over closed carrier
Source–Observer Degeneracy	theorem	S = O for Earth flybys
Peters times at 1466/730/360 R_S	calculation	GR, 30+30 $M_\odot$
$c_T = c$ on the sGB route	calculation	$\alpha_T \simeq 8(\ddot{f}-H\dot{f})/M_{Pl}^2$
$4\pi^2$ Hopf/anti-Hopf	project theorem	Topological Closure
scalar–Gauss–Bonnet parent	derived conditional	compactification ansatz

IV.E Conditional extension ledger

Dark energy, MOND scale, inflation, binary radiation, particle constants: retained with their internal calculations at the dependency level Appendix E assigns — each conditional on the threshold normalization (§III.D) and, where a static or stationary source is involved, on the additional-sector route the two-clock theory requires (§III.F, Appendices I–J of the V7.9 record).

IV.F The 11/8 functional form

The blind likelihood over UHECR arrival times returns $n = 11/8$ and a mean period 3.31 yr. Its status: an observational-statistical result independent of the Peters calculation, used here as a convergence check and not as an input to any derivation.

V. Falsification and Discrimination Program

V.A Core action tests

The theorem core is not exposed to experiment — it fails only by refutation: an error exhibited in the proof of the gradient-clock obstruction (Appendix B.1), or a demonstration that premise (i), the scalar representation of universal ordering, is not available to STF. The dynamical claims fail if: a detected sign-flip of curvature-rate response locks to the 1.66-year half-cycle (the amplitude, not the phase, would then orient the coupling); the response to *static* curvature is found nonzero (the zero-mode subtraction fails); or the completed clock action is shown to propagate a ghost or to violate the multimessenger tensor-speed bound.

V.B Late-inspiral tests

The activation channels sit at successive halvings of separation. A population of merger-associated transients whose lead times do not organize on the a^4 hierarchy — or whose central period is not 3.32 yr — falsifies the phase assignment.

V.C Flyby measurement tests

This is where the theory is most exposed and most specific. The observer-clock branch predicts (Appendices L–M, R):

- a capacity bound: $|\Delta\hat{V}/V_\infty| \le (2|\Omega_O|R_O/c)(\cos\delta_{in} + \cos\delta_{out})$ for the observer carrier — any reliable anomaly exceeding it rules the mechanism out;
- a utilization law: $\Delta\hat{V}/V_\infty = (2\Omega_O R_O/c)[\eta_{in}\cos\delta_{in} - \eta_{out}\cos\delta_{out}]$, with η_a *computed* from the orbit-determination design matrix of arc a, not fitted; detections should cluster at high η, nulls near zero — pre-registered as a rank correlation between computed η_a and reported $|\Delta V|$ across all nine arcs, with the significance criterion fixed before the anomalies are consulted;
- observer dependence: an encounter at planet B tracked from Earth carries Earth's $2\Omega_\oplus R_\oplus/c$, not the planet's; a source-force theory predicts the reverse;
- link-mode dependence: coherent two-way, three-way and one-way tracking of the *same* encounter expose different clock ratios (Appendix J); a source force is blind to link mode;
- no physical energy change: simultaneous range, Doppler and angular tracking must show a common directional deflection or a link-dependent phase residual with $\delta E_\infty = 0$ — never a common energy change.

The decisive experiment is not another flyby. It is one encounter measured through two differently closed clock architectures. The historical program is: compute η_a from the actual DSN metadata for every early detection and every later null.

V.D Cosmic Bell and quantum tests

Inherited from the Universal Embedding companion: any curvature-, phase- or background-dependent modulation of *normalized* Bell correlations falsifies the common-mode/no-local-mechanism result; any controllable use of the STF advanced arc to signal falsifies the no-signaling marginals.

V.E Closure–capacity and one-bit falsifiers

A marginal loop persisting on a zero write stream; a second-order anesthesia transition without hysteresis; the biography migrating off the Peters rungs. Inherited; stated here because the two-clock theory now shares the closure machinery.

V.F Extension-specific tests

Dark energy: a late-time $w(z)$ inconsistent with the Branch-B suppression $\mathscr{G} \sim H^5$. Inflation: a tensor-to-scalar ratio outside the recalculated I_4-enhanced range. Galactic: the additional-sector route makes its own predictions (Appendix I of the record).

V.G Minimum completion criteria

The framework's next version must contain: a varied universal-clock sector with its constraint analysis; the saturation and Euclideanization theorems or their honest replacement by constitutive postulates; the SI threshold bridge or an honest restatement; and η_a computed for the historical flyby record.

VI. Extension Sectors After the Two-Clock Revision

Each sector is retained with its calculation and reassigned a status. **Cosmology:** the FLRW response uses $|R|$ (the $\mathcal{R}_{STF}$ limit), Branch B suppresses the late-time source by two powers of H relative to V7.9's expectations, dark-energy sourcing is conditional on the threshold normalization, the attractor and $w(z)$ corrections are recorded in Appendix M of the record. **Galactic/MOND:** the stationary-source obstruction ($D_U \mathcal{R} = 0$ for a carrier stationary relative to the galaxy) is a carrier fork, not a wall — a cosmological carrier gives $D_U \mathcal{R} = -nH\mathcal{R} \neq 0$ (Branch C, proved) — but that channel is kernel-suppressed by $H/\omega_s \approx 4\times10^{-11}$, so direct curvature-rate sourcing is negligible either way. What survives is the ultralight-condensate sector itself ($w = 0$, Schrödinger–Poisson dynamics, kpc-scale coherence, solitonic cores); the phonon–baryon vertex descended from the withdrawn cross-disformal coupling and falls with it. The MOND scale $a_0 = cH_0/2\pi$ is a conditional target, not a result. The arithmetic is not the issue — $H\bar{\lambda}_C/T_s = cH/2\pi$ is an exact identity (the mass cancels; the 2π is the reduced-length/full-period ratio). What is underived is the *constitutive selection*: why one inverse-mass spatial correlation length and one complete internal recurrence are the spatial and temporal write intervals of galactic dynamics, with unit gain into the baryonic lapse (the Correlation–Cycle Write Principle; a 2π-Provenance-Rule case-(iii) pairing, §II.C). The corpus's only prior license for that pairing was the General Theory locality argument, which contained the corrected $(2\pi)^3$ error; Clock-Gradient Marginality would supply the selection, and its three clauses remain undischarged. The condensate interpretation's most severe live constraint is the Lyman-α bound (m_s a factor ~500 below the free-field exclusion); whether the compactification's $\varphi^2 I_4$ self-interaction, which reaches O(1) of gravity at $z \approx 5\times10^4$, moves that bound is a named open calculation. **Inflation:** the I_4-based parent enhances the early-universe response — a recalculation target with the former saturation model as benchmark. **Particle and flavour sectors:** untouched by the two-clock revision; the CICY #7447/Z_{10} construction, the phase-lag CP mechanism and the Weil–Petersson numerics remain in the V7.9 record at their assigned status (numerical constructions and matches). **10D parent and the rate bridge:** the parent stands; the retarded-response map from parent to local rate operator is a constitutive completion target, not a proven reduction (Appendix O). **UHECR/GRB production — an open gap, stated plainly (August 2026):** the present working action has **no production channel for either observational anchor**. V7.9's phenomenological fermion vertex $g_{\psi\varphi\bar{\psi}\psi}$ — the framework's only link to the UHECR record it was discovered in — was dropped in the V7.9 → V8.1 triage; the Maxwell equation is homogeneous in $F_{\mu\nu}$, so starting from $F_{\mu\nu} = 0$ a nonzero STF scalar generates no classical photons; the residual photon coupling is sequestered, and on-shell decay of an ultralight scalar yields ultralow-energy photons, not gamma rays. The consequence is the **Production-Map Non-Entailment result**: this action, with the derived linear response kernel, determines a local scalar response once g, N and boundary data are supplied, but determines no event-rate functional $\Gamma_{UHECR}(\tau)$ or $\Gamma_{GRB}(\tau)$ — it specifies neither a production world tube (Appendix Q.6) nor a visible-sector production functional. Restoring the discovery-record vertex is not a one-line fix: a modulus Yukawa must be shown consistent with the sequestering analysis of Appendix O before it can carry a status better than phenomenological. **Named open items:** the covariant production surface Σ_{prod}; the sequestering-consistent visible-sector vertices; the channel-threshold ratio (A.6.iv); and the $\tau_- = 0.1$ yr window boundary, which belongs to this sector (A.6.iii). Until these close, the paper's fifteen references to the UHECR/GRB anchors describe the discovery record and the timing structure — not channels the displayed action produces. **Universal embedding and Bell:** Born- and Bell-compatible, not Born-deriving; the Cosmic Bell test has no jurisdiction over the framework's future-boundary structure. **Closure, capacity and the one bit:** declared conjectures; the zero-capacity corollary — a topologically fixed, setting-invariant closure certificate carries zero controllable capacity — is the theorem the one-bit lemma needs, and it also shows a one-bit channel cannot carry the continuous $\omega R/c$ (Appendix M).

VII. Consistency with Existing Constraints

Tensor speed (calculated). On the scalar–Gauss–Bonnet route $\mathcal{G}$ is topological in four dimensions, so a static coupling leaves c_T untouched and the correction enters only through the coupling's time-variation, $\alpha_T \simeq 8(\ddot{f} - H\dot{f})/M_{Pl}^2$. With $f = \kappa(\zeta/\Lambda)(\varphi/M_{Pl})M_{Pl}^2$, the tracking regime gives $|c_T/c - 1| \lesssim 7 \times 10^{-41}$ and the oscillating dark-matter regime — amplitude from $\rho_{DE} = \frac{1}{2}m_s^2A^2$, $A/M_{Pl} \approx 8 \times 10^{-11}$ — gives $\lesssim 2 \times 10^{-30}$, fourteen orders inside GW170817. Robust to the O(1) normalization. Open only for the completed two-clock action if its carrier brings its own dynamics. Appendix N.

PPN. Covariance alone does not force $\alpha_1 = \alpha_2 = \alpha_3 = 0$; a covariantly defined scalar gradient can select a physical foliation. In the tracking regime with the dependent n^μ_φ the vanishing is a calculational result; for any completion with an independent carrier it must be re-derived. **Status: open, not failed and not passed.**

Binary pulsars. The flyby-calibrated dephasing bounds are withdrawn. The symmetry-cancellation argument for dipole suppression is retained conditionally; the compact-body charge difference is unknown; the correct constraint program is stated in the record.

Fifth forces and light propagation. Visible-sector coupling sequestered at tree level; conditional on the matter reduction; the photon coupling perturbs normalized Bell statistics by an interaction amplitude $\sim 10^{-59}$.

Stability, causality, well-posedness. Regime-limited: exterior vacuum and Kerr via the Gauss–Bonnet parent; the local rate operator on general backgrounds and the N-dependent norm require the ADM analysis of the completed theory. The former Horndeski proof does not transfer (Appendix P).

Constraint ledger.

CONSTRAINT	V7.9 CLAIM	V8.1 STATUS	DECISIVE CALCULATION
$c_T = c$	passed by class label	**calculated on sGB parent** ($\lesssim 10^{-30}$); open for full two-clock action	quadratic tensor action of the completed theory
PPN α_i	zero identically	open (tracking-regime calc; completion re-derivation)	weak-field solution + matter matching
ghost-freedom	proved (Horndeski)	regime-limited (GB parent); general open	ADM of the N-dependent action
dipole radiation	10^{-20}–10^{-14} rad	bounds withdrawn; symmetry argument conditional	compact-body charges
fifth force	sequestered	conditional UV claim	matter/photon metric derivation
flyby	derived force, 98%	measurement reading (structural theorems proved); unit normalization + utilization open	η_a from DSN metadata

VIII. Discussion

VIII.A Two clocks are a proof of structure

The gradient-clock obstruction entered as a contradiction and left as a derivation — of a distinction *Theory of Time* had already drawn (§10.3: universal time created once and shared; local time created by each closed system and referencing the universal background), now proved rather than posited. What looked like the field's clock failing at its turning points was the horizontal coordinate of uniform circular motion pausing at the edge of the circle while the point moved on: the amplitude was a local chart, never the clock. Every subsequent result in this paper turned on keeping the two clocks apart — the curvature norm is defined relative to N^μ; the probe derivative separates evolution from sampling; the flyby is a relation between the universal history and the internal clocks that read it. The distinction is not interpretive language. It does dynamical work.

VIII.B What the late-inspiral numbers establish

Two independently observed temporal numbers and one Lagrangian-forced outer anchor lie on one Peters trajectory at nearly exact successive halvings of separation — a convergence that neither the observations nor the theory manufactured separately, mediated by an a^4 law that predates both. Stated at its correct strength in both directions: the 54-year anchor is a genuine theoretical output (the closure theorem of A.6, conditional on the $\tau_- = 0.1$ yr boundary) that organizes the two observed times; and 730 R_S is the GR image of the observed 3.3-year anchor relative to that branch, not an independent theoretical selection. What STF adds is the claim that the three points are distinct activation channels — and the honest statements that the threshold which would select the separations from first principles has an unwritten normalization bridge, that the inner boundary of the emission window is underived, and that the production operators that would make the channels physical are presently open (§VI). The convergence is real; its first-principles legs are incomplete; the paper says all of it.

VIII.C Measured and observed

The framework's oldest distinction — the four-state ontology's "measured within an internal clock" against "observed as a correlation of the universal history" — is, in the flyby, no longer philosophy. DSN measures accumulated radio phase against a station clock; ΔV_∞ is a parameter of an orbit fit. The No-Work Holonomy Correspondence says the original STF interaction is a connection that does no work and carries holonomy; the No-Work Projection Theorem says a Doppler-dominated estimator can represent a transverse deflection as a scalar speed change; the operator norm says the closed Earth carrier's rotational clock channel has exactly Anderson's angular structure; and the Source–Observer Degeneracy Theorem says Earth data could never have told a source field from an observer clock. The anomaly, on this reading, is real as measured phase, absent as physical energy, and present as an inferred parameter — three statements that were contradictory under V7.9 and are consistent under two clocks. That the later nulls occurred under continuous, redundant, multi-station tracking — the configuration that closes the phase contour — is what the theory predicts, and what it must now compute.

VIII.D What is genuinely first-principles

The two-clock structure; the dimensional obstruction and its capacity-saturation resolution; the positive clock norm; the Peters hierarchy; the tensor speed; the flyby no-gos and the holonomy correspondence; the vorticity and operator-norm derivations of Anderson's structure; the source–observer degeneracy. Not first-principles, and labelled: the selection of the 3.32-yr anchor (730 R_S is its Peters image); the τ_- = 0.1 yr inner boundary of the 54-year closure; the 71-day channel-threshold ratio; the UHECR/GRB production operators; the constitutive clock–photon law and its unit normalization; the utilization coefficients; the saturation and Euclideanization theorems; the universal-clock carrier. The paper's confidence rests on the first list and its honesty on the second.

VIII.E Falsifiability

§V. The framework's most exposed prediction is the flyby capacity–utilization law, because it is quantitative, computable from archived data, and unlike anything a source-force theory would say.

IX. Conclusion

The Selective Transient Field is a two-clock, capacity-limited, curvature-response theory. Its universal clock orients every rate and defines the positive norm the field responds to; its internal phase is the field's cycle; the two are distinct by theorem. Its observed operator — the rate of the curvature magnitude, coupled with a dimensionless κ built from the compactification scale — is the capacity-saturated response of the ten-dimensional curvature parent, and its numerical structure at the late inspiral is the Peters image of successive halvings. Its most striking result is that the interaction which was thought to fail at the flyby is the one that predicts the flyby's observational form: a connection whose antisymmetric curvature does no work and carries the holonomy a coherent radio transaction reads, with Anderson's coefficient emerging as the vorticity and operator norm of the observer's own clock carrier. What is withdrawn is withdrawn once; what is open is named; and the calculation that would decide the framework's sharpest claim — the utilization of each historical tracking arc — is specified and waiting.

Acknowledgements

The June–August 2026 audits and derivations recorded in Appendices B–M and R were conducted in adversarial sessions with independent machine reviewers; the derivations were independently reproduced before inclusion. The observational discovery record is at uhecrtoday.com.

Conflict of Interest

The author declares no conflict of interest. ***

Appendices — Derivation Records

Every derivation the main body relies on, in full. Each step carries a verification tag: ***[reproduced]*** *— recomputed symbolically or numerically in the June–August 2026 sessions from the framework's own definitions;* ***[standard]*** *— a textbook result used without modification;* ***[stated]*** *— a theorem or completion named as a target, not proved. Where V7.9 asserted the contrary, the withdrawal is recorded in place. Sign convention (−,+,+,+); $c = \hbar = 1$ unless units are displayed.*

Appendix A — The Peters Hierarchy

A.1 The formula. For a circular binary of masses m_1, m_2, $M = m_1+m_2$, $\mu = m_1 m_2/M$, the Peters time to merger from separation a is $t_{merge}(a) = (5/256)\, c^5 a^4/(G^3 \mu M^2)$. [standard]

A.2 Direct evaluation, 30+30 $M_\odot$. $R_S = 2GM/c^2 = 1.772 \times 10^5$ m. t(1466 R_S) = 54.07 yr; t(730 R_S) = 3.324 yr; t(360 R_S) = 71.82 d. [reproduced]

A.3 The halving structure. $t \propto a^4 \Rightarrow t(a/2) = t(a)/16$. $(1466/730)^4 = 16.26$; $(730/360)^4 = 16.91$. Observed ratios: 54/3.3 = 16.36; 3.3 yr/71 d = 16.98. The temporal hierarchy is the a^4 image of successive near-halvings of separation. [reproduced]

A.4 What GR does and does not do (provenance corrected, August 2026). GR supplies the times at given separations and the a^4 law connecting them; it originates none of the three physical anchors. The correct derivation history: observation → {3.3 yr, 71 d}; STF Lagrangian → 54 yr (via the closure theorem, A.6); Peters = the common translator. Using the Lagrangian-forced 54-yr anchor at ≈1466 R_S: $a(3.3\text{ yr}) = 1466(3.3/54)^{1/4} = 728.9\ R_S$ and $a(71\text{ d}) = 1466((71/365.25)/54)^{1/4} = 359.1\ R_S$ — the origin of the 730 and 360 R_S levels. STF assigns the three points their physical roles (outer activation boundary; principal Compton phase; later photon/GRB phase); the near-halving hierarchy was the unexpected convergence. An earlier version of this appendix stated that all three times were found first and the Peters sequence was the surprise; that told the story observation-first for all three, hiding the load-bearing theoretical result (the Lagrangian-forced outer anchor) while overstating the independence of 730 R_S. [reproduced — back-projections and Peters evaluations verified; supersedes both V7.9's "Peters converts STF-selected separations" and the August draft's observation-first narrative]

A.5 The late-inspiral curvature rate. At 730 R_S, $\sqrt{K} = \sqrt{48}\, GM/(c^2 r^3) = 2.8 \times 10^{-19}$ m^{-2}, Peters $\dot{r} = 0.31$ m/s, and $\mathscr{D}_{GR} \approx 3\sqrt{K}\, \dot{r}/r \approx 2 \times 10^{-27}$ m^{-2}s^{-1} — the scale V7.9 quoted as $\mathscr{D}_{crit}$ (Appendix Q). [reproduced] *Convention note (August 2026):* this evaluation uses the total mass M in the one-hole proxy; the external-tidal convention (companion of mass M/2 at separation a) gives $\sqrt{K_{ext}} = 1.42 \times 10^{-19}$ m^{-2} and $\mathscr{D}_{ext} = 1.01 \times 10^{-27}$ m^{-2}s^{-1}. The factor-2 spread between conventions is one instance of the production-location ambiguity that Appendix Q.6 shows is load-bearing.

A.6 The 54-year closure theorem, its boundary condition, and the 71-day circularity (added August 2026). [reproduced — all numbers independently re-derived]

(i) The universality theorem. Write the source and threshold scalings as $\Phi_S = A_0 M_c^p \tau^{-n}$ and $\Phi_{crit} = B_0 M_c^q$. Activation $\Phi_S(\tau_+) = \Phi_{crit}$ gives $\tau_+ = (A_0/B_0)^{1/n} M_c^{(p-q)/n}$, so **$p = q \Rightarrow \tau_+$ is independent of chirp mass** — the outer anchor is universal. This is a theorem of the scaling structure. It does not, by itself, evaluate τ_+: the normalizations (or an observational closure) are still required.

(ii) The closure. For the Phase-I emission density $p_I(\tau) \propto \tau^{-n}$ on $[\tau_-, \tau_+]$, the centroid $\bar{\tau}_I$ is strictly monotone in τ_+ for $1 < n < 2$, so the outer endpoint is unique given $(\bar{\tau}_I, n, \tau_-)$. With the framework's inputs $n = 11/8$, $\bar{\tau}_I = 3.31$ yr, $\tau_- = 0.1$ yr: **$\tau_+ = 53.8804$ yr ≈ 54 yr** (the few-day propagation correction moves it to ≈54.0). This is exact and reproduced, including monotonicity. **Status: theorem (universality and uniqueness); derived conditional (the value 54, on τ_-).**

(iii) The hidden premise, declared. $\tau_- = 0.1$ yr entered silently: the published Test-40a table's uniform-profile entry is (0.1+54)/2 = 27.05 yr, exactly the reported value, which reconstructs the boundary. The result is highly sensitive to it: $\tau_- = 0.05 \rightarrow \tau_+ = 85.10$ yr; $0.1 \rightarrow 53.88$; $0.2 \rightarrow 33.48$; $0.5 \rightarrow 17.12$. **Deriving the 0.1-yr inner cutoff is a named open item — and it is known not to belong to the universal-clock sector:** by Clock-Rate Invisibility, an action depending on T_U only through N^μ cannot fix an absolute interval, so the cutoff must come from UHECR production dynamics (the same sector as the open production operators, §VI).

(iv) The 71-day derivation as previously published is circular, and is flagged as such. The manuscript computed $R = (3.3\text{ yr}/71\text{ d})^{11/4} \approx 2400$ from the observed times and then recovered 71 d from $\tau_{II} = \tau_I R^{-4/11}$ — algebraic inverses of one another. The channel-threshold ratio R must be derived from canonically normalized couplings and a specified production criterion *without* the GRB timing before 71 d counts as a prediction; until then it is an observed anchor. [flagged — open]

Appendix B — Clock Separation

Origin. The universal/local distinction this appendix proves is the two-clock ontology of *Theory of Time* §10.3 (universal time ontologically real from first activation; local temporal loops that create their own "now"; local loops that reference universal time). This appendix supplies the theorem that makes it necessary and the field-level consequences that V7.9's single-clock formalism missed. General Theory §1.4/§6.4 (State 1 "carried by universal time"; State 3 generating its own now) states the same distinction in the four-state ontology.

B.1 Gradient-clock obstruction (theorem). Let q have timelike, nonvanishing gradient on U and $n^\mu_q = s\nabla^\mu q/\sqrt{(-\nabla q\cdot\nabla q)}$, $s = \pm1$. Then $n_q\cdot\nabla q = -s\sqrt{(-\nabla q\cdot\nabla q)} \neq 0$ with definite sign; q is strictly monotone on every integral curve; a periodic q cannot define a continuous global clock this way. Applied to $\varphi = A\cos\Theta_I$: n^μ_φ is undefined at $\dot{\varphi} = 0$ ($X = \frac{1}{2}\dot{\varphi}^2 = 0$) and reverses chart orientation across it. On homogeneous

FLRW the interaction reduces to $-a^3\gamma\varphi\,\mathrm{sgn}(\varphi)\dot{R}$, non-differentiable at turning points; varying it produces $\delta(\varphi)$ terms. [reproduced] V7.9's use of n^μ_φ is valid on monotonic patches only.

B.2 Corollary (STF clock separation). If universal ordering is represented by a scalar T_U with timelike gradient — as Theory of Time does — then $T_U \neq \varphi$, and with $\Theta_I \simeq m_s T_U + \delta \pmod{2\pi}$ the internal clock and universal time are distinct-but-related. A continuous time *orientation* alone gives a direction field, not a scalar function; within STF the scalar representation is by construction. [entailment]

B.3 Phase-lift completion (conditional). With winding integer w: $T_U = (2\pi w + \Theta_I - \delta)/m_s$, the lift of $\mathbb{R} \to S^1$, $T_U \mapsto e^{i m_s T_U}$. Universal time retains the continuous ordering including w; the wrapped phase erases w. A global lift exists only if the class in $H^1(U,\mathbb{Z})$ vanishes — nontrivial winding, which the topological sector invokes, is where a single-valued global unwrapped phase can be obstructed. Three lifts to keep apart: worldline (always), spacetime scalar (topologically conditional), boundary-defined ordering (different construction). [reproduced for the covering-space algebra; conjecture as an STF completion]

B.4 Turning points are diagnostic. $d\varphi/dT_U = -A m_s \sin\Theta_I = 0$ while $d\Theta_I/dT_U = m_s \neq 0$. In the fixed-amplitude limit $(\varphi, v_\varphi/m_s)$ with $v_\varphi = \dot{\varphi}$ satisfies $\varphi^2 + (v_\varphi/m_s)^2 = A^2$ and $\Theta_I = \mathrm{atan2}(-v_\varphi/(A m_s), \varphi/A)$ is well defined away from $A = 0$. With $A(t)$ redshifting, $\dot{\varphi} = \dot{A}\cos\Theta_I - A\dot{\Theta}_I \sin\Theta_I$: WKB regime $|\dot{A}|/(m_s A) \ll 1$, a slowly contracting spiral. atan2 gives an S^1 phase; the $\mathbb{R}$ lift is B.3. [reproduced]

B.5 Clock-Rate Invisibility (lemma). $T_U \to f(T_U)$, $f' > 0$: $\nabla f = f'\nabla T_U$, so $N^\mu = -f'\nabla^\mu T_U/(f'\sqrt{-\nabla T_U\cdot\nabla T_U}) = N^\mu$ unchanged. An action depending on T_U only through N^μ detects orientation and foliation, not the rate $J_O = dT_U/d\tau_O$. [reproduced]

B.5b Spatial Clock-Gradient Invariance (theorem). The refinement the invisibility lemma admits: although the absolute relative rate $J_C = dT_U/d\tau_C$ is invisible, its spatial logarithmic gradient on a universal slice is invariant under every allowed relabelling $T_U \mapsto f(T_U)$, because $\nabla_\nu \ln f'(T_U) \propto \nabla_\nu T_U \propto N_\nu$ and $h_\mu{}^\nu N_\nu = 0$: $D^\perp_\mu \ln J_C \equiv h_\mu{}^\nu \nabla_\nu \ln J_C$ is unchanged. A spatially uniform rescaling drops out of a gradient; only the spatially varying part of the rate is physical, and it is exactly reparameterization-invariant. This supplies an acceleration-dimensioned invariant, $\mathfrak{a}^{(C)}_\mu = c^2 D^\perp_\mu \ln J_C$, whose c^2 is the lapse↔potential normalization ($J_C \simeq 1 - \Phi/c^2 \Rightarrow c^2\nabla \ln J_C \simeq -\nabla\Phi$), not a fitted coefficient. Consistent with B.5: the lemma kills the absolute rate; the gradient survives it. [reproduced — August 2026 delegation, independently verified]

B.6 The $4\pi^2$ firewall. $\mathscr{D}_{crit}$'s $4\pi^2$ is the cup product of the retarded and advanced Green-function sectors on the Hopf torus, $\int_{T^2_\gamma}\omega_R \wedge \omega_A = 4\pi^2$ (Topological Closure V6.3, Heegaard transgression) — not internal × universal periods. The clock theorem supports distinct temporal structures; the cup product is the separate derivation of the constant. [corpus-verified] One precision (August 2026): the coordinate-free content of the pairing is the primitive integer $\langle[\omega_R/2\pi i] \smile [\omega_A/(-2\pi i)], [T^2]\rangle = \mathbf{1}$; the raw $4\pi^2$ is that integer expressed in canonical unnormalized angular coordinates ($\int d\theta \wedge d\tilde{\theta} = (2\pi)^2$). Canonical once $e^{i\theta}$ is adopted, not tunable — but not extra topological information beyond the integer one. [reproduced]

B.7 The repair is a new theory, not notation. Replacing n^μ_φ by N^μ inside the action changes the Euler–Lagrange equation, $T_{\mu\nu}$, the constraint algebra, the DHOST class, and the foliation/perturbation analysis. Candidate carriers: independent khronon/time scalar; constrained timelike vector or foliation; complex or rotating scalar with a phase dof; boundary-defined nonlocal ordering; or restriction of the EFT to $X > 0$. Each has its own dof count and stability conditions. The minimal Lagrange-multiplier form $S_U = \int\sqrt{-g}\,\lambda_U(\nabla T_U\cdot\nabla T_U + 1)$ enforces $\nabla T_U\cdot\nabla T_U = -1$ and gives $\nabla_\mu(\lambda_U N^\mu) = 0$; if varied it is a new constrained sector; if held fixed it is the fixed-clock theory. One obstruction is already proved: for a normalized-gradient clock $N_\mu = -\alpha\nabla_\mu T_U$ with $\alpha = q^{-1}$, $q = \sqrt{(-\nabla T_U\cdot\nabla T_U)}$, the flow acceleration is $A^{(N)}_\mu = D^\perp_\mu \ln \alpha$ — not generically zero — but the minimal form's constraint $q = 1$ forces $A^{(N)}_\mu = 0$, a geodesic universal flow with no lapse gradient. The minimal completion therefore forecloses every effect carried by a spatially varying clock rate (B.5b); a completion admitting a nontrivial lapse requires more structure than the unit-norm multiplier. [reproduced — August 2026] *Candidate-list update (August 2026):* the companion paper *The Universal Clock Carrier* resolves this appendix's five-way fork — amplitude closed by theorem; the unwrapped/axionic phase closed as a *global* carrier (shift-charge dilution $\dot\theta \propto a^{-3}$, $\rho \propto a^{-6}$, plus KKLT periodicity; it survives as a finite-epoch local reference); the unit-eikonal route closed (this paragraph); a propagating khronon excluded absent a UV derivation — leaving the boundary-selected CMC construction as the conditional candidate, with its own named open items.

Appendix C — Branch A/B and the Response Kernel

C.1 Dimensions. $[\varphi] = 1$, $[I_4] = 4$, $[\sqrt{I_4}] = 2$, $[N] = 0$, $[\nabla] = 1$. $\varphi N\cdot\nabla I_4$ has dimension 6 → coefficient M^{-2} ✓ for ζ/Λ; $\varphi N\cdot\nabla\sqrt{I_4}$ has dimension 4 → coefficient dimensionless. $\gamma\varphi\mathscr{G}$ has dimension 5 → $[\gamma] = M^{-1}$; retarded matching $\zeta/\Lambda = \gamma\tau_{eff}$ has dimension M^{-2} and multiplies $N\cdot\nabla\mathscr{G}$. $g(\mathcal{R}) = 2\mathcal{R}$ gives $2\mathcal{R}N\cdot\nabla\mathcal{R} = N\cdot\nabla I_4$ (chain rule) — Branch B collapses to A. [reproduced] V7.9's boxed action attached ζ/Λ to $N\cdot\nabla\sqrt{I_4}$; withdrawn.

C.2 The kernel. V7.9 App. O used the normalized $L_R = \omega_c e^{-\omega_c t}\Theta(t)$, $\int L_R = 1$, whose expansion $(L_R \ast I) = I - \dot I/\omega_c + \dots$ generates a rate only as a correction to a nonzero static response — contradicting $K_R(0) = 0$. Repair: zero-mode subtraction $K^R_{sel} = \delta(t) - \omega_c e^{-\omega_c t}\Theta(t)$, $\int K = 0$, $(K\ast I) = \dot I/\omega_c - \ddot I/\omega_c^2 + \dots$, $\tau_{eff} = 1/\omega_c$, $C_{match} = m_s/\omega_c$. Frequency response $K(\omega) = -i\omega/(\omega_c - i\omega)$: $\approx -i\omega/\omega_c$ ($\omega \ll \omega_c$, the rate operator); $O(1)$ at $\omega \sim \omega_c$; → 1 for $\omega \gg \omega_c$. Since $\omega_c \sim m_s$, phenomena on the 3.32-yr scale have ω/ω_c not small and the full memory kernel governs. [reproduced]

C.3 Scalings. Schwarzschild $\mathcal{R} = \sqrt{I_4} \propto M/r^3$: $\dot{\mathcal{R}} \propto Mv/r^4$, $\dot I_4 = 2\mathcal{R}\dot{\mathcal{R}} \propto M^2v/r^7$; at 10× radius Branch A is suppressed by $\sim 10^{-3}$ relative to B. FLRW $\mathscr{G} = 24H^2(H^2 + \dot H) \sim H^4$: $\mathscr{G} \sim H^5$ vs $\sqrt{\mathscr{G}} \sim H^3$ — Branch A adds two powers of the small late-time H (dark-energy sourcing harder; early-universe response stronger). [reproduced]

C.4 The in-in form. A purely retarded kernel cannot be obtained by varying a single-copy real action (symmetric bilinear kernel); the minimal in-in form is $\Gamma_{STF} = S_{parent}[\Phi_+] - S_{parent}[\Phi_-] + \gamma\int\varphi_a K^R_{sel}(x,y;\mathfrak{o}_U)\,\mathscr{I}_r(y) + (i/2)\int\varphi_a N\varphi_a + \dots$, with $\mathfrak{o}_U$ the universal causal orientation. Varying the difference field and taking the physical limit gives causal equations. This is the shape the Universal Embedding companion identifies with the T^2 doubling — proposed correspondence, not proof. [standard structure; correspondence stated]

Appendix D — Capacity Saturation

D.1 Setup. Clock-resolved curvature components $\mathscr{C}^A$, positive clock-relative metric $h_{AB}(N)$, $q_N = \sqrt{h_{AB}\mathscr{C}^A\mathscr{C}^B}$ ($[q_N] = L^{-2}$). Response covector P_A.

D.2 Unsaturated (Branch A). $P_A = \alpha h_{AB}\mathscr{C}^B \Rightarrow P_A D_U \mathscr{C}^A = (\alpha/2) D_U(h_{AB}\mathscr{C}^A\mathscr{C}^B) = (\alpha/2) D_U I_4$. $\|P\| = \alpha q_N$ grows without bound. [reproduced]

D.3 Capacity-limited (Branch B). $\|P\| \le M^2$, $M = L^{-1}$. *Support function* $Q(\mathscr{C}) = \max_{\|P\|\le M^2} P_A\mathscr{C}^A \le \|P\|\|\mathscr{C}\| \le M^2 q_N$ *(Cauchy–Schwarz), equality at* $P_A = M^2 h_{AB}\mathscr{C}^B/q_N$*. Then* $D_U Q = P_A D_U\mathscr{C}^A = M^2 D_U q_N$ *— verified:* $P\cdot dC - M^2 dq = 0$ exactly, $\|P\|^2 = M^4$. Finite capacity + saturation ⇒ $M_*^2 D_U\sqrt{I_4}$. [reproduced]

D.4 The coefficient. $\kappa = \gamma\tau_{eff} M^2 = (\zeta/\Lambda)M^2 = (\zeta/\Lambda)/L_*^2 = 1.35\times10^{11}\ \mathrm{m}^2/(3.64\times10^{-30}\ \mathrm{m})^2 = 1.02 \times 10^{70}$, dimensionless — the conversion V7.9's cosmological calculation already used. No new scale. [reproduced]

D.5 Auxiliary-field action. $S_B \supset \int\sqrt{-g}[\kappa\varphi N^\mu\nabla_\mu\chi + \lambda(\chi^2 - \mathscr{I}_N)]$; $\delta\lambda \Rightarrow \chi = q_N$; integration by parts shows χ has no kinetic term — zero propagating dof. V7.9 used essentially this in vacuum with $\lambda(\chi^2 - \mathscr{G})$; what was missing was why $\chi = \sqrt{\mathscr{G}}$ is the channel variable — capacity saturation supplies it. [reproduced]

D.6 The transverse polarization. Decompose $\mathscr{C}^A = q\mathscr{C}^A$: $D\mathscr{C}^A = \mathscr{C}^A Dq + qD\mathscr{C}^A$. Aligned $P \propto \mathscr{C}$ projects out the angular term (Branch B, radial). A rotating source needs $P_A = M_*^2(\cos\alpha\, \mathscr{C}_A + \sin\alpha\, \mathscr{T}_A)$ with $\mathscr{T}$ tangent to the curvature-state orbit: $P\cdot D\mathscr{C} = M_*^2[\cos\alpha\, Dq + \sin\alpha\, q\Omega_C]$. Radial polarization → Branch B; transverse → the spin-sensitive channel (Appendix G). [reproduced]

D.7 Named completions. *Curvature-Polarization Saturation Theorem*: compactification and causal closure produce a nonpropagating response polarization of fixed magnitude L^{-2}*, aligned with the curvature state selected by* N^μ*.* Capacity-Normalized Curvature Theorem*: the 10D internal-trace projector and one-winding closure induce an isotropic bounded dual response space of radius* L^{-2} whose support function is $L_*^{-2}\sqrt{\mathscr{I}_N}$. If proved, they derive the square root, the normalization, alignment, Branch B over A, and the absence of a new parameter simultaneously. [stated — open]

D.8 One correction to Closure–Capacity. $D_N q_N$ is a curvature-amplitude production rate, not a Lyapunov exponent; the fractional/Lyapunov-like rate is $D_N \ln q_N = D_N q_N/q_N$. [recorded]

Appendix E — The Norm Fork

E.1 $\mathscr{G}$ is indefinite. With $S_{\mu\nu} = R_{\mu\nu} - \frac{1}{4}Rg_{\mu\nu}$, $\mathscr{G} = C^2 - 2S_{\mu\nu}S^{\mu\nu} + R^2/6$ (verified against $\mathscr{G} = R^2_{\mu\nu\rho\sigma} - 4R^2_{\mu\nu} + R^2$ and $C^2 = R^2_{\mu\nu\rho\sigma} - 2R^2_{\mu\nu} + R^2/3$). [reproduced]

E.2 FLRW sign table. Flat FLRW, constant w: $\dot{H} = -(3/2)(1+w)H^2$, $R = 3(1-3w)H^2$, $\mathscr{G} = -12(1+3w)H^4$. de Sitter: $R = 12H^2$, $\mathscr{G} = +24H^4$; matter: $3H^2$, $-12H^4$; radiation: 0, $-24H^4$. $\sqrt{\mathscr{G}}$ is imaginary through matter and radiation domination and cannot reproduce the real $\kappa\varphi\dot{R}$. Kerr's Kretschmann crosses zero (Semerák); VSI/type-N spacetimes have all polynomial invariants vanishing — the square-root problem is structural. [reproduced]

E.3 The clock supplies positivity. $E_{\mu\nu} = C_{\mu\alpha\nu\beta}N^{\alpha}N^{\beta}$, $B_{\mu\nu} = {}^*C_{\mu\alpha\nu\beta}N^{\alpha}N^{\beta}$; $\mathscr{W}_N = E^2 + B^2 \geq 0$ (spatial metric orthogonal to N positive definite) — the Bel–Robinson superenergy relative to N. Detects type-N waves where all polynomial invariants vanish. $C^2 = 8(E^2 - B^2)$ can vanish or flip while $\mathscr{W}_N > 0$. [standard; reproduced numerically]

E.4 $\mathcal{R}_{STF}(N) = \sqrt{R^2 + 8\mathscr{W}_N}$. Schwarzschild: $R = 0$, $B = 0 \Rightarrow \sqrt{8E^2} = \sqrt{C^2}$ — Schwarzschild/binary/flyby radial scaling preserved exactly. FLRW: $E = B = 0 \Rightarrow |R|$ — cosmological source preserved (sign at $R = 0$ to be treated). Kerr/radiative: $\sqrt{8(E^2 + B^2)}$ real and positive; sees type-N. Radiation FLRW: $R = 0$, $C = 0 \Rightarrow 0$ — traceless conformally-flat radiation invisible to the channel: a selection rule, stated as such. Not a full Riemann norm (no trace-free Ricci channel). [reproduced]

E.5 The price. $R^2 + 8\mathscr{W}_N \neq \mathscr{G}$. The map $\mathscr{G} \to R^2 + 8\mathscr{W}_N$ under universal-clock projection and saturation is the *Clock-Euclideanization Theorem*: the compactification supplies an indefinite curvature bilinear; closure relative to N^μ projects it onto the positive trace–tidal subspace accessible to the channel. Not proved; the internal-trace projector 6/9 used for L* does not by itself perform this projection. Once $\mathcal{R}$ depends on N^μ, the GB auxiliary-field argument no longer establishes ghost-freedom; the completed action needs its own ADM analysis. [stated — open]

E.6 Cosmology's residual question. The compactification reportedly gives $I_4 = aR^2 + bR_{\mu\nu}R^{\mu\nu}$; $q_{cos} = \sqrt{aR^2 + bR^2_{\mu\nu}}$; the replacement $q_{cos} \to |R|$ is justified only if $b = 0$, or FLRW makes the Ricci term $\propto R^2$, or the polarization selects the R direction, or the unwanted combination decouples. The most important possible source of change to cosmological numbers. [stated]

Appendix F — The Four Flyby No-Gos

F.1 No-work (derived). Velocity-linear generalized potential $L_{int} = A_i v^i - A_0$; Euler–Lagrange $F_i = -\partial_i A_0 - \partial_t A_i + v^j F_{ij}$, $F_{ij} = \partial_i A_j - \partial_j A_i = -F_{ji}$. Stationary pure-vector part: $F_i = v^j F_{ij} \Rightarrow F_i v^i = v^i v^j F_{ij} = 0$. Coriolis/Lorentz-type: rotates the velocity, cannot change speed by work; open or closed trajectory. [reproduced] V7.9 B.10.4 treated the velocity-dependent potential as static; B.3 applied the fundamental theorem of line integrals to a non-gradient force; B.4/B.14 derived the factor of two as $\Delta V = (\zeta/\Lambda)[\dot{\mathcal{R}}_{out} - \dot{\mathcal{R}}_{in}]$ with "contributions add" — the endpoint difference of a non-gradient force. V7.9's April-2026 note conceded $F\cdot v = 0$ but fenced off "the geometric derivation of $K = 2\omega R/c$ (B.4) is correct and stands"; that fence is false — B.4 rests on the invalidated step. **Withdrawn.**

F.2 Stationarity (theorem under hypotheses). Geodesics of a stationary asymptotically flat effective metric $\partial_t \tilde{g}_{\mu\nu} = 0$ with common asymptotic form: Killing energy $E = -\tilde{g}_{\mu\nu}\xi^{\mu}u^{\nu}$ conserved; asymptotic $E \leftrightarrow V_\infty$ relation the same at both ends $\Rightarrow V_{\infty,out} = V_{\infty,in}$. A local interval with $F\cdot v \neq 0$ does not evade this. Permanent change needs explicit nonstationarity, dissipation, different asymptotic structures, or a non-mechanical inference from the tracking observable. Real-transfer route: a co-rotating nonaxisymmetric $\varphi_0(r,\theta,\varphi - \omega t)$ with helical Killing vector $k = \partial_t + \omega\partial_\varphi$ conserves $E - \omega L_z$, so $\Delta E = \omega \Delta L_z$; Anderson would require $\Delta L_z/m = (2RV_\infty^2/c)(\cos\delta_{in} - \cos\delta_{out})$ — a concrete torque target; axisymmetric Kerr/Lense–Thirring cannot (E, L_z separately conserved). [reproduced]

F.3 Spin parity (theorem). Slow Kerr: $E_{ij} = E^{(0)}_{ij} + O(a^2)$, $B_{ij} = O(a)$. $C^2 = 8(E^2 - B^2) = C_0^2 + O(a^2)$; $\sqrt{8(E^2 + B^2)} = \sqrt{8E_0^2} + O(a^2)$; both even under $\omega \to -\omega$. Verified: coefficient of a^1 in C^2 and in $\mathscr{W}_N$ is zero; $I_2 \propto E\cdot B$ has a^1 coefficient $E_0 b_1 \neq 0$. Hence $D\sqrt{C^2}$ and $D\sqrt{8\mathscr{W}_N}$ contain no term linear in ω and cannot reverse for retrograde Venus, while $K = 2\omega R/c$ is linear in ω. No scalar magnitude channel produces it at first order; the signal must live in orientation (I_2/ϑ_C — Appendix G) or in the clocks (Appendices I–L). [reproduced] V7.9 acknowledged $\mathcal{R} = \sqrt{K}$ has no linear-spin correction and then assigned an $O(\omega)$ contribution to its "effective curvature rate"; incompatible. Also: the breathing-mode source $A(\sigma)C^2$ is spin-even $\Rightarrow \sigma(a) = \sigma(-a)$, $\nabla\sigma = \nabla\sigma^{(0)} + O(a^2)$, so the cross-disformal $H^{XD}_{\mu\nu} = \hat{B}(\nabla_\mu\sigma\nabla_\nu q + \dots)$ has no intrinsic $O(a)$ carrier — "$\nabla\varphi_0$ carries ω^1" is unsupported (Appendix O).

F.4 The stationary-source obstruction. For a stationary axisymmetric source with Killing vectors t^μ, ψ^μ, any invariant scalar has $\mathcal{L}_t\mathcal{R} = \mathcal{L}_\psi\mathcal{R} = 0$, so a rigidly corotating clock $k = t + \Omega\psi$ gives $k^\mu\nabla_\mu\mathcal{R} = 0$. Rotating a perfect sphere changes nothing. Under any stationary universal slicing, $N^\mu\nabla_\mu q = 0$ and the repaired universal-rate interaction vanishes on the Earth background; V7.9's "quasi-static rotation-sensitive φ_0" cannot follow from $N\cdot\nabla q$. What survives is D_I: the spacecraft's convective sampling $u\cdot\nabla q = \Gamma v\cdot\nabla q$, and its sampling of the $O(a)$ phase ϑ_C. Curvature evolution ≠ curvature sampling. [reproduced] ## Appendix G — Kerr Curvature Phase, Holonomy and the Exterior-Information No-Go

G.1 The complex Weyl invariant. $m \equiv GM/c^2$, $a \equiv J/(Mc)$. Kerr $\Psi_2 = -m/(r - ia\cos\theta)^3$; the quadratic complex Weyl invariant $\mathfrak{I} = 48m^2/(r - ia\cos\theta)^6 = C^2 + iP$ (P the Pontryagin $C\cdot{}^*C$). Writing $z = r - ia\cos\theta = \rho e^{-i\chi}$, $\rho = \sqrt{r^2 + a^2\cos^2\theta}$, $\chi = \arctan(a\cos\theta/r)$: $\mathfrak{I} = q^2 e^{2i\vartheta_C}$ with $q = 4\sqrt{3}\, m/\rho^3$ and $\vartheta_C = 3\arctan(a\cos\theta/r)$. Verified: $|\mathfrak{I}| = q^2$, $\arg\mathfrak{I} = 2\vartheta_C$ at a random point. Slow rotation: $q = 4\sqrt{3}\, m/r^3 + O(a^2)$ (spin-even), $\vartheta_C = 3a\cos\theta/r + O(a^3)$ (spin-odd). $C^2 = 48m^2/r^6 + O(a^2)$; $P = 288m^2 a\cos\theta/r^7 + O(a^3)$; $P/C^2 \simeq 6a\cos\theta/r$. The first-order rotational information absent from $\sqrt{K}$ is entirely in ϑ_C. [reproduced, exact]

G.2 The curvature-phase connection. $\mathscr{A}_C = q\, d\vartheta_C$; $\mathcal{F}_C = d\mathscr{A}_C = dq\wedge d\vartheta_C = 36\sqrt{3}\, ma\sin\theta/\rho^5\, dr\wedge d\theta$ (verified exact); slow rotation $36\sqrt{3}\, ma\sin\theta/r^5$ — linear in a hence in ω; sign-reversing; maximal at the equator; zero on the axis; with $\theta = \pi/2 - \delta$, $\sin\theta = \cos\delta$, so $\mathcal{F}_C \propto \omega \cos\delta$. The specific differential-geometric object carrying the Anderson angular factor. [reproduced]

G.3 The two-clock normalized phase field. With $h_{\mu\nu} = g_{\mu\nu} + N_\mu N_\nu$ and $Y_N = h^{\mu\nu}\nabla_\mu q \nabla_\nu q$: Schwarzschild $q = 4\sqrt{3}m/r^3$, $\sqrt{Y_N} = 3q/r$, so the local curvature radius $r_{\mathscr{C}} = 3q/\sqrt{Y_N} = r$ — no explicit M, G, R or coordinate. $\Xi_\mu = r_{\mathscr{C}}\, h_\mu{}^\nu \nabla_\nu \vartheta_C$; slow Kerr $\Xi_{\hat{r}} \simeq -(3a/r)\cos\theta$, $\Xi_{\hat{\theta}} \simeq -(3a/r)\sin\theta = -(3a/r)\cos\delta$; $d\Xi = -(3a\sin\theta/r)\,dr\wedge d\theta \neq 0$ — cannot be removed by redefining one clock. [reproduced]

G.4 The surface scale. At $r = R$, $-\partial\vartheta_C/\partial\theta \simeq (3a/R)\cos\delta$ per leg; $a = J/(Mc) = I\omega/(Mc) = k_I R^2\omega/c \Rightarrow K_{phase} = 6k_I\,\omega R/c$; $K_{phase}/K_{Anderson} = 3k_I$. Earth $k_I = 0.3307 \Rightarrow 0.992$ ($K_{phase} = 3.075\times10^{-6}$ vs 3.099×10^{-6}); Venus $0.337 \pm 0.024 \Rightarrow 1.01$ (sign-reversing, $\omega < 0$); Jupiter $0.263 \Rightarrow 0.79$ ($K \approx 6.65\times10^{-5}$ vs 8.41×10^{-5}) — a genuine discriminator. **Status: local geometric scale, not a derived DSN coefficient** (Appendix H — the direction-odd coupling cancels on a retraced link). [reproduced]

G.5 Correction to V7.9's Kerr section. $a_\oplus = k_I R^2\omega/c = 3.27$ m (not ≈ 0.009 m); $a/R = 5.1\times10^{-7}$ (not $\sim10^{-9}$); $3a_\oplus/R_\oplus = 1.54\times10^{-6} \simeq \omega R/c$ because $3k_I \simeq 1$. [reproduced]

G.6 Exterior-information no-go. Two rotating bodies with the same exterior M and J but different R and k_I: identical local vacuum curvature to the relevant multipole order ⇒ every local functional $F[C, \nabla C, N, \ldots]$ agrees; but $2\omega R/c = 2J/(k_I McR)$ differs. No purely local exterior-curvature theory derives $2\omega R/c$ universally; it must receive R, or ω, or k_I, or a nonlocal carrier of source-boundary data. $r_{\mathscr{C}}$ reconstructs the radius of the *event*, not the planet's surface. [reproduced]

G.7 ϑ_C is not the internal clock. Inserting $\delta\Theta_I = \vartheta_C$ into $T_U = (2\pi w + \Theta_I - \delta)/m_s$ gives $\delta T_U = \vartheta_C/m_s$; near Earth $|\vartheta_C| \lesssim 1.5\times10^{-6}$ and $\hbar/(m_s c^2) = 1.67\times10^7$ s ⇒ $\delta T_U \sim 26$ s, enormously larger than any flyby residual. And $\Theta = m_s T_U + \vartheta_C$ has timelike gradient only if $\mu^2 > h^{\mu\nu}\nabla_\mu\vartheta_C\nabla_\nu\vartheta_C$, $\mu = m_s c/\hbar \simeq 2.0\times10^{-16}\ \mathrm{m}^{-1}$, while $|\nabla\vartheta_C| \sim 3a_\oplus/R_\oplus^2 \simeq 2.4\times10^{-13}\ \mathrm{m}^{-1}$ — ratio 10^3, spacelike. Three irreducible roles: T_U (ordering), Θ_I (Compton phase), ϑ_C (spatial curvature orientation). [reproduced]

Appendix H — Reciprocity Selection

H.1 The theorem. Decompose a small optical-metric perturbation relative to N^μ: $h^{(\gamma)}_{\mu\nu} = 2\Phi N_\mu N_\nu + 2N_{(\mu}A_{\nu)} + H_{\mu\nu}$ (A, H spatial). For a ray of spatial direction ℓ^μ, $c\,\delta t = \int(\Phi - A_\mu\ell^\mu + \tfrac{1}{2}H_{\mu\nu}\ell^\mu\ell^\nu)\,d\ell$. Under exact retrace $\ell \to -\ell$: Φ even (adds), $A\cdot\ell$ odd (cancels), $H_{\ell\ell}$ even (adds). The clock-shift coupling $N_{(\mu}\Xi_{\nu)}$ is in the cancelling vector sector; on a retraced link $\delta\rho = 0$, and for moving endpoints only the loop holonomy $\oint\Xi = \int d\Xi$ remains — a Sagnac-like area observable, not twice an endpoint value. Toy rectangular loop: $\oint\Xi = -3a\ln(r_2/r_1)(\cos\theta_1 - \cos\theta_2) \propto (\sin\delta_1 - \sin\delta_2)$, *not* Anderson's $\cos\delta_{in} - \cos\delta_{out}$, and containing $\ln(r_2/r_1)$ — tracking-distance, station and arc dependence Anderson lacks. [reproduced]

H.2 The magnetic-Weyl candidate. $\tilde g^{(\gamma)}_{\mu\nu} = g_{\mu\nu} + \lambda_B\chi\mathscr{G}(W)B_{\mu\nu}/\sqrt{W}$, $W = E^2 + B^2$, $\mathscr{G}(W)$ the closure gate (0 flat, → 1 saturated), χ a pseudoscalar for parity. Quadratic in $\ell \Rightarrow$ uplink and downlink add. Weak Kerr: $E_{ij} = (m/r^3)(\delta_{ij} - 3n_in_j)$, $B_{ij} = -(3m/r^4)[a_in_j + a_jn_i + (\delta_{ij} - 5n_in_j)(a\cdot n)]$, $\sqrt{E_{ij}E^{ij}} = \sqrt{6}\, m/r^3 \Rightarrow \hat B_{\ell\ell} = -\sqrt{3/2}\,(1/r)[2(a\cdot\ell)(n\cdot\ell) + (a\cdot n)(1 - 5(n\cdot\ell)^2)] + O(a^2)$ — *mass cancelled, $O(a/r)$; the closure gate is essential or $M \to 0$ leaves a finite effect. Straight ray $x = b + s\ell$, $b \perp \ell$:* $\int_{-\infty}^{\infty}\hat B_{\ell\ell}\,ds = \pm(3\pi/2)\sqrt{3/2}\;a\cdot\hat b = 5.771\;a\cdot\hat b$ (verified numerically for $a \parallel \hat b$; zero for $a \perp \hat b,\ell$ and for $a \parallel \ell$). Earth $2\omega R/c = (2/\alpha_E)(a/R) = 6.046\;a/R$ ($\alpha_E = 0.3308$) — 4.5% from the rank-2 Kerr integral, not inserted. Not yet a prediction: units of length ($\sim 5.771a$); DSN ray finite; λ_B underived; even in ℓ *and* in $v \Rightarrow$ no $\cos\delta_{in} - \cos\delta_{out}$ from it alone. [reproduced]

H.3 The three "twos". Uplink + downlink: real in raw phase, removed by DSN's c/2 conversion (round-trip light time to one-way range). Incoming vs outgoing branches: could remain, needs a derived sign reversal. $K = 2\omega R/c$: Anderson's coefficient, not derived by the optical tensor. [reproduced]

Appendix I — Vorticity, Transponder and Carrier

I.1 The factor of two. Earth-fixed internal-clock congruence $U^\mu_E = \Gamma_E(N^\mu + \beta^\mu_E)$, weak rigid rotation $\beta_E = (\omega\times r)/c$. Spatial curl relative to N: $\nabla\times(\omega\times r) = 2\omega$ exactly (verified) $\Rightarrow \mathscr{H}_C = 2\omega/c$; with $r_{\mathscr{C}} = R$ at Earth's clock boundary, $\mathscr{K}_C = r_{\mathscr{C}}|\mathscr{H}_C| = 2\omega R/c$ — Anderson's K. Kerr normalization used $a = J/(Mc)$ and k_I; clock-flow vorticity uses ω directly, no $GM/(c^2R)$, no artificial cancellation. The same factor appears in congruence-adapted gravitoelectromagnetic decompositions (twice the vorticity). [reproduced]

I.2 Coherent Transponder Cancellation. A direction-independent conversion $\nu_I = \mathscr{C}\nu_U$ cancels exactly through a fixed turnaround ratio q. Direction-odd conversion $\nu_I(k) = [1 + \varepsilon(x,u,\ell)]\nu_U(k)$, $\varepsilon(-\ell) = -\varepsilon(\ell)$: $\nu_{U,\downarrow}/(q\nu_{U,\uparrow}) = (1+\varepsilon)/(1-\varepsilon) \simeq 1 + 2\varepsilon$ survives. $y_{STF} = 2\varepsilon$; conventional $y_{Doppler} \simeq -2\delta V_{LOS}/c \Rightarrow \delta V_{arc} = -\mathscr{K}_C V_\infty \cos\delta$ — the transponder's 2 is removed by the c/2 conversion; $\Delta V_\infty = \delta V_{out} - \delta V_{in} = \mathscr{K}_C V_\infty(\cos\delta_{in} - \cos\delta_{out}) = (2\omega R/c)V_\infty(\cos\delta_{in} - \cos\delta_{out})$. [reproduced]

I.3 The angular structure. $v_\perp = \sqrt{v\cdot v - (v\cdot\hat s)^2} = V_\infty\cos\delta$ — the *norm* of the equatorial component; a linear contraction $\hat s\cdot v$ gives $V\sin\delta$ (wrong function). [reproduced]

I.4 The carrier is a connection, not T_U. Hypersurface-orthogonal $N_\mu = -\nabla_\mu T_U/|\nabla T_U|$: Frobenius $\Rightarrow \omega^{(N)} = 0$ — the universal clock has no vorticity, appropriately. Rotation lives in U_E. Synchronization one-form $\mathscr{A}_\mu = h^{(N)}{}_{\mu\nu}\beta^\nu_E = (\omega\times r)/c$; $\mathcal{F} = 2D_{[\mu}\mathscr{A}_{\nu]}$, spatial dual $\mathscr{H}_C = \nabla_N\times\mathscr{A} = 2\omega/c$; $R|\mathscr{H}_C| = 2\omega R/c$. Phase-bundle form: $D_\mu\Theta_I = \nabla_\mu\Theta_I - q_C\mathscr{A}_\mu$, transport $W_\gamma = \exp(iq_C\int_\gamma\mathscr{A})$, $W_{\gamma^{-1}} = W_\gamma^{-1}$. *Retraced two-way:* $W_{\gamma^{-1}}W_\gamma = 1$ — a universal clock connection produces no residual on a reciprocal path; non-retraced legs close to $\oint\mathscr{A} = \int\mathcal{F}$ — Sagnac, already in relativistic time transfer and JPL light-time models. Clock connection + ordinary transport = standard Sagnac, not a new anomaly. [reproduced]

I.5 The direction-odd conversion is new physics. $\nu_I = -(1/2\pi)k_\mu u^\mu$ is standard; its direction dependence is ordinary Doppler. $\varepsilon_{req} = \lambda_C\mathscr{G}_{closure}\, r_{\mathscr{C}}\Omega_C(v_\perp/c)\sigma_\gamma$, $\sigma_\gamma = \mathrm{sgn}(k_\mu r^\mu)$, $\Omega_C =$

$\sqrt{(\tfrac{1}{2}\mathcal{F}_{\mu\nu}\mathcal{F}^{\mu\nu})}$: at Earth's boundary $\varepsilon_{req} = \lambda_C(2\omega R/c)(V_\infty/c)\cos\delta\,\sigma_\gamma$; Anderson iff $\lambda_C = 1$ acting in the coherent readout chain. Nonanalytic (norm, sign), observer- and ray-dependent, not generated by the scalar action, generally preferred-frame detector physics. Closure topology gates but cannot normalize: $\lambda_C \to \lambda_C + \delta\lambda$ leaves the winding number unchanged (One Bit of Destiny's lemma turned on the flyby); a unit coefficient must come from canonical normalization, quantized clock charge, 10D reduction of a matter/photon operator, or a derived constitutive principle. [reproduced]

Appendix J — Coherent-Link Cancellation and the Local Reciprocal-EFT No-Go

J.1 Cancellation theorem. $J_A \equiv dT_U/d\tau_A$; $\nu_A = J_A(1/2\pi)d\Phi/dT_U$. Two-way: Earth emits $\nu_0 \Rightarrow \nu^{(U)}{\uparrow} = \nu_0/J_E(1)$; *spacecraft receives* $J_S(2)P_{\uparrow}\nu_0/J_E(1)$, emits $q\times$ that; back to universal $\div J_S(2)$: $\nu^{(U)}{\downarrow} = qP_{\uparrow}\nu_0/J_E(1)$ — spacecraft clock cancels identically; Earth receives $\nu_3 = q\nu_0[J_E(3)/J_E(1)]P_{\uparrow}P_{\downarrow}$. Same station, stationary map: $J_E(3) = J_E(1) \Rightarrow$ ordinary rate difference disappears; slowly varying: $J_E(3)/J_E(1) \simeq 1 + \Delta_{RT}\, d\ln J_E/dT_U$ — a round-trip derivative, not $K(\cos\delta_{in} - \cos\delta_{out})$. Three-way ($A\to B$): $J_B(3)/J_A(1)$ survives; one-way onboard: J_E/J_S survives. Hierarchy: 2-way same-station — only temporal change or path holonomy; 3-way — receiver/transmitter ratio; 1-way — Earth/spacecraft ratio; VLBI — inter-station. Two-way minus three-way exposes $\ln[J_B/J_A] + \Delta\Pi_{BA}$. [reproduced]

J.2 Clock-Holonomy Requirement. The two-way measurement is a closed contour $\Gamma = \gamma_{\uparrow} + \gamma_{\downarrow} - \gamma_E$; $\delta\Phi = \oint_\Gamma \mathscr{A} = \int_\Sigma \mathcal{F}$; an exact scalar rescaling $\mathscr{A} = d\chi$ gives $\oint d\chi = 0$. A two-clock effect survives coherent closure only if $\mathcal{F} \neq 0$ or the observational contour is not closed (independently normalized inbound/outbound arcs). [reproduced]

J.3 Operator audit. Most general local quadratic photon action $S_\gamma = -\tfrac{1}{8}\int \chi^{\mu\nu\rho\sigma}F_{\mu\nu}F_{\rho\sigma}$; real action $\Rightarrow$ pair-exchange symmetry (reciprocity); premetric decomposition: principal (20, optical cone, generically birefringent), axion (1, polarization/phase rotation), skewon (15, nonreciprocity, absent from a real quadratic action). $\mathcal{F}^{C\_\mu\nu F}{}_{\mu\rho}F^{\nu}{}_{\rho} = 0$ (antisym × sym); $\mathcal{F}^{C\_\mu\nu F}{}_{\mu\rho}\tilde{F}^{\nu}{}_{\rho} = 0$ ($F^{\mu\rho}\tilde{F}_{\nu\rho} = \tfrac{1}{4}g^{\mu\nu}F\tilde{F}$). Dilaton $Z_C F^2$: reciprocal, direction-even. Axion $\vartheta_C F\tilde{F}$: polarization, wrong observable. Kinetic mixing $\varepsilon_C\mathcal{F}^C F$: source/diagonalization, no direction-odd cone. Nonbirefringent principal $K^{\mu\nu(F\_\mu\rho F\_\nu}{}_{\rho} - \tfrac{1}{4}g_{\mu\nu}F^2) \equiv$ effective metric — the only viable polarization-independent sector; the required $K^{\mu\nu}{}_{req} \sim N^{(\mu R}{}_{\nu)}$ is an optical shift one-form $\Rightarrow \delta t_{\uparrow} + \delta t_{\downarrow} = 0$ on retrace — back to H.1. A stationary passive medium in the transponder conserves frequency (changes wavelength/phase velocity/delay/impedance only); slowly varying parameters give $\delta\nu \sim \nu\, d(L_{dev}\,\varepsilon/c)/dt$, suppressed by $L_{dev}/c \sim$ ns–μs against flyby minutes–hours. **Local Reciprocal-EFT No-Go:** under local action + gauge invariance + real quadratic F + stationary clock background + polarization-independent propagation + ideal coherent transponder, the constitutive tensor reduces to effective metric + dilaton + axion, and none produces the Anderson clock bridge. Escapes: birefringence, dissipation/nonreciprocity (skewon; hardware/temperature/power dependent), nonlocality, active matter/transponder physics (matter–photon operators $B^{\mu}{}_{C}\bar{\psi}\gamma^{\nu}\psi F_{\mu\nu}$ — composition/design dependent, no universality theorem), or a real force. [reproduced]

Appendix K — The No-Work Holonomy Correspondence and the No-Work Projection Theorem

K.1 The correspondence (derived). Pull the curvature-rate interaction back to a worldline: $L_{int} = \gamma\varphi u^\mu \nabla_\mu \mathcal{R} = \mathcal{A}_\mu u^\mu$ with $\mathcal{A}_\mu = \gamma\varphi\nabla_\mu\mathcal{R}$. $\mathcal{F}_{\mu\nu} = 2\nabla_{[\mu}\mathcal{A}_{\nu]} = \gamma(\nabla_\mu\varphi\nabla_\nu\mathcal{R} - \nabla_\nu\varphi\nabla_\mu\mathcal{R}) = \gamma(d\varphi\wedge d\mathcal{R})_{\mu\nu}$ (verified). Euler–Lagrange $a^\mu = \mathcal{F}^{\mu}{}_{\nu}u^\nu \Rightarrow u_\mu a^\mu = \mathcal{F}_{\mu\nu}u^\mu u^\nu = 0$ (no work). Same connection: $\oint_\Gamma \mathcal{A} = \int_\Sigma \gamma\, d\varphi\wedge d\mathcal{R} \neq 0$ wherever $\nabla\varphi \nparallel \nabla\mathcal{R}$. **Antisymmetric STF force ⟺ zero mechanical work ⟺ potentially nonzero phase holonomy.** V7.9 obtained the first half and treated it as a failure; the two-clock reading says no work was the prediction. Doppler-space target: $\delta y_{Anderson} = -(4\Omega R V_\infty/c^2)(\cos\delta_{in} - \cos\delta_{out})$; the derivation must show $(1/2\pi\nu_0)(d/d\tau_E)\oint_\Gamma\mathcal{A}$ equals it. Three bridges open: $\mathcal{A}$ couples to the operational radio/clock phase with fixed normalization; its rotating-Earth flux gives $2\Omega R/c$ without inserting Anderson; when the contour closes/stays open and why later Earth flybys are null. [reproduced]

K.2 The closure norm (geometric correspondence, demoted). Rotating carrier $r_O(\theta) = R(\cos\theta, \sin\theta, 0)$, $v_O = \Omega R(-\sin\theta, \cos\theta, 0)$; $\hat{s}(\alpha,\delta) = (\cos\delta\cos\alpha, \cos\delta\sin\alpha, \sin\delta)$; $p(\theta) = v_O\cdot\hat{s} = \Omega R\cos\delta\sin(\alpha - \theta)$ exact. Linear average $(1/2\pi)\int p = 0$. Retarded/advanced closure norm $Q = [(1/\pi)\int p_R p_A]^{1/2}$ with $p_A = p_R^* \Rightarrow Q = \Omega R|\cos\delta|$ — right ascension gone, declination retained; $\varepsilon_O = (2/c)Q \Rightarrow$ Anderson with separate arc closure and 2-way doubling; kernel $D_{ij} = (1/\pi)\int p_i p_j$ has diagonals $\Omega^2R^2\cos^2\delta_i$ and off-diagonal $\Omega^2R^2\cos\delta_{in}\cos\delta_{out}\cos(\alpha_{in} - \alpha_{out})$: separated arcs keep the diagonal difference (Anderson), joint closure keeps the cross-coherence. **But** orbit determination is linear to first order: $\Delta V = h_V^T W P_\perp s/(h_V^T W P_\perp h_V)$ is a linear functional of s; a positive nonlinear Q cannot arise in the estimator from a zero-mean p ($\int p = 0 \Rightarrow$ zero projection onto a constant step). The quadratic operation must occur in the physics before measurement or not at all; importing the retarded/advanced adjoint here assumes the missing gluing theorem. **Status: geometric correspondence** — it identifies Anderson's $\cos\delta$ as the phase-independent amplitude of ordinary diurnal rotational Doppler geometry (declination → amplitude, right ascension → phase), and station-local projections carry $\cos\lambda$ and $\sin(\alpha - \theta)$ that a global positive quantity does not (cf. Mbelek's special-relativistic term with $\cos\varphi_S/\cos\alpha$). [reproduced]

K.3 The No-Work Projection Theorem (derived, linear). $F\cdot u = 0 \Rightarrow V\cdot\delta V = 0 \Rightarrow \delta|V| = 0$ to first order while $\delta\hat{v} = \delta V/V_\infty \neq 0$. Two-way Doppler $\delta y = -(2/c)\hat{n}\cdot\delta V \neq 0$ generically (verified: transverse δV gives $\delta|V| \sim 10^{-10}$ m/s but $\hat{n}\cdot\delta V = O(\delta V)$). If Doppler dominates and angular rank is weak, $h_V \approx a\, h_{RA} + b\, h_{Dec}$, direction and speed are partially degenerate, and the estimator represents a transverse deflection as $\Delta V_\infty \neq 0$ with $\Delta V_{\infty,physical} = 0$. With continuous multi-observable tracking, rank(H) increases, the degeneracy breaks, and the same signal is reconstructed as a tiny deflection, absorbed, or rejected — $\Delta V \to 0$ without the field vanishing. Later nulls become evidence of greater observational closure. Two sub-branches: **B1** kinematic projection (original no-work force → real transverse deflection → Doppler/range residual →

apparent ΔV; no new coupling; investigate first); **B2** clock holonomy (connection → direct signal/clock phase → apparent ΔV; needs the clock–connection coupling theorem, substantive after photon sequestering). Exact next calculation: $\delta v(T) = \int a_{STF}\, dT'$; verify $v\cdot\delta v = 0$; propagate $\delta y_{2w} = -(2/c)\hat{n}\cdot\delta v + \delta y_{lt}$, $\delta\rho = \hat{n}\cdot\delta r + \delta\rho_{prop}$; pass through the actual estimator. [reproduced]

Appendix L — Clock-Carrier Capacity and Utilization

L.1 The global carrier. Closed rotating system C with universal normal N^μ, internal phase $\theta \in S^1$, axial generator $\psi^\mu = \partial\theta$, *rate* Ω_C*; spatial metric* $h_{\mu\nu}$*; cylindrical radius* $\rho(x) = \sqrt{h_{\mu\nu}\psi^\mu\psi^\nu}$*; boundary radius* $R_C = \sup_{\partial C}\rho = R_\oplus$ at the equator; carrier velocity $v^\mu_C = \Omega_C\psi^\mu$. [definition]

L.2 The operator norm (theorem). $\ell_s(x) = v_C\mu s^\mu/c$; rotating sphere $\ell_s(\theta,\lambda) = (\Omega R\cos\lambda/c)\cos\delta\,\sin(\alpha - \theta)$. $\|\ell_s\|_{\infty,C} = \sup_{\partial C}|\ell_s| = (|\Omega|R/c)\cos\delta$ — attained at the equator ($\lambda = 0$), $\alpha - \theta = \pi/2$ (verified on a 2001×2001 grid). Restoring orientation: $\kappa_C(s) = \mathrm{sgn}(\Omega)\|\ell_s\| = (\Omega R/c)\cos\delta$. Explains simultaneously: equatorial R not station $R\cos\lambda$; declination not right ascension; linear sign-sensitive rotation; no G or M. Two-way capacity $C_{2w} = 2\kappa_C = (2\Omega R/c)\cos\delta$; if inbound and outbound records each saturate it, $\Delta V/V_\infty = (2\Omega R/c)(\cos\delta_{in} - \cos\delta_{out})$ exactly. [reproduced]

L.3 Capacity is not saturation. Closure–Capacity says capacity gates whether a loop can close ($C \geq H$), not that every closed loop runs at capacity. Using capacity as the anomaly would require “every completed STF measurement transaction saturates the directional clock capacity of its carrier” — too strong; fully closed later flybys would then show the effect. [recorded]

L.4 Capacity × utilization. $\varepsilon_a = \eta_a(2\Omega_C R_C/c)\cos\delta_a$, $\eta_a \in [-1,1]$; $\Delta V/V_\infty = (2\Omega_O R_O/c)[\eta_{in}\cos\delta_{in} - \eta_{out}\cos\delta_{out}]$; Anderson is $\eta_{in} = \eta_{out} = 1$; nulls at $\eta \simeq 0$ or $\eta_{in}\cos\delta_{in} \simeq \eta_{out}\cos\delta_{out}$. η_a *must not be fitted*: $\eta_a = h^T VWP_\perp s_{STF,a}/(C_a\, h^T VWP_\perp h_V)$, $C_a = V_\infty(2\Omega_C R_C/c)\cos\delta_a$ — computed from station identities, tracking windows, link mode, phase continuity, range/VLBI coverage, clock resets, solve-for parameters, and the design-matrix projection of the STF template. Capacity supplies the scale; the waveform $s_{STF}(t)$, derived from the action or clock/link coupling, supplies the utilization. [reproduced]

L.5 The bound. $|\varepsilon_a| \leq (2|\Omega_O|R_O/c)\cos\delta_a$; $|\Delta V/V_\infty| \leq (2|\Omega_O|R_O/c)(\cos\delta_{in} + \cos\delta_{out})$. Any reliable anomaly exceeding it rules out the observer-clock mechanism. Anderson lies inside, at a saturated orientation. [reproduced]

L.6 Carrier discrimination. Encountered-body source: $\Omega_P R_P$, changes planet to planet. Global Earth carrier: $\Omega_\oplus R_\oplus$, persists for Earth-tracked encounters elsewhere. Local station: $\Omega_\oplus R_\oplus\cos\lambda_A$, station-latitude and sidereal structure. Link holonomy: oriented path functional, changes with routing. No-work deflection: not a carrier rate; stations reconstruct one common deflected trajectory. Distinct predictions; the same encounter can yield different fitted anomaly capacities depending on which closed clock system completes the transaction. [reproduced]

L.7 The Clock-Carrier Capacity–Observability Theorem (stated). For a measurement transaction embedded in universal time and closed by a rotating internal clock carrier, the maximum apparent first-order velocity fraction is the operator norm $2|\Omega|R \cos \delta/c$, and the realized fraction is its projection through the transaction's actual observation operator. Accommodates in one equation: Anderson's Earth coefficient, source–observer degeneracy, early detections, later nulls, non-Earth failures, no physical energy change, the two-clock architecture. Empirical step: compute η_a for every early detection and later null. [stated; components L.2, L.4 reproduced]

Appendix M — Source–Observer Degeneracy and Clock–Carrier Interchange

M.1 The degeneracy (theorem). Every original Anderson event was a flyby *of* rotating Earth observed *through* rotating Earth's tracking and clock infrastructure: source = observer = ⊕. $K_{source} = 2\Omega_s R_s/c$ and $K_{observer} = 2\Omega_o R_o/c$ coincide identically. When the rotating gravitational source and the rotating observational clock carrier are the same body, a source-local dynamical correction and an observer-local temporal correction share the same first-order rotational coefficient; Earth-only data cannot identify its causal location. [reproduced]

M.2 What non-Earth flybys decide. Source = B, observer = ⊕: the dynamical branch predicts $K_B = 2\Omega_B R_B/c$ with projections on the planet's axis; the observer branch predicts $K_{obs} = 2\Omega_\oplus R_\oplus/c$ with projections on the terrestrial network. Failure of planet-local scaling falsifies the source-force interpretation while leaving — and favoring — the observer-clock interpretation. Confirmation requires an observer-based law predicting tracking-mode and closure dependence *before* reanalysis; non-Earth data are not yet clean (planetary gravity fields, bound-orbit reconstruction, Jovian normal modes). This is what "observational relativity" means in a rigorous inverse-problem sense: the inferred parameter depends on the physical history and the observation operator. [reproduced]

M.3 The symmetry verdict. Anderson's K: linear in Ω; odd under $\Omega \to -\Omega$; independent of G and M; no periapsis-curvature dependence; scale $\Omega R/c$. Source-curvature force: obstructed for parity-even invariants; needs an odd invariant or added structure; needs cancellation/amplification of the compactness $GM/(c^2R) \approx 7\times10^{-10}$ (a source-local effect ~ compactness × $\Omega R/c$ ~ 10^{-15} vs Anderson 3×10^{-6} — nine orders); the natural gravitational scale is not $\Omega R/c$. Observer-clock map: linear, sign-reversing, G- and M-free, and $\Omega R/c$ is the bare rotational rapidity — all automatic; no work expected. Branch B is the structurally economical branch. [reproduced]

M.4 The covariant two-clock observable. $N^\mu = \Gamma(u^\mu_O + v^\mu_O)$, $\Gamma = -u_O\cdot N$; $\nu_O = -k\cdot u_O$, $\nu_U = -k\cdot N$; $\nu_O/\nu_U \simeq 1 - v_O\cdot\hat{s}/c$; two-way $\delta y_O \simeq -(2/c)v_O\cdot\hat{s}$; Earth $v_O = \Omega_\oplus\times r_O$. Right symmetry; but a station gives $\Omega R \cos \lambda \cos \delta \sin(\alpha - \theta)$, so the Universal Clock Carrier must specify whether u_O belongs to a station, the closed Earth system, the ECI congruence, or the STF phase restricted to Earth closure — this is Appendix L's answer (the closed carrier's operator norm). [reproduced]

M.5 Clock–Carrier Interchange (derived). $r = H_x\delta x + r_{link} + r_{clock}$; $\Delta\hat{V} = h^{T\_VWP\_\perp r/(h}T\_VWP\_\perp h\_V) \Rightarrow \Delta\hat{V} \neq 0 \nRightarrow \Delta E_\infty \neq 0$. Three branches: energy-changing force ($v\cdot\delta v \neq 0$; Doppler, range, angular all change; ordinary geometry); no-work deflection ($v\cdot\delta v = 0$, $\delta v_\perp \neq 0$; direction changes; different stations project one trajectory); clock/link holonomy ($\delta x = \delta v = 0$, $\delta\Phi_\Gamma \neq 0$; no optical trajectory change; intrinsic link dependence). Observable decomposition: $\delta y_2 \simeq -(2/c)(\hat{n}\cdot\delta v + \dot{\hat{n}}\cdot\delta r) + \delta y_{link} + \delta y_{clock}$; $\delta\rho \simeq \hat{n}\cdot\delta r + c\delta t_{link}$; $\delta\theta \simeq P_\perp\hat{n}\delta r/\rho$; $\delta E_\infty = v_\infty\cdot\delta v_\infty$. Link test: $\mathscr{D}_{AA} = \ln[J_A(T_3)/J_A(T_1)] + \Pi_{A\uparrow} + \Pi_{A\downarrow}$; $\mathscr{D}_{AB} - \mathscr{D}_{AA} = \ln[J_B/J_A] + \Delta\Pi_{BA}$; $\mathscr{D}_{S\to A} = \ln[J_A/J_S] + \Pi$. **The decisive experiment:** during one encounter, coherent two-way from one station + simultaneous three-way from another + one-way from a stable onboard oscillator + range + calibrated angular tracking. A common energy change → work-producing branch; a common deflection with $\delta E_\infty = 0$ → original no-work interaction; a station/link-dependent residual with no optical change → carrier/holonomy; disappearance under full joint estimation → observational projection; disappearance without structure → weakens the identification. [reproduced]

M.6 The one-bit channel cannot carry ωR/c. The advanced closure certificate carries one topological bit (closed/open); $\omega R/c$ is a continuously varying real number differing between planets. It cannot be transmitted by the one-bit advanced arc; it must reside in an ordinary retarded field sourced by matter, a boundary condition, or a conventional exterior multipole. And closure normalization ≠ dynamical amplitude: $(1/4\pi^2)\int\omega_R\wedge\omega_A = 1$ normalizes a completed transaction and does not fix $K_R^{-1}J_{rot}$; $4\pi^2$ cannot legitimately set the flyby coupling to unity. Zero-capacity corollary for the “One Bit Is Not No Signal” program: if the certificate is topologically fixed for every admissible completed transaction and its distribution is invariant under all local instrument choices, $P(w|a,b) = P(w)$ and the advanced sector has zero controllable signaling capacity. [reproduced; corollary stated] ## Appendix N — Tensor Speed on the Gauss–Bonnet Route

N.1 Method. For $f(\varphi)\mathscr{G}$, $\mathscr{G}$ is topological in 4D: a static coupling leaves c_T untouched; the correction enters through the coupling’s time-variation. Horndeski tensor sector (Kobayashi–Yamaguchi–Yokoyama 2011; Bellini–Sawicki α-basis): $c_T^2 - 1 = \alpha_T \simeq 8(\ddot{f} - H\dot{f})/M_{Pl}^2$, cross-checked against the exact ratio $F_T/Q_T = (1 - 8\ddot{f}/M^2)/(1 - 8H\dot{f}/M^2)$. $f = \kappa(\zeta/\Lambda)(\varphi/M_{Pl})M_{Pl}^2$, $\kappa = O(1)$ the C.5b auxiliary factor; $(\zeta/\Lambda)/c^2 = 1.5\times10^{-6}\ \mathrm{s}^2$; $H_0 = 2.43\times10^{-18}\ \mathrm{s}^{-1}$; $m_s = 3.94\times10^{-23}$ eV. [standard; reproduced]

N.2 Tracking regime. $\dot{\varphi} \sim H_0\varphi$, $\ddot{\varphi} \sim H_0^2\varphi$, Planck-order stabilized modulus $x_0 = \varphi/M_{Pl} \leq 1$: $|c_T/c - 1| \lesssim 8\kappa(\zeta/\Lambda)H_0^2x_0/c^2 \approx 7\times10^{-41}$ — 25 orders below GW170817’s 10^{-15}. [reproduced]

N.3 Oscillating regime. $\varphi = A\cos m_st$, $m_s/H_0 = 2.5\times10^{10}$ — the potentially dangerous case. Amplitude from the framework’s own $\rho_{DE} = \frac{1}{2}m_s^2A^2$: with $\rho_{DE} = 0.7\times3H_0^2M_{Pl}^2 = 3.2\times10^{-47}\ \mathrm{GeV}^4$ and $m_s = 3.94\times10^{-32}$ GeV, $A = 2.0\times10^8$ GeV, $A/M_{Pl} = 8.3\times10^{-11}$. $|c_T/c - 1| \lesssim 8\kappa(\zeta/\Lambda)m_s^2A/(M_{Pl}c^2) \approx 1.8\times10^{-30}$ at $\kappa = 1$ cycle-averaged (the instantaneous envelope $|\ddot{\varphi}|_{max} = m_s^2A$ gives twice this, 3.6×10^{-30} — 14 orders inside the bound either way); 1.8×10^{-26} at $\kappa = 10^4$ (still 10 orders). Saturating amplitude $\varphi/M_{Pl} \approx 4.7\times10^4$ — super-Planckian. [reproduced] *Process note:* a first pass mis-read the dark-matter paper’s “A ~ 780 SI units” as $\varphi/M_{Pl} = 780$, placing a spurious worst case within 60× of the bound; caught by re-deriving the amplitude from ρ_{DE}. Recorded because a single-pass calculation would have shipped it.

N.4 Status. $c\_T = c$ holds by calculation on the sGB parent in both regimes, robust to κ and H_0. Open only for the completed two-clock action if its carrier brings its own dynamics.

Appendix O — The Ten-Dimensional Parent and the Carrier Audit

O.1 Reduction. $ds^2_{10} = e^{\{-6\sigma\}g\_\mu\nu dx}\mu dx\^\nu + e^{\{2\sigma\}\hat{g}\_mndy}mdy\^n$, block-diagonal (G_μm = 0); 4D massless sector g_μν and σ, no vector; the curvature-squared descendant A(σ)𝒢 with [γ] = M^{-1}; L* = 3.64×10^{-30} m from the internal-trace projector; the Kähler potential with Re T ≡ e^{4σ}, −3ln(T+T̄) = −12σ − 3ln 2 (σ the log-breathing coordinate; the exponent is fixed by canonical normalization against the reduction's φ_c = √24 M_Pl σ — §II.D. Two prior errors on this line, both corrected: V7.9's −6σ read as −3ln(2σ), a notational collision; and an interim repair wrote Re T ≡ e^{2σ}, whose n = 2 gives φ_c = √6 M_Pl σ against the reduction's √24 — a factor-2 normalization error, August 2026). [reproduced; V7.9 record for the full reduction]

O.2 The visible photon sector. L_γ = −¼Re f_γ(φ)F²; f_γ = $f_0 + f_1\delta\varphi$; canonical F^(c) = $\sqrt{f_0}F$ ⇒ g_φγ = *∂φ ln Re f_γ*|{φ_0} — not ζ/Λ (different dimension and origin). Sequestering: f_SM ~ T_s depends on the local cycle, ∂τ_s/∂τ_b ≈ 0 ⇒ g^tree_φγ = 0; residual mixing K_bs̄ ~ 1/𝒱: g^eff_φγ = c_γ/(𝒱M_Pl), |c_γ| ≲ 0.612 by analogy with α_eff ~ 0.612/𝒱 (assumption, not theorem); 𝒱 > 175 ⇒ g^eff ≲ 1.4×10^{-21} GeV^{-1}; virtual γγ → φ* → γγ at 1.6 eV: |ℳ| ≲ 5×10^{-60}; Γ = $g^2m\_s^3/(64\pi)$ ≲ 6×10^{-139} GeV, τ_φ ≳ 10^{114} s. Photon-coupling cancellation: L = −¼Z(φ)F², Z = 1 + g_φγδφ, ∇_μ[ZF^μν] = j^ν; geometric optics: both polarizations on one null cone, common transport ∇_μ[Z|a|²k^μ] = 0; K_φ = c_φ𝟙 on the polarization space ⇒ (K_A⊗K_B)ρ(K†_A⊗K†_B) = |c_Ac_B|²ρ ⇒ ρ′ = ρ after normalization; efficiency cancels under fair sampling; free wave F² = 0. On-shell φ → γγ gives 2×10^{-23} eV photons (λ ≈ 6.7 ly), $10^{23}\times$ below optical. S_STF = S_QM + O(E²/𝒱²M²_Pl); the visible-sector coupling is unnormalized-Z-free: V7.9's (α/Λ)φF² lacked the ¼ and overloaded α; corrected in the boxed action and the LOD-appendix width. [reproduced]

O.3 The carrier audit — no field carries both O(ω) and boundary data. Breathing mode σ: sourced by parity-even C² ⇒ σ(a) = σ(−a), O(a^0, a²), carries no R; produced by the reduction. Universal clock T_U: no vorticity (Frobenius), no R, ω, k_I; shift-symmetric T_U → T_U + C ⇒ orientation, foliation, ordering — not absolute winding, not planetary boundary data; completion open. Ordinary Kerr g_tφ: O(a), carries J not R; GR. Curvature phase ϑ_C: O(a), local r not source R; geometric, not dynamical. Axion ϑP: O(a) via P = 288m²a cos θ/r^7 (dynamical Chern–Simons mechanism, Yunes–Pretorius) — the natural pseudoscalar is STF's own imaginary modulus partner ϑ in T = σ + iϑ; but a conventional analytic ϑ ∝ (α_CS/f²)P retains m²a/R^5 (mass and compactness), and ϑP couples to stationary orientation, not its universal rate (ϑN·∇P again vanishes in stationary Kerr); the mass cancels only in the *normalized* ratio P/C² ≃ 6a cos θ/r — which loops back to Branch B (a regularized 𝒪_odd = P/√((C²)² + P² + *𝒥²) with 𝒥* a derived closure scale). Matter-vorticity carrier B_μ: could carry R via the boundary (χ^μ_Σ = R_Σϖ^μ, |χ_Σ| ≃ ωR/c) but is not in the reduction; would need $\mathscr{K}^{\mu\_\nu B}\nu$ = J^μ_rot, a source coupling, and a photon coupling — three underived quantities. **The present 10D theory contains no field carrying both O(ω) and source-boundary information; the cross-disformal metric is not generated by the compactification performed ($\hat{B}_{KK} = 0$).** [reproduced]

O.4 Circularity ledger. $L^* = 3.64\times10^{-30}$ m vs dark-energy-required 3.55×10^{-30}: conditional consistency check. Coupling near the historical flyby value: not validation (flyby derivation withdrawn). $\Omega_{STF} \sim 0.65$ vs observed: matched downstream benchmark. Flux integer ~ few million: consistent with the chosen stabilization ratio. No inconsistency in using these as calibration; they must not be counted again as predictions. [recorded]

O.5 The static-response problem. $A(\sigma)\mathcal{G}$ responds to *static* curvature; STF's selectivity must come from the response kernel ($K(0) = 0$, Appendix C), making STF a nonlocal response theory rather than the minimal local scalar-tensor theory V7.9 branded. The retarded map from the compactified parent to the local rate operator is a constitutive completion target, not a proven reduction. [recorded]

Appendix P — Why the Former Horndeski/DHOST Proof Does Not Transfer

P.1 The record. V7.9 C.6 integrated by parts, $S_{int} = -\gamma\int\sqrt{-g}\, \mathcal{R}\nabla_\mu(\varphi n^\mu)$, and called $\mathcal{F} = -\gamma\nabla_\mu(\varphi n^\mu)$ a function of $(\varphi, \nabla\varphi)$. But $\nabla_\mu n^\mu = h^{\mu\nu}\nabla_\mu\nabla_\nu\varphi/\sqrt{2X}$, so $\nabla_\mu(\varphi n^\mu) = -\sqrt{2X} + (\varphi/\sqrt{2X})h^{\mu\nu}\nabla_\mu\nabla_\nu\varphi$ — Hessian of φ and $X^{-1/2}$; the FLRW specialization $\Theta \to 3H$ ($\dot\varphi + 3H\varphi$) is correct *on FLRW* and was promoted to an off-shell identity. C.7 wrote $G_4(\varphi,\dot\varphi) = \frac{1}{2}M^2_{Pl} - (\zeta/\Lambda)(\varphi\dot\varphi + 3H\varphi^2)$ — an extra φ (would follow from $\varphi^2 n\cdot\nabla\mathcal{R}$, not the stated linear interaction) — and asserted $G_{4X} = 0$; on FLRW $|\dot\varphi| = \sqrt{2X}$, so any $\dot\varphi$-dependence is X-dependence and $G_{4X} = \mp(\zeta/\Lambda)/\sqrt{2X} \neq 0$ from C.7's own expression. A nonzero G_{4X} requires the companion $G_{4X}[(\Box\varphi)^2 - (\nabla\nabla\varphi)^2]$; the mapped action omitted it. No rescue: $G_{4X} = 0$ needs no $\dot\varphi$-dependence, but the rate-coupling *is* the $\dot\varphi$ piece. Category problem: $\mathcal{R}$ is Weyl-based, not Ricci; $\mathcal{F}\mathcal{R}$ is not automatically L_4. **Withdrawn**: that ghost-freedom uniquely selects the rate operator; that integration by parts proves it Horndeski; that the two-clock theory is DHOST Ia; that $c_T = c$, PPN and dipole suppression follow from that classification. [reproduced verbatim against V7.9 C.6/C.7]

P.2 What survives. The scalar–Gauss–Bonnet parent $A(\sigma)\mathcal{G}_4$ is a recognized ghost-controlled construction analyzable without the rate operator; on Ricci-flat regions $\mathcal{G}_4 = I_4 = C^2$ supports the single curvature-squared ancestor there; the Kerr ADM cascade (April 2026) confirms the terminal term is non-propagating on exterior vacuum. **Regime-limited ghost-freedom: established on exterior-vacuum and Kerr backgrounds; open on FLRW and general backgrounds and for the local rate operator as such.** [record]

P.3 The two-clock obligation. With N^μ independent and $\mathcal{R}_{STF}(N)$ clock-dependent, DHOST conditions must be applied to the complete local action with all fields and constraints (lapse, shift, clock, scalar, influence-functional auxiliaries) — degeneracy cannot be inherited from a one-field action. Redshifting-clock perturbations $\delta u_i \propto \partial_i\pi/q$, $q \to 0$ toward the de Sitter future (strong coupling); spintessence avoids $q \to 0$ but $F = \rho^2 \propto a^{-3}$ reintroduces it in the canonical $\pi_c = \rho\pi$. Multi-field degeneracy analysis: not started. [recorded]

Appendix Q — Closure Threshold: Unit Audit and the Missing Bridge

Q.1 Distinct claims not to be merged. (i) The $4\pi^2$ Hopf/anti-Hopf cup product — a topological theorem. (ii) The threshold ansatz $\mathscr{D}$_crit(m_s) = m_sM_PlH$_0$/($4\pi^2$) — a natural-unit parametric expression. (iii) Its SI value $\mathscr{D}$_crit ≡ $\mathscr{D}$_GR(730 R_S) ≈ 10^{-27} $m^{-2}s^{-1}$ — an assignment. [record]

Q.2 The audit. $\hbar H_0 = 1.60\times10^{-33}$ eV; unreduced M_Pl = 1.2209×10^{28} eV: $\mathscr{D}$_crit = 1.95×10^{-29} eV^3; 1 eV^3 = $1/((\hbar c)^2\hbar)$ $m^{-2}s^{-1}$ = 3.90×10^{28} $m^{-2}s^{-1}$ ⇒ $\mathscr{D}$_crit ≃ 0.76 $m^{-2}s^{-1}$; reduced M_Pl ⇒ 0.15. Neither is 10^{-27}; the discrepancy is 26–27 orders (10^{-27} $m^{-2}s^{-1}$ = 2.56×10^{-56} eV^3). The 10^{-27} is $\mathscr{D}$_GR at 730 R_S (Appendix A.5: ≈ 2×10^{-27}). The former evaluation was not a unit conversion; it introduced an unreported normalization by matching to $\mathscr{D}$_GR. This does not refute the cup product; it refutes the naive identification of the cup-product-normalized *mass scale* with the SI curvature-rate *observable*. [reproduced]

Q.3 What the bridge must contain. A map from the topological/natural-unit threshold to the geometrical SI curvature-rate normalization — an additional STF conversion scale (the capacity radius L^{*-2} is the natural candidate, Appendix D) or an honest restatement that 730 R_S is observationally selected and m_s is a phase conversion (this paper's current position). Until then Path 1 has a written normalization gap; the Peters timing calculation remains valid; the threshold cannot be counted as an independent derivation of 730 R_S. [stated — open] A second provenance question rides with the bridge (August 2026, declared, not resolved here): the threshold divides by $4\pi^2$, whose coordinate-free invariant value is the primitive integer 1 (B.6); whether the physical normalization should carry the angular representative $4\pi^2$ or the normalized integer is part of what the bridge must decide, since the choice moves the natural-unit value by ~39.5 — small against the 27 orders, but not free. [stated — open, rides with the SI bridge]

Q.4 The Framework Guide. It presents the natural-unit expression as directly yielding 1.07×10^{-27} $m^{-2}s^{-1}$; that page must be aligned with Q.2. [housekeeping]

Q.5 A concrete bridge candidate — recorded at its audited strength (August 2026). The August threshold audit supplies numbers for the bridge Q.3 asks for. With the external-tidal functional $\mathscr{D}$_ext(x) = $(3\sqrt{3}/20)c^7/(G^3M^3)x^{-7}$ (companion of mass M/2 at separation a; all values below independently re-derived): $\mathscr{D}$_ext(730 R_S) = 1.0137×10^{-27} $m^{-2}s^{-1}$, so the required constitutive suppression against $\mathscr{D}$_crit = 0.7606 $m^{-2}s^{-1}$ is **Z_$\mathscr{D}$ = 1.333×10^{-27}**. The compactification supplies ***(ℓ_Pl/L)^5 = 1.726×10^{-27} — within a factor 1.30 of the requirement; with unit coefficient the crossing sits at 703.5 R_S against the framework's 730, and an O(1) coefficient C_5 = 0.772 recovers it. The exponent fitted to the requirement is p = 5.02, so the fifth power is singled out among neighbouring integers ((ℓ_Pl/L)^4 = 3.9×10^{-22}, (ℓ_Pl/L)^6 = 7.7×10^{-33}). Three cautions prevent promotion to a derivation, and they are the audit's own: (i) six compact dimensions naturally produce six volume powers — 5 = d_int − 1 suggests a codimension-one boundary, flux or kernel-moment origin, which is a clue, not a proof; (ii) the best numerical agreement uses mixed Planck conventions (the declared L* carries the reduced-Planck ratio while the threshold uses the unreduced mass; consistent conventions move the required coefficient to 1.97 or 4.04 and the crossing to 804 or 891 R_S); (iii) the match is not unique — √(m_s/M_Pl)/($4\pi^2$) = 1.439×10^{-27} fits better (coefficient 0.926), and many monomials live***

***in the available hierarchy. Two unrelated constructions within a factor 1.4 of the target is not evidence. Status: a sharp target for the retarded-kernel derivation — determine whether the doubled influence functional or a compactification boundary calculation produces Z_𝒟 = $C_5(\ell\_Pl/L)^5$* with C_5 fixed independently and one consistent Planck convention — not a completed bridge.** Also from the audit, two closures and one correction: the unsuppressed threshold crosses the tidal functional only at x ≈ 0.11 (inside merged horizons — it selects no physical separation); a universal threshold implies x*(M,z) ∝ $M^{\{-3/7\}}H${−1/7}, so 730 R_S cannot be a universal activation radius for all masses and is retained as the reference value for the reference binary; and the "Pretorius & Lehner 2002" citation formerly attached to the binary cross-term suppression is withdrawn (that identifier is a cosmological-perturbation paper). The audit's verdict is this appendix's closing sentence:* STF retains an empirical/theoretical convergence at the supplied 730 R_S reference separation, but the closure threshold does not yet independently select that separation.* [recorded at audit strength; numbers reproduced]

Q.6 The production location is load-bearing (world-tube result, August 2026). The proxy √K = √48 $Gm/(c^2a^3)$ never specified *which surface* it represents, and the choice is not a coefficient: at the equal-mass binary midpoint the two leading electric-Weyl tensors add (each hole at distance a/2), giving ℛ_mid = **16** ℛ_proxy exactly at leading order [reproduced analytically]. Imposing the same threshold there moves the anchor by a → 16^{1/7}a = 1.486a and t → 16^{4/7}t = 4.876t — i.e. 730 R_S / 3.324 yr → **1085 R_S / 16.2 yr**. This is not a proposed replacement; it proves the **Binary World-Tube Sensitivity result**: a threshold on a local binary curvature scalar selects no unique separation until the spacetime support of the response is specified. Related non-commutations, all verified in the audit: a body-centred world-tube point responds at a^{-3}; the sphere-averaged tube cancels the first-order tidal quadrupole and responds at a^{-6}; a far-zone radiative point responds at a^{-4}/D — so norm-taking, angular averaging, filtering and spatial integration do not commute physically. (The far-zone kernel's rungs, 16.26/16.91, sit closest to the observed 16.36/16.98.) The exact kernel also selects nothing by resonance: at all three anchors Ω_GW/ω_c ~ 10^6 — deeply saturated — and time-remaining-to-merger is not a local oscillation frequency (the Countdown–Response point: τ_merge = T_s at the central anchor is a numerical comparison, not a dynamical resonance). The well-posed replacement observable is 𝒟_bin[N,u,γ] = N^α∇_α√(8$\mathcal{E}^{\text{ext_μν}[u,γ]\mathcal{E}_\text{ext}}$μν[u,γ]) on a specified worldline with stated self-field regularization — which preserves the two-clock separation and makes the normalization part of the observable's definition. [recorded; midpoint factor and scalings reproduced]

Appendix R — The Empirical Flyby Record, Corrected

R.1 The 2008 set. Anderson's relation was constructed from the six flybys available in 2008; those events cannot independently validate the formula extracted from them. Under the flyby paper's *own* quoted uncertainties, "within measurement uncertainty" is false: Galileo I 0.22/0.08 = 2.75σ; Rosetta I 0.27/0.05 = 5.4σ; Cassini 0.93/0.10 = 9.3σ. The quoted $R^2 = 0.997$ excludes the predictive Juno test and is dominated by NEAR. [reproduced]

R.2 The out-of-sample tests. Rosetta II: Anderson +0.523 mm/s, reconstruction null. Rosetta III: +1.099 mm/s, null. Juno: +6.34 mm/s using published asymptotes, null (published 2014; JPL reports metre-scale trajectory accuracy despite the post-perigee safe-mode complication; no along-track anomaly). The flyby paper's Juno row — "not published / pending", $\delta_{in} = -18.4°$, $\delta_{out} = +39.2°$, $G = 0.476$, +4.8 mm/s — is wrong on three counts: Juno is published; $G = \cos 18.4° - \cos 39.2° = 0.174$, not 0.476; its own formula then gives $(3.099\times10^{-6})(10389)(0.174) = 5.60$ mm/s, not 4.8; and either value conflicts with the observed null. Rosetta II/III were labelled "symmetric, zero predicted"; the published Anderson evaluation gives 0.523 and 1.099. [reproduced; deployed page confirmed]

R.3 What the record now says. The ungated source-only relation is rejected by the later nulls. The hardware branch is constrained (Rosetta anomalous in 2005, null later on the same radio system; Juno's coherent X-band transponder null; anomalies across S and X bands). What the record does correlate with more plausibly is tracking coverage, attitude/solar-pressure modelling, and how separate inbound and outbound arcs were fitted (a Delft reanalysis found reflectivity and direct solar-radiation-pressure uncertainties could account for some cases while stressing that missing tracking/attitude data prevent a firm conclusion). Juno's encounter had unusually extensive tracking and reconstruction — a plausible zero-closure case, to be demonstrated from tracking metadata, not asserted. [record]

R.4 The reinterpretation. Under two clocks: early Earth detections identify the rotational coefficient under source–observer coincidence; planetary failures test whether the coefficient belongs to the source (it does not scale that way); later Earth nulls test whether it depends on observational closure (Juno is the strongest such case). Together the pattern can distinguish a real force from a two-clock observation map. The generalized law $\Delta V/V_\infty = (2\Omega_O R_O/c)[\eta_{in} \cos \delta_{in} - \eta_{out} \cos \delta_{out}]$ with η_a computed from each arc's design matrix is the object to evaluate. The flyby paper should be retitled and reframed as a hypothesis about clock–orbit closure, with Juno and Rosetta II/III as central constraints. [record]

R.5 The η_a program. For each of Galileo I/II, NEAR, Cassini, Rosetta I/II/III, Messenger, Juno: assemble station identities, transmit/receive time tags, link mode (1/2/3-way), count intervals, ramp records, range coverage, VLBI/angular data, clock resets and solve-for parameters; build H and W; form $P_\perp$; compute η_a from the STF template $s_{STF,a}$ (from the no-work deflection or the connection holonomy); compare. The test is pre-registered: compute η_a for all nine arcs first, then test rank correlation against the reported $|\Delta V|$ under a significance criterion fixed before the anomalies are consulted. Detections should cluster at high utilization, nulls near zero. [stated]

Appendix E′ — Master Claim and Dependency Matrix

CLAIM	DEPENDS ON	DOES NOT DEPEND ON	STATUS
two clocks	periodic φ + scalar T_U	dynamics	theorem/entailment

CLAIM	DEPENDS ON	DOES NOT DEPEND ON	STATUS
$\mathcal{R}$_STF(N)	N^μ; Bel–Robinson positivity	$\mathcal{G}$ positivity	derived; Euclideanization open
Branch B operator	bounded response + alignment	new scale	derived conditional (saturation thm)
κ = (ζ/Λ)/L*²	parent + capacity radius	fit	derived; identification open
Peters hierarchy	GR, masses, radii	STF	calculation
m_s	observed/converged 3.32-yr anchor (Peters image: 730 R_S)	threshold SI value	derived conditional
54-yr outer anchor	closure theorem (A.6) + τ_- = 0.1 yr	chirp mass (universality theorem)	theorem (universality); derived conditional on τ_-
τ_- = 0.1 yr inner cutoff	— (silent premise, now declared)	universal-clock sector (Clock-Rate Invisibility)	**open** — belongs to production dynamics
71-day channel ratio R ≈ 2400	observed times (circular as published)	—	observed anchor; derivation open (A.6.iv)
$\mathcal{D}$_crit (SI)	unwritten bridge	—	**open**
c_T = c (sGB)	α_T formula, background	class label	calculation
F·v = 0	antisymmetric force	STF specifics	derived
spin parity	Kerr expansion	STF	theorem
No-Work Holonomy	$\mathcal{A}$ = γφd$\mathcal{R}$	cross-disformal	derived
∇×(ω×r) = 2ω	rigid rotation	STF	identity
operator norm	closed carrier	station	theorem
Source–Observer Degeneracy	S = O	mechanism	theorem
Anderson (η = 1)	operator norm + 2-way + separate closure	force	derived conditional (η, unit normalization)
η_a	OD design matrix + s_STF	fit	computable; not yet computed
ghost-freedom	GB parent	Horndeski	regime-limited; general open

CLAIM	DEPENDS ON	DOES NOT DEPEND ON	STATUS
PPN α_i = 0	tracking regime, dependent n_φ	covariance alone	open for completion
photon sector	sequestering	ζ/Λ	conditional (c_γ)
dark energy / MOND / inflation	threshold normalization; additional sector	—	conditional
Bell compatibility	Embedding companion	STF force	consistent embedding
SM / CICY / flavour	V7.9 record	two-clock revision	numerical constructions
UHECR/GRB production operators	— (dropped in triage; sequestering-consistent restoration unproven)	—	**open** — no production channel in the current action (§VI)

References

Project papers (existshappens.com): *First Principles V7.9 — derivation record*, papers/first-principles-v7-9/ (SM unification K; CICY Q; flavour R; Weil–Petersson S; full 10D reduction L; cosmology M; MOND I; inflation J; dipole H); *Clock-Separation Theorem* V1.1; *Universal Embedding Principle* V1.1; *Topological Closure on the Complexified Null Cone* V6.3; *The Complexified Null Cone as the Geometric Seat of Retrocausal Activation* V1.0; *The Structure of What Happens* (General Theory) V3.1; *Theory of Time* V4.3; *Consciousness, Time & Identity* V4.0; *Retrocausality & Life* V0.7; *Temporal Workspace* V0.5; *Closure–Capacity Correspondence* V1.0; *Theorem Class* V1.0; *One Bit of Destiny* V1.0; *Bandwidth Argument* V2.0; *Framework Guide* V3.3; observational manuscript, uhecrtoday.com/papers/manuscript/.

External: Acedo, L. (2017), arXiv:1701.05735 (Rosetta/Juno nulls). Anderson, J.D. et al. (2008), PRL 100, 091102. Bellini, E. & Sawicki, I. (2014), JCAP 07, 050 (α-basis). Bonilla & Sopuerta (1999), gr-qc/9904031 (Bel tensor). Boyle, Caldwell & Kamionkowski (2002), PLB 545, 17 (spintessence). Costa & Herdeiro (2008), gr-qc/0612140; Costa & Natário (2014), arXiv:1207.0465 (GEM congruences). Crossley, Glorioso & Liu (2017), JHEP 09, 095 (SK EFT). Durante et al. (2022), Nature Commun. (Jovian normal modes). Galley, C. (2013), PRL 110, 174301 (nonconservative action). Hehl & Obukhov (2003), *Foundations of Classical Electrodynamics*; Hehl (2016) arXiv:1601.00320 (premetric). Hervik, Ortaggio & Wylleman (2013), arXiv:1203.3563 (superenergy norms). Henry (2000), astro-ph/9912320; Cherubini et al. (2003), gr-qc/0302095 (Kerr invariants). JPL DESCANSO Monograph 2 §13 (DSN observables); Monograph 14 ch.5 (transponders); Descanso 16 (Juno). Kase & Tsujikawa (2019), IJMPD 28, 1942005. Kobayashi, Yamaguchi & Yokoyama (2011), PTP 126, 511. Margot et al. (2018), NTRS 20190002330 (Earth k_I); Jupiter interior arXiv:1109.1627; Venus arXiv:2103.01504. Mbelek (2008), arXiv:0809.1888. Minguzzi (2002), gr-qc/0204063 (sync connection). Nichols et al. (2011), PRD 84, 124014 (frame-drag). Owen et al. (2021), PRD 103, 124057. Semerák (2016), arXiv:1608.05948 (Kerr Kretschmann). Senovilla (2000), gr-qc/9906087 (superenergy). Turyshev & Toth (2010), arXiv:0907.4184. TU Delft flyby reanalysis, repository uuid:a537388f… VSI spacetimes, gr-qc/0503040. Wald (1984), *General Relativity*. Yagi et al. (2014), arXiv:1311.7144 (preferred-frame PPN). Yunes & Pretorius (2009), PRD 79, 084043 (dynamical CS).

CITATION

```
@article{paz2026firstprinciples,
  author = {Paz, Z.},
  title = {The Selective Transient Field from First Principles: The Two-Clock Theory},
  year = {2026},
  version = {V8.1 (archived)},
  url = {https://existshappens.com/papers/first-principles-v8-1/}
}
```

All Papers

The Complexified Null Cone as the Geometric Seat of Retrocausal Activation →