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

The two-clock theory and its conditional gravitational completion — Theory Edition: the theory stated on its own terms, with no observational input, the scalar mass carried as its one free scale, and every derivation delegated to the published Verification Record

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VERSION HISTORY

V9.7 — 3 September 2026 — *current* (this page): Theory Edition — the paper stated with no observational input; the scalar mass is carried as the framework's one free scale, the source clock in coefficient-complete scaling form, and every observational statement of earlier editions is published on the observational track. The complete technical record is the Verification Record.

V9.6.1 — 1 September 2026 — archived: page · PDF — Backbone Edition: the last edition to carry the observational timing anchors, the preregistered multiplet protocol and the composition discrimination inside the paper.

V9.2–V9.6 technical releases — 30 August to 1 September 2026 — consolidated without separate pages; their complete text and hashes are carried in the Verification Record and tabulated in §IX.A below.

V9.1 — 29 August 2026 — archived: page · PDF — frozen-consolidation release: the v9.0 content carried in full plus §XI and the seven post-v9.0 stop-gate records (Appendices AB–AH); 44-item ledger.

V9.0 — 28 August 2026 — archived: page · PDF — the repaired v8.2 revision byte-intact plus the five-gate audit layer.

V8.1 — August 2026 — archived: page · PDF — the two-clock revision; frozen baseline of the gravitational audit.

V7.9 — archived derivation record: page · PDF — SM unification, CICY #7447, flavour, and cosmology appendices.

The Two-Clock Theory and Its Conditional Gravitational Completion

Version 9.7 — Theory Edition — 3 September 2026

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This paper is the reader-facing statement of the STF programme as a theory. It takes no input from any observation: no measured duration, rate, direction, energy, or composition enters any statement below. The framework's observational programme — including the association record that historically motivated it — is published separately, on its own track; it tests what is stated here and does not feed it. Every result below is established in a machine-verified record: the complete, hash-pinned release chain — over thirty-three million checker assertions — is preserved as the STF First Principles Verification Record, referenced in §IX. The paper states results at their exact grades; the record verifies them.

Abstract

The Selective Transient Field (STF) is a scalar-response framework organized around two temporal objects: a universal ordering field and an internal cyclic phase. The distinction is forced by the gradient-clock obstruction: an oscillatory scalar amplitude cannot serve as a normalized-gradient clock, because its gradient vanishes at every turning point and therefore cannot carry a continuous global ordering. STF consequently uses a universal scalar T_U, with future-directed unit normal

$$N_\mu = -\frac{\nabla_\mu T_U}{\sqrt{-\nabla T_U \cdot \nabla T_U}}, \qquad D_U = N^\mu \nabla_\mu,$$

and a distinct internal phase $\Theta_I \in S^1$. Universal time orients causal response and the clock-relative curvature decomposition; the internal phase labels the field cycle. What the framework's prior ontology held as a distinction, the obstruction proves as a theorem. **[theorem]**

The theory's response sector is built on the positive clock-relative curvature state $q_N^2 = R^2 + 8\mathcal{W}_N$, an exact causal high-pass memory with a single Drude turnover, and the regulated compact readout $Q_\Delta = M_*^2(\sqrt{q_N^2 + \Delta^2} - \Delta)$. The memory carries the framework's one intrinsic time, the Drude time $\tau_c = \hbar/(m_s c^2)$, where m_s is the scalar mass. That mass is the framework's one free scale: an adversarial audit of every route the record offers for fixing it from the action found none admissible, and the one self-consistent closure that can be written is a tuning, not a derivation. This edition therefore carries m_s symbolically and states what the theory predicts as functions of it. **[free scale; declared]**

The gravitational sector is a conditional completion, audited rather than assumed. A five-gate adversarial audit, two frozen consolidations of thirteen calculation records, a fifty-one-gate covariant architecture programme, and eleven comparative gravity lift studies establish, among their results: a constructive non-identifiability theorem for the previously symbolic compact response port; an explicit eleven-component completion amendment that passes the resulting contract on the radial classical branch with one dyadic coupling chosen inside a derived stability window and zero timing input; a stable compact baseline spectrum on a finite relational phase star, with fundamental $\omega_0 R = 0.1889913902$; and a same-port positivity theorem for every closed Hermitian sub-fundamental response. Four withdrawals, one declared tuning, and two branch suspensions from the gate chain are retained in the record; nothing is deleted. The controlling grade is unchanged throughout:

$$\boxed{\text{STF is a coherent gravitational candidate — not a completed gravity theory.}}$$

On this architecture the programme states its response law. The selected source branch gives the onset law $\tau_{\text{src}} = C\,\mathcal{R}^{-8/5}$ for particle rigidity $\mathcal{R}$, with the exponent derived and the coefficient C a coefficient-complete function of the binary's chirp mass and a declared comparator field, $C \propto \mathcal{M}_c^{13/5} B_*^{8/5}$; charged small-angle transport contributes $\Delta_{\text{mag}} = A\,\mathcal{R}^{-2}$ with A fixed by line-of-sight magnetics; and the detector lead $L = \tau_{\mathrm{src}} - \Delta_{\mathrm{mag}}$ admits the exact affine representation

$$X = \mathcal{R}^{2/5}, \qquad Y = \mathcal{R}^2 L, \qquad \boxed{Y = CX - A.}$$

Two rigidity-resolved events from one source episode determine both coefficients; every further event is a prediction with no refit permitted. The memory sector adds a second, independent prediction: any activation-timing distribution driven by a monotone inspiral is a broken power law with a knee at $\tau \simeq \tau_c$, steepening by exactly one power, and no peak — so the scalar mass is read from a shape, never from a centroid. What remains between this edition and an absolute prediction is measurement — principally the remote-converter factor $\mathcal{F}$ and per-event source properties — and it lies entirely outside the Lagrangian.

The programme's empirical status is stated once. This edition claims no agreement with any observation. Its gates G1–G5 are open; its gate calculations do not depend on the free scale, because for any τ_c long compared with the orbital periods of the gate systems the memory response is saturated at pulsar and gravitational-wave frequencies, to second order in ω_c/ω; and its observational tests — the knee, the affine multiplet test, the mass and field scalings of the source clock — are published on the observational track as tests of this edition, not as inputs to it.

I. Introduction

I.A Origin and scope

The STF programme originated in an observational association programme, which is published separately on its own track [25]. This edition is the theory stated on its own terms: every quantity in it is a theorem, a derivation, a declared architecture parameter, or the single free scale m_s, and no measured association number enters at any point. The theoretical reconstruction asked whether a scalar-response framework could be built from General Relativity, topology, compactification [9], and causal response without any phenomenological coefficient on its input list; what follows is the answer at its current grade. The project-paper chain on which the reconstruction relies is part of the record [1–10]: *Theory of Time* [2] supplies the universal/local temporal distinction; *The Structure of What Happens* [3] supplies the universal-history/local-measurement framework; *Framework Guide* [4] records the framework-wide dependency and claim discipline; and *First Principles* V7.9 [1] remains the derivation record for downstream sectors where this paper expressly delegates to it.

I.B The dependency discipline

A quantity is a *prediction* only if the calculation producing it does not use the observation against which it is tested. A quantity is a *calibration* if it does. A quantity is a *validation* if an independent calculation reproduces an observation it did not use. A *discovery* is the empirical route by which a pattern was first found; later reconstruction does not erase that history. A *free scale* is a parameter the framework carries symbolically because no mechanism in the record fixes it. The gravitational audit added three further grades: an *existence construction* proves that at least one parent with a stated property exists; a *conditional bridge* supplies no prediction until its conditions and coefficients are independently fixed; and a *closed* or *superseded* realization remains in the record rather than being silently removed. These rules bind every claim in this paper. Where a past claim was corrected, the correction and the superseded statement are both preserved: in this programme, withdrawal is a status, never a deletion.

I.C How to read this paper

This edition tells the theory once, in a single voice, at its current state. It does not re-derive; it states each result with its grade and delegates every derivation to the machine-verified release chain summarized in §IX — the Verification Record [11] — which preserves, byte-intact and hash-pinned, every version of this paper's technical predecessor, all calculation records, all checkers, and all negative results. Readers who want to audit rather than read should start there: the record's packages verify their own checksums, rerun their assertions, and regenerate their results byte-identically on any machine with Python and NumPy.

Two statements about scope, made once so the rest of the paper can be positive. First, nothing here claims a completed quantum theory of gravity; the boxed grade above is controlling everywhere. Second, nothing here claims any empirical validation: this edition contains no data confrontation of any kind, and the tests of its predictions, which are published on the observational track, have not been run to a recorded verdict.

I.D Notation and units

SYMBOL	MEANING	UNITS / CONVENTION
T_U	universal ordering scalar	arbitrary future-preserving monotone label
$N_\mu,\ D_U$	unit normal to T_U; universal derivative $N^\mu\nabla_\mu$	defined where ∇T_U is timelike
Θ_I	internal cyclic phase	radians on S^1
q_N	clock-relative curvature norm state, $q_N^2 = R^2 + 8\mathcal{W}_N$	curvature (length^{-2})
$Q_\Delta,\ M_*,\ \Delta$	regulated compact readout; declared scale and regulator	frozen architecture parameters
m_s	scalar mass	the framework's free scale, carried symbolically
$\omega_c,\ \tau_c$	Drude turnover frequency and time	$\tau_c = \hbar/(m_s c^2)$; full recurrence $T = 2\pi\tau_c$
$\mathcal{M}_c,\ M,\ R$	binary chirp mass; equal-mass component mass $2^{1/5}\mathcal{M}_c$; phase-star radius	$R = (\bar{R}/\bar{M})\,GM/c^2$ on the frozen compact solution
B_*	surface field of the source comparator	declared comparator input
Z	nuclear charge number	dimensionless
$\mathcal{R}$	magnetic rigidity, $\mathcal{R} = E/Z$ for a particle of energy E	**EV (exavolt, 10^{18} V) — not eV**
$\tau_{\rm src},\ \Delta_{\rm mag},\ L$	source onset, magnetic delay, detector lead	time before merger
C	source normalization, $\tau_{\rm src} = C\,\mathcal{R}^{-8/5}$	time at $\mathcal{R} = 1$ EV

SYMBOL	MEANING	UNITS / CONVENTION
A	transport coefficient, $\Delta_{\mathrm{mag}} = A\,\mathcal{R}^{-2}$	time at $\mathcal{R} = 1$ EV
$\mathcal{F}$	remote-converter lift, $C_{\mathrm{rem}} = C_{\mathrm{loc}}\,\mathcal{F}^{8/5}$	dimensionless
β_{EGMF}	$(B/\mathrm{nG})\sqrt{L_c/\mathrm{Mpc}}$	dimensionless field–coherence combination
$X,\ Y$	affine coordinates $X = \mathcal{R}^{2/5}$, $Y = \mathcal{R}^2 L$	EV$^{2/5}$; EV^2·time

II. The Two-Clock Foundation

II.A The gradient-clock obstruction

If an oscillatory scalar amplitude $\phi = A\cos\Theta_I$ is used as a normalized-gradient clock, its gradient vanishes at every turning point; a periodic amplitude therefore cannot provide a continuous global ordering. This is the gradient-clock obstruction, and it forces the framework's central structural decision: the internal cyclic phase and the universal ordering cannot be the same object. **[theorem]**

STF therefore carries two temporal structures. The universal scalar T_U defines, wherever its gradient is timelike, the future-directed unit normal N_μ and the universal derivative $D_U = N^\mu \nabla_\mu$; it orients causal response and the clock-relative decomposition of curvature. The internal phase $\Theta_I \in S^1$ records where the field lies in its cycle; the amplitude is a local half-cycle chart of the clock, never its global coordinate. **[definition]** Because N^μ is hypersurface-orthogonal, its own vorticity vanishes by Frobenius: the universal clock supplies ordering, not rotation. **[definition]**

The framework's prior ontology already held these roles separate: *Theory of Time* [2] states universal time as an ontologically real, globally coherent temporal background that local systems reference while creating their own time; *The Structure of What Happens* [3] makes the same operational separation between the universal history and the internal clocks by which a subsystem measures it. The obstruction promotes that ontology to a theorem of the field representation. Conditional on a global phase lift and dynamical synchronization, universal time may be represented by an unwrapped phase and internal time by its cyclic projection, the covering map $\mathbb{R} \to S^1$ — the carrier of T_U being its own open construction [10]; that is a completion, not the theorem. **[theorem/entailment]**

II.B Clock-rate invisibility and the observation map

Because N^μ depends on T_U only through its normalized gradient, it is invariant under any future-preserving monotone relabelling $T_U \to f(T_U)$. The **Clock-Rate Invisibility Lemma** follows: the action knows which direction is future but not the operational rate at which universal time advances against a particular clock. Two clocks are necessary; their relative readout requires an observation map. **[lemma/open]** This lemma shapes the entire framework: every empirical statement in STF is ultimately a statement about a comparison between clocks, and every sector below — the curvature response, the flyby record, the gravitational completion, the response law — is a different face of that comparison.

II.C The 2π-provenance rule

The internal phase is a compact $U(1)$ coordinate, so one primitive recurrence spans 2π in canonical radian coordinates. Every 2π in this framework must carry one of three provenance labels: conversion between angular frequency and a full recurrence; conversion between normalized integral cohomology and canonical angular representatives; or a physical law deliberately pairing a reduced correlation scale with a full cycle. The first two follow from a derived cycle or winding; the third requires an independent constitutive derivation. A mixed reduced/full pairing is not forbidden, but it cannot be presented as a causal identity. **[house rule]**

III. The Selective Transient Field

III.A The response state and the exact memory

The theory's curvature input is the positive clock-relative state

$$q_N^2 = R^2 + 8\mathcal{W}_N, \qquad \mathcal{W}_N = E_{\mu\nu}E^{\mu\nu} + B_{\mu\nu}B^{\mu\nu},$$

built from the electric and magnetic parts of the Weyl tensor relative to N^μ, together with the Ricci scalar. The response couples not to curvature directly but to its universal rate through an exact causal high-pass memory: a retarded kernel whose transfer function vanishes at zero frequency, rises through a single Drude turnover at ω_c, and saturates at unity. The turnover time is the Drude time $\tau_c = \hbar/(m_s c^2)$ — the framework's one intrinsic timescale, carried symbolically (§III.B); the exact kernel value at ω_c is $1/\sqrt{2}$. A statically curved universe produces no steady-state response; only change in the clock-relative curvature state is registered. **[derived]**

The readout is regulated: the compact-alignment response

$$Q_\Delta = M_*^2\left(\sqrt{q_N^2 + \Delta^2} - \Delta\right)$$

is smooth through $q_N = 0$, linear in q_N^2 at small argument, and asymptotically linear in q_N at large argument. Its regulator Δ and scale M_* are declared parameters of the frozen architecture, carried explicitly in every downstream calculation.

III.B The scalar mass as the free scale

The memory's one scale is the scalar mass. Earlier editions fixed its value from an observed period; this edition does not, and states why. An adversarial audit of the record (Study 21, 2 September 2026) examined every route by which the action, the compactification, the flux quantization, the modulus potential, or the compact port could fix m_s without a binary-specific input, and found none admissible. The one closure that can be written self-consistently — the fixed point of the threshold and bridge relations — depends on the binary mass and has its numerical value set by an undetermined bridge coefficient raised to a large power; it is a tuning, not a derivation. The scalar mass is a free scale of the theory, in the same sense that the graviton mass is free in massive gravity or the coupling parameter is free in scalar–tensor gravity: the theory fixes how every prediction depends on it and leaves its value to measurement. **[free scale; Study 21 negative result]**

Two consequences follow inside the theory. First, the full recurrence of the internal phase and the Drude time stand in the fixed ratio $T = 2\pi\tau_c$, a case-(iii) pairing under the 2π-provenance rule; interchanging the reduced and full scales is the response sector's standing warning (§III.D). Second — and this is what makes the free scale measurable — the memory leaves a specific fingerprint in any activation-timing distribution. Under a monotone inspiral drive $Q \propto \tau^{-p}$ in time-to-merger τ, the memory response $Z = Q - y$, with $(d/dt + \omega_c)\, y = \omega_c Q$, is a broken power law: $Z \simeq Q$ for $\tau \ll \tau_c$ and $Z \simeq (p/\omega_c\tau)\, Q$ for $\tau \gg \tau_c$. The distribution therefore steepens by exactly one power at $\tau \simeq \tau_c$ and has no peak. A centroid of such a distribution is set by its window edges, with at most a fractional-power sensitivity to τ_c; a full-shape fit for the knee is sensitive to τ_c directly. The scalar mass is read from a knee, not from a mean, and no centroid may be inverted for it [13]. **[derived; Study 22 Tasks A–B, model class of the recorded kernel and drives]**

No observed timing enters this edition anywhere. The association record, and every comparison of the framework with it, belongs to the observational track [25].

III.C The flyby sector: a measurement map, not a force

Pulled back to a worldline, the original STF interaction is the connection one-form $\mathcal{A} = \gamma\phi\, dq$ with curvature $\mathcal{F} = \gamma\, d\phi \wedge dq$. Its antisymmetry does no work, while a closed radio transaction can register the holonomy $\oint \mathcal{A}$. The factor of two in the Earth-flyby phenomenology is the vorticity identity $\nabla \times (\boldsymbol{\omega} \times \mathbf{r}) = 2\boldsymbol{\omega}$; the equatorial radius and declination-only dependence are the operator norm of the rotational clock channel over the closed carrier. Earth flybys are source–observer degenerate because Earth is both the rotating gravitating source and the rotating clock carrier. The constitutive clock–link normalization and each tracking configuration's utilization coefficient remain open. **[derived/theorem/open]**

This sector is the cleanest illustration of the framework's epistemic posture: an early mechanical force interpretation was withdrawn when the audit showed the interaction does no work, the withdrawal is preserved in the record, and what survives — a holonomy-level observation map with the correct factor structure — is graded exactly as far as it is proved.

III.D Carried falsifiers

The response sector carries its own falsification program independent of everything below: the half-cycle test of the recurrence — a component at $T/2$ with the phase relation the cycle structure predicts; the τ_c/T interchange warning, which would misassign the Drude turnover and the full recurrence if the reduced and full scales were swapped; the knee test of §III.B — a memory-driven activation distribution must steepen by one power at τ_c and must not peak; the realization-specific tensor-speed envelope of the recorded scalar–Gauss–Bonnet route, an effectively null observational prediction whose violation would falsify that recorded realization; and the rank, Ward, pole, hyperbolicity, preferred-frame, static-response, flyby-utilization, and production-map falsifiers of the frozen architecture. These remain in force at their recorded grades.

IV. The Gravitational Architecture

IV.A The supersession that started the programme

Version 8.2 superseded the claim that the local reciprocal interaction $\int \sqrt{-g}\,\phi\, D_U q_N[g, N]$ is a healthy fundamental metric action. When the curvature norm is eliminated into a finite-order local metric theory [23], its Hessian generically produces a nondegenerate metric-acceleration block and an opposite-residue quartic pole; ordinary torsion-constrained connection reduction, regular auxiliary or BF/Legendre completion, generic same-metric Plebański simplicity, spectator six-null sectors, and curvature-dependent shifted metrics do not remove that physical rank with a constant constraint structure. The supersession is preserved in the record; the surviving readout is the regulated response of §III, and the gravitational question became: what parent theory carries it consistently? Everything in this section is the audited answer, at its exact current grade.

IV.B The audit programme in brief

The answer was built adversarially, in layers, each layer frozen before the next began.

The five gates (v9.0). Open-operator and deformed-identity classification (G1); the covariant Q_Δ -environment vertex and horizon spectral supply (G2); all-loop zero-DC protection (G3); gravitational-wave emission — direct local action versus analytic parent (G4); and merger-production activation with the visible-sector vertex (G5). The audit layer attached four numeric acceptance gates to any coefficient-complete parent, to be passed simultaneously on one common branch: Hulse–Taylor orbital-decay correction below 3.59×10^{-3}; PSR J1738+0333 flux correction below 1.81×10^{-1}; a GW170817 chirp-rate envelope below 6.67×10^{-3}; and $|c_T/c - 1| \lesssim 10^{-15}$. All five gates opened; none closed at this layer. The tolerances are settled measurements that sit outside the theory; the theory takes nothing from them as input, and because the memory response is saturated at the frequencies of these systems, the gate calculations carry no dependence on the free scale m_s beyond corrections of second order in ω_c/ω.

The frozen consolidations (v9.1, v9.2). Thirteen standalone calculation records were consolidated in two frozen releases. Among their permanent results: a no-go for the common-shift Stueckelberg completion with algebraic locks, which remains controlling for that class; a one-loop static zero that is exact but non-identifiable in the full coefficient space; Derrick and material-support constraints on finite world tubes; a compactification exact-charge stop gate that closes the parameter-free route from the displayed frozen compactification; a conditional derivative-lock bridge that reopens protection through clock-origin factorization at the price of a new parent class with a genuine physical relative-rate mode; the exact bookkeeping identity $M_I = g_Q^2$, which removes an adjustable amplitude from the pulsar sector; explicit Hulse–Taylor and J1738 coefficient inequalities; and two rejected microscopic shortcuts — ordinary neutron-star tides are a safe body-dependent comparator but not the universal scalar bath, and an isolated finite tube cannot supply the gapless Drude continuum. The established rank count of the frozen architecture, $44 + 2 + 12 = 58$ per causal leg and 116 doubled, is carried as a module subtotal throughout.

The covariant architecture chain (v9.3–v9.4.2). A fifty-one-gate programme executed the covariant two-clock architecture and its constraint discipline [21,22,24]. Its permanent discipline record: four withdrawals, each by an explicit correcting gate — a premature no-parent-selected claim, a cubic window composition, a Carter-mobility identification, and a one-datum-unlock implication — together with one declared tuning (a renormalized tadpole condition, labeled a running matching datum) and two branch suspensions (the ARP-BL and CMC-BSk24 prediction branches, structural results retained). The chain also produced a microscopic material-clock normalization from the BSk24 neutron-superfluid phase cycle, and closed the exact-DHOST fork: the current parent's exact quadratic-DHOST label is retired — the regulated norm and active portal are not exact quadratic DHOST — while the order-reduced CRGC effective classification is retained and no universal DHOST no-go is claimed.

The comparative gravity lift studies (v9.5). Eleven studies took the architecture to a compact-response boundary. A finite, CMC-regular relational $P(Y)$ phase star was constructed as the frozen compact comparator; the constraint-reduced GR-plus-phase radial operator was derived and its first eight eigenvalues computed positive, with fundamental

$$\omega_0 R = 0.1889913902;$$

the physical-vacuum surface theorem showed the canonical surface traction vanishes quadratically at the free surface, so the star's information lives in a stable self-adjoint bulk spectrum rather than a boundary kernel; and the **same-port positivity theorem** was proved: any closed Hermitian same-port compact response is real, positive, and monotone below the fundamental. Study 11 then proved the decisive negative constructively: the **current-parent port non-identifiability theorem**. The parent as then written declared the scalar portal constants and the regulated norm of an eleven-component compact curvature state, but left that state symbolic; explicit families of arbitrarily small stable completions preserved every frozen datum while changing modal residues, antiresonances, constraint-block shifts, and exterior projections. No unique compact response followed from the parent data alone. The release converted the stop into an exact machine-readable completion contract and a version policy: no successor could advance by fitting timing or choosing an arbitrary projection — only by new action-level information passing the contract.

IV.C Why the negative results are load-bearing

A reader should not skim the previous subsection's negatives as throat-clearing. They are the reason the positive results below mean something. The non-identifiability theorem is what makes the subsequent completion a genuine theory choice rather than a curve-fit; the compactification stop gate is what forces new physics to enter as a declared branch rather than a silent parameter; the withdrawn claims are what calibrate the reader's trust in the claims that stand. The framework's rule — nothing deleted, everything graded — is not bookkeeping; it is the theory's principal defense against its own authors.

V. The Compact Completion

V.A What the contract demanded and what the amendment supplied

The Compact CRGC Port Completion Amendment is the record that answered Study 11's contract, and it is the programme's one new theory choice since the freeze. It replaces the symbolic compact map by an explicit eleven-component, sign- and coefficient-complete order-reduced map; evaluates it on the frozen phase star; supplies first and second variational kernels; derives — rather than deletes — the mixed constraint block, which materially matters: the naive unity portal coupling fails its own stability test once the derived block is included, two of five carrier kinetic eigenvalues turning negative. The derived radial stability window is

$$|g_R| < 0.4312478776,$$

and the amendment freezes the dyadic value $g_R = 1/4$ inside it, chosen with zero timing input. The five effective kinetic eigenvalues at the frozen choice are $(0.664, 0.914, 0.967, 0.990, 0.998)$. A canonically normalized outgoing relative-clock carrier, matching condition, detector functional, energy ledger, and an explicit reference-absence declaration complete the contract's sections; all seven pass.

V.B Scope, honestly

The amendment's self-grade is exact and this paper carries it verbatim: a **radial-classical completion pass** — not a full nonlinear, nonradial, or quantum completion. On that scope, and only on it, the long-paused compact-port gate is closed by the selected amendment. The gates G1 through G5 remain open, four of them materially advanced: the radial constraint audit does not inherit globally; the same-parent microscopic environment is not completed; quantum counterterm protection is open; and the normalized common-branch emission and detector map were, at this layer, still missing. The source-and-transport programme of the next section then advanced those gates with a selected source and transport map; it did not close them — every gate G1 through G5 remains formally open. What the amendment changed is categorical nonetheless: a normalized retarded compact-to-detector response functional exists on one explicit two-clock branch, so the question “what does STF predict?” stopped being ill-posed and became a calculation with named missing inputs.

VI. Source and Transport

VI.A From binary tide to source clock

With a normalized compact port in hand, the source question became concrete: what drives the compact response of a merging binary, and when? The chain runs in four derived steps.

The leading quadrupolar tide has zero linear overlap with the radial port; the first nonzero source is quadratic, giving a port drive $S_{\rm port} \propto b^{-6}$ in binary separation b and a detector-side response rate $\mathcal{D}Z \propto b^{-14}$. Through the Peters relation [14] $b \propto \tau^{1/4}$ — the GR translator between separation and time before merger — this is $\mathcal{D}Z \propto \tau^{-7/2}$ in time before merger. **[derived]**

The source’s particle side is an independent capacity statement, separate from the response-rate chain above. On the selected comparator — two equal-mass phase stars of chirp mass $\mathcal{M}_c$, scale-matched to the frozen compact solution, $R = (\bar{R}/\bar{M})\,GM/c^2$ with $M = 2^{1/5}\mathcal{M}_c$, carrying a declared surface field B_* with dipolar interaction geometry — the Hillas capacity with accelerator size b gives a maximum rigidity that grows as the binary tightens, $\mathcal{R}_{\max} \propto b^{-5/2}$, and the two-loss inspiral clock gives $\tau \propto b^4/(1+\chi)$ with χ the constant electromagnetic-to-gravitational loss ratio. Eliminating b yields the frozen source-clock law

$$\boxed{\tau_{\rm onset}(\mathcal{R}) = C\,\mathcal{R}^{-8/5},} \qquad C = \frac{5c^5}{512\,G^3M^3(1+\chi)}\left[\kappa_H B_* R^3\sqrt{\frac{2GM}{c^2}}\,\right]^{8/5}:$$

particles of rigidity $\mathcal{R}$ can first be produced at time $\tau_{\rm onset}$ before merger. The exponent is derived and is a diagnostic of the pair (dipolar field, accelerator size b); the coefficient is coefficient-complete and scales as $C \propto B_*^{8/5}\mathcal{M}_c^{13/5}/(1+\chi)$. Three properties of the law carry its physical content and are the statements the theory owns: at fixed rigidity the source time scales as the $13/5$ power of the chirp mass; the ratio of the times at which two rigidity tiers are first attained is fixed, $(\mathcal{R}_2/\mathcal{R}_1)^{-8/5}$, for every source; and the field enters as the $8/5$ power. The chirp mass is a measured per-event input, the field is a declared comparator input, and the rigidity tier at which the clock is read is an operational choice. The numerical layer of the law — its evaluation on a measured chirp-mass population and the declared field — is carried in the process-clock derivation record [12]; no number from it is needed here. **[derived on selected comparator; coefficient-complete]**

VI.B The two normalization branches

The local calculation then failed its own production audit: local magnetospheric UHE ion production fails the curvature ceiling below 1 EV, and representative charged transport does not preserve a premerger detector lead. The surviving production route is a remote converter — a Poynting-flux bubble at distance from the compact object, where merger outflow converts magnetic luminosity to UHE ions [15–17]. A parameter sweep established the branch as a conditional existence result, not a unique selection. The normalization consequence is exact: the remote branch multiplies the local rigidity capacity by a factor

$$\mathcal{F} = \frac{\zeta_{\rm acc}\ \min(\beta_w/\eta_{\rm acc},\, \epsilon_c)}{\sqrt{2 f_\Omega \beta_w}},$$

built from five measurable bubble parameters — geometry fraction, outflow speed, coherence ratio, and two acceleration efficiencies — and therefore multiplies the timing coefficient by $\mathcal{F}^{8/5}$:

$$C_{\rm rem} = C_{\rm loc}\,\mathcal{F}^{8/5}, \qquad C_{\rm rem} = C_{\rm loc} \text{ iff } \mathcal{F} = 1.$$

The record's reference tuple — $f_\Omega = 0.03$, $\beta_w = 0.3$, $\epsilon_c = 0.3$, $\eta_{\rm acc} = \zeta_{\rm acc} = 1$ — gives $\mathcal{F} = \sqrt{5}$. It is a declared tuple, not a measurement: no literature-supported joint prior for the five parameters exists, and plausible literature-leaning values move $\mathcal{F}$ substantially in both directions. $\mathcal{F}$ is, at this writing, the single most consequential unmeasured number in the programme.

VI.C Transport, in SI and honestly

Charged transport contributes a nonnegative small-angle delay $\Delta_{\mathrm{mag}} = A\,\mathcal{R}^{-2}$, and A does not need to come from the STF Lagrangian at all: it is external propagation physics, legitimately fixed from independent measurements [18–20]. The closure derives it in two closed-form pieces — an extragalactic coefficient $A_{\mathrm{EG}} = 5.1135 \times 10^7\,(D_{\mathrm{Mpc}}\,\beta_{\mathrm{EGMF}})^2$ days with β_{EGMF} the field-and-coherence combination in nanogauss–megaparsec units, and a Galactic coefficient A_{G} from the turbulent line-of-sight integral. The honest arithmetic is sobering and is stated as such: the reference Galactic line of sight alone gives $A \approx 3.19 \times 10^5$ days — a delay near 874 years at 1 EV and still 798 days at 20 EV — which erases any premerger lead. A detected premerger charged lead therefore requires an exceptionally clean magnetic corridor, a high rigidity, or both; quantitatively, the lead survives at 20 EV only for line-of-sight coefficients some forty times below the Galactic reference. The neutral channel has no such delay. The framework does not soften this: the transport ledger records that a representative line of sight fails, that standard neutral conversion candidates fail, and that the surviving corridor is narrow and must be established per event. **[derived; conditional-fail-open]**

VII. The Response Law

VII.A The affine theorem

The detector lead $L(\mathcal{R}) = C\mathcal{R}^{-8/5} - A\mathcal{R}^{-2}$ looks nonlinear, but it has an exact affine representation:

$$X = \mathcal{R}^{2/5}, \qquad Y = \mathcal{R}^2 L, \qquad \boxed{Y = CX - A.}$$

The consequence is the framework's first coefficient-eliminating falsifier. Two rigidity-resolved events from one source, one emission episode, and one line of sight determine C and A exactly; every third event is then a prediction with no refit permitted. Physicality requires positive slope and nonpositive intercept, which for two positive-lead events is equivalent to the parameter-free pair inequality

$$\frac{L_2}{L_1} \geq \left(\frac{\mathcal{R}_2}{\mathcal{R}_1}\right)^{-8/5}, \qquad \mathcal{R}_2 > \mathcal{R}_1.$$

The theorem needs no normalization to be tested — only three rigidity-resolved events from one source, one emission episode, and one line of sight. **[theorem]**

VII.B The test protocol

A preregistered protocol for the multiplet test — eligibility contract, immutable calibration split, fixed rejection thresholds, a forbidden-refit list that bars the source exponent, the transport exponent, the frozen normalization, and any post-hoc membership change, and an executable evaluator with a worked synthetic example — is frozen in the record and published on the observational track [25]. This edition states the law; it does not run the test, and no qualifying sample has been declared.

VII.C The measured-input path

The normalization closure upgrades the target from relative to absolute. Because C is a formula in source observables and $\mathcal{F}$, and A a formula in line-of-sight magnetics, a source with an independently measured dossier — mass and field likelihoods, bubble parameters, composition likelihood, propagation inputs, all frozen before any timing residual is seen — yields a predicted lead band for every rigidity with no timing calibration at all. The programme's stated maximum, short of data: *independently measured source and propagation properties determine C and A, so every event is predicted.* The two execution modes are distinct, and both are frozen: the preregistered relative test, in which the first two eligible events calibrate C and A as nuisance coefficients; and the absolute measured-input route, in which no event timing calibrates anything. What remains between the current state and the absolute maximum is measurement — principally $\mathcal{F}$ — and a qualifying sample. Both are outside the Lagrangian, and neither can be shortcut from inside it; the version policy forbids exactly that shortcut.

VIII. Falsification Program and Status

VIII.A The standing falsifiers

The programme can be wrong in more ways than at any earlier version, which is its principal achievement. In force, at their recorded grades: the half-cycle test, the τ_c/T interchange warning, and the knee test of the response sector; the rank, Ward, pole, hyperbolicity, preferred-frame, static-response, flyby-utilization, and production-map falsifiers of the frozen architecture; the four numeric gravitational acceptance gates of §IV; and the response-law rejections — non-collinearity of an eligible multiplet in the affine plane at the declared thresholds, a nonpositive inferred C, a significantly negative inferred A on a common charged branch, exclusion of the $-8/5$ source slope in independently reconstructed source time, per-event source times that do not scale as $\mathcal{M}_c^{13/5}$ at fixed rigidity, a transport exponent incompatible with -2 on the selected branch, and a premerger charged lead on a line of sight whose measured transport coefficient forbids it. Each of these is a test the observational track can run; none has been run to a recorded verdict.

VIII.B What is established and what is not

Established, with machine-checked records: the two-clock theorem and its kinematics; the exact causal memory and regulated readout; the free-scale status of the scalar mass, with its knee signature; the audited supersession of the naive gravitational action; the phase-star baseline spectrum and the same-port positivity theorem; the port non-identifiability theorem and the radial-classical completion that answers it; the frozen source and transport exponents; the coefficient-complete source-clock law and its scaling form; the affine response theorem; and the measurable-input normalization closure.

Not established, stated as plainly: any gate closure beyond the radial-classical compact port; full nonradial constraint closure, quantum completion, or a two-polarization claim; the value of m_s; a universal absolute event time — the coefficients await the measured dossier, principally $\mathcal{F}$; a unique remote-converter geometry; and any empirical validation — this edition contains none, and the tests of its predictions have not been run to a recorded verdict. The zero-fit record is unbroken: no observed quantity has ever solved a theoretical coefficient, a property asserted mechanically by every checker in the chain; in this edition no observed quantity enters at all.

VIII.C Status

$$\boxed{\text{Coherent gravitational candidate — not a completed gravity theory.}}$$

Programme status: **a closed theoretical construction with one free scale.** The response law's remaining freedom is measurement, not algebra; the gravitational completion retains the open obligations listed above, and its gate calculations do not depend on the free scale; the programme's next decisive inputs are the gate calculations on the theory side and, on the observational track, the knee, multiplet, and scaling tests of this edition's predictions — by which the programme has bound itself, by frozen protocol and version policy, to be judged.

IX. Provenance and the Verification Record

IX.A Version history

VERSION	DATE	CONTENT	RECORD IDENTITY (SHA-256, ABBREVIATED)
V7.9	2026	legacy derivation record; downstream-sector delegate	published edition
V8.1	26 Aug 2026	frozen baseline; two-clock theorem; corrected provenance	`4788576a`
V8.2	28 Aug 2026	gravitational supersession and revision (repaired release)	`2cd54dae`
V9.0	28 Aug 2026	five-gate audit layer	`2ef09ed7`

VERSION	DATE	CONTENT	RECORD IDENTITY (SHA-256, ABBREVIATED)
V9.1	29 Aug 2026	frozen consolidation, seven records; research boundary	`3bbea34b` / author `177fd72b`
V9.2	30 Aug 2026	six-record consolidation; derivative-lock programme	`842863ac` / author `100bfe00`
V9.2-UC-R1	30 Aug 2026	matter-blind activation; M5 discharge	`04c37aaa`
V9.3	30 Aug 2026	relative-rate and quantum world-tube decision	embedded in chain
V9.4–V9.4.2	31 Aug 2026	fifty-one-gate covariant architecture; DHOST fork closure	package `b7e10376`
V9.5	1 Sep 2026	comparative gravity lift studies; non-identifiability; contract	package `49921c5e`
V9.6	1 Sep 2026	prediction freeze; affine theorem; preregistration	package `c301a801`

VERSION	DATE	CONTENT	RECORD IDENTITY (SHA-256, ABBREVIATED)
V9.6.1	1 Sep 2026	measurable-input normalization closure; Backbone Edition	package `e322752d` / author `a6c3f249`
Study 21	2 Sep 2026	scalar-mass mechanism audit: no admissible mechanism; m_s free	author's session record; package pending
Study 22 A–B	3 Sep 2026	memory-gated forward model: knee at τ_c, no centroid	result `c299b15e`; blind table `b7f0f19d`
Process clock V1.1	3 Sep 2026	coefficient-complete source-clock law; scaling form	`cad10961`
V9.7	3 Sep 2026	Theory Edition: observational purge; m_s carried as the free scale	this edition

Each release embeds or hash-pins its predecessor byte-intact; the chain from the frozen v8-series baseline to this edition is continuous and independently re-verified. Superseded statements remain readable inside the frozen payloads under explicit notices. The observational studies of the record — the association analyses, the composition discrimination, and the measurement specification for $\mathcal{F}$ — are catalogued on the observational track [25], where they belong; the V9.6.1 Backbone Edition, the last edition to carry them, remains published as an archived edition.

IX.B The Verification Record

The complete technical stack — every release manuscript with its historical layers, every calculation record, every checker, every negative result, every withdrawal — is preserved as the *STF First Principles Verification Record* [11], published alongside this paper. Auditing it requires Python with NumPy and nothing else: each package verifies its own checksums, reruns its assertions — over thirty-three million across the frozen chain, with the zero-fit and zero-timing-anchor counters asserted in every release — and regenerates its results byte-identically; the release archives are deterministic builds, and the v9.5 and v9.6 archives were independently rebuilt byte-for-byte on review. The record, not this paper, is the framework's proof; this paper is its face.

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The calculations, audits, and adversarial reviews consolidated here were carried out with AI research assistants operating under the programme's verification discipline, with every quantitative claim bound to machine-checked records. Errors of judgment remain the author's.

Conflict of Interest

The author declares no conflict of interest.

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Project papers (existshappens.com):

1. Z. Paz, *The Selective Transient Field from First Principles*, V7.9 — delegated derivation record for downstream sectors.
2. Z. Paz, *Theory of Time*, V4.3.
3. Z. Paz, *The Structure of What Happens* (General Theory), V3.1.
4. Z. Paz, *Framework Guide*, V3.3.
5. Z. Paz, *Clock-Separation Theorem*, V1.1.
6. Z. Paz, *Topological Closure on the Complexified Null Cone*, V6.3.
7. Z. Paz, *Closure–Capacity Correspondence*, V1.0.
8. Z. Paz, *Bandwidth Argument*, V2.0.
9. Z. Paz, *The Universal Embedding Principle*, V1.1.
10. Z. Paz, *The Universal Clock Carrier*, V1.0.

The Verification Record and derivation records:

11. Z. Paz, *STF First Principles Verification Record* — the hash-pinned release chain V8.1 through V9.7, as tabulated in §IX.A; published alongside this paper.
12. Z. Paz, *The STF Process Clock: A Coefficient-Complete Source-Capacity Timing Law with Declared Inputs*, V1.1, 3 September 2026 — the numerical layer of §VI.A.
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Observational programme (published separately; no input to this paper):

25. Z. Paz, *The STF Observational Programme*, uhecrtoday.com — the association record and the tests of this edition's predictions. This paper takes no quantity from it.

Complete per-record reference lists, with roles and hashes for every source, are carried inside the Verification Record's packages [11].

End of STF First Principles, Version 9.7 — Theory Edition.

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All Papers

Verification Record for this paper →