

STF Framework Guide

Entry Points, Reading Paths, and Conceptual Map

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Abstract

The Selective Transient Field (STF) is a scalar field extension of General Relativity in which a real scalar field ϕ_S couples to the covariant time derivative of spacetime curvature, $n^\mu \nabla_\mu \mathcal{R}$. The field activates selectively — only where curvature is changing rapidly — placing it beyond the reach of current Solar System tests while making it observationally accessible in binary inspiral systems and spacecraft flybys.

The framework has two fundamental parameters: a curvature coupling $\zeta/\Lambda = 1.35 \times 10^{11} \text{ m}^2$ derived from the Lagrangian structure and confirmed by flyby data, and a scalar mass $m_s = 3.94 \times 10^{-23} \text{ eV}$ derived from first-principles compactification over CICY #7447. From these two numbers, through purely mathematical derivation, the framework accounts for: galactic rotation curves without dark matter particles; the dark energy density ($\Omega_{\text{STF}} \approx 0.71$); the spectral index and tensor-to-scalar ratio of the primordial power spectrum; the numerical values of Standard Model constants including the electron mass (99.35%), proton mass (99.78%), and baryon asymmetry (99.74%); and seven predictions from the lepton and quark flavour sector including the reactor angle $\theta_{13} = 8.55^\circ$ (0.2% from PDG) and Cabibbo angle $\theta_{12} = 14.1^\circ$ (8% from PDG) — all derived with zero free parameters from the Picard-Fuchs period integral at the STF resonance point.

This document is a guide to the STF framework as a whole — its logical architecture, the papers that constitute it, the derivations for each domain, the cross-paper dependencies, and the falsification conditions. It is intended for scientists encountering the framework for the first time and for collaborators navigating between papers.

1. The Logical Arc

1.1 From Anomaly to Field

One anomaly defined the problem. Between 1990 and 2013, six spacecraft performing Earth

gravity assists showed unexplained velocity changes of 1–13 mm/s. The anomalies followed the empirical pattern $\Delta K = 2\omega R/c$, where ω is Earth's rotation rate and R is the closest approach distance — a formula with no explanation in GR or the Standard Model. This points to a field that couples to dynamically evolving spacetime: specifically to $n^\mu \nabla_\mu \mathcal{R}$, the covariant time derivative of the tidal curvature scalar.

The STF Lagrangian was built from this structural property. The flyby pattern $K = 2\omega R/c$ emerges as a derivation from the Lagrangian and is confirmed by Anderson et al. (2008).

1.2 From Field to Framework

Once the field was defined and its parameters derived, the derivation cascade was deterministic. The field mass m_s combined with the activation threshold $\mathcal{D}_{\text{crit}} = m_s \cdot M_{\text{Pl}} \cdot H_0 / (4\pi^2) \approx 10^{-27} \text{ m}^{-2}\text{s}^{-1}$ specifies which physical systems activate the field. The logarithmic field profile $\phi_S(r) \propto \ln(r)$ that solves the field equation in galactic disk geometry gives a $\propto 1/r$ — exactly the acceleration profile that produces flat rotation curves. The MOND acceleration scale $a_0 = cH_0/2\pi$ emerges from cosmological boundary conditions. The residual potential $V(\phi_{\text{min}})$ at the field minimum gives $\Omega_{\text{STF}} \approx 0.71$. The curvature-pump mechanism that activates the field during late inspiral, run backward to the Planck epoch, loads the inflaton to the correct energy scale and produces $r = 0.003\text{--}0.005$ and $n_s = 0.963$.

The Standard Model connection followed from the observation that the 10-dimensional structure required to classify the STF Lagrangian within Horndeski/DHOST gravity also provides the geometric building blocks for deriving particle masses and coupling constants. The electron mass, proton mass, fine structure constant, strong and weak couplings, and baryon asymmetry all emerge as combinations of $\{m_s, M_{\text{Pl}}, \alpha, D = 10, d = 4\}$ with accuracy averaging 99.5%.

1.3 From Observation to First Principles

The companion first-principles paper (STF First Principles V7.7) derives ζ/Λ and m_s from 10-dimensional compactification over the Calabi-Yau threefold CICY #7447 — selected by three independent topological constraints, not by fitting. The timescale $T = 3.32$ years emerges as a prediction from GR orbital mechanics via the Peters formula at $730 R_S$. No observational input enters the derivation.

1.4 From Physics to Philosophy

The STF coupling $n^\mu \nabla_\mu \mathcal{R}$ instantiates a specific physical structure: a system whose present state is constrained by both past and future boundary conditions — a self-referential temporal loop. This is not a philosophical interpretation of the physics; it is a direct consequence of the retrocausal boundary conditions that the field satisfies. The Theory of Time paper shows that this structure is precisely what a physically grounded, empirically testable theory of temporal ontology requires. The Consciousness, Time and Identity paper argues that this same structure satisfies the conditions that phenomenological analysis identifies as necessary and sufficient for temporal experience,

dissolving the hard problem of consciousness without adding anything to the physics.

The General Theory (V2) synthesises the ontological architecture that the preceding papers individually instantiate. It introduces the EXISTS/HAPPENS distinction as the framework's foundational ontological binary — EXISTS is the pre-temporal state ($\dim C_T = 0$, no closed trajectory), HAPPENS is the activated state ($C_T \cong S^1$) — and advances a constitutive claim: the inside of a closed temporal loop above threshold is not a further fact over and above the loop's structure. The General Theory also develops the two-layer resolution of the Fermi paradox, including quantitative departure conditions derived from zero new parameters: $M_{\text{dep}} \sim 10^{12} M_{\odot}$, $t_{\text{dep}} \sim 2.4 \times 10^{14}$ yr. The Locality Theorem proves that temporal loop density cannot be pooled across distances greater than $\tilde{\lambda}_c \approx 0.53$ ly.

The Biology paper extends the STF framework to living systems: retrocausal boundary conditions make certain developmental outcomes inevitable in a precise physical sense, not merely probable.

1.5 From Jarlskog to Lepton Sector

The same Picard-Fuchs ODE integration that fixes $\text{Im}(t_{\text{res}}) = 0.20913$ from the CICY #7447 geometry propagates into the full lepton and quark flavour sector. A single number — the holomorphic period at the STF resonance point — determines six independent physical observables without additional parameters: the Kähler suppression ϵ_K , the CP phase $\varphi_{\text{CP}} = 84.94^\circ$, the winding mode mass $M_{\text{wind}} = m_Z$, the physical Yukawa matrix Y_{phys} , the instanton convergence parameter $q^2 = 0.0722$, and the radiative LFV loop structure.

From these, seven falsifiable predictions follow: the reactor angle $\theta_{13} = 8.55^\circ$ (0.2% from PDG), the Cabibbo angle $\theta_{12} = 14.1^\circ$ (8% from PDG), near-maximal CP violation $|\sin \delta_{\text{CP}}| = 0.9961$, $\text{BR}(Z \rightarrow \mu\tau) \sim 3 \times 10^{-8}$, and three radiative LFV rates. The generation assignment is resolved without external bundle data: A_1, A_2, A_3 are confirmed as the Z_{10} -equivariant generation sections via the monad connecting homomorphism, with the electron identified as the null eigenvector at 99.7% Gram alignment. These results are developed in companion papers 08a–08e.

2. The Field and Its Lagrangian

2.1 The Core Coupling

The STF Lagrangian density is:

$$\mathcal{L}_{\text{STF}} = R / (16\pi G) + \frac{1}{2} (\nabla_{\mu} \varphi_S)^2 - \frac{1}{2} m_S^2 \varphi_S^2 + (\zeta/\Lambda) \varphi_S (n^{\mu} \nabla_{\mu} \mathcal{R}) + g_{\psi} \varphi_S \bar{\psi} \psi + (\alpha/\Lambda) \varphi_S F_{\mu\nu} F^{\mu\nu}$$

TERM	PHYSICAL MEANING
$R / 16\pi G$	Standard GR — unchanged
$\frac{1}{2}(\nabla\phi_S)^2$	Scalar field kinetic energy
$\frac{1}{2}m_s^2\phi_S^2$	Field mass \rightarrow oscillation period $\tau = h/m_s c^2 = 3.32$ years
$**(\zeta/\Lambda)\phi_S(n^\mu\nabla_\mu\mathcal{R})**$	Key term: curvature rate sources the field; zero for static spacetime
$g_\psi\phi_S\bar{\psi}\psi$	Fermion coupling
$(\alpha/\Lambda)\phi_S F F$	Photon coupling

The field equation is:

$$\square\phi_S + m_s^2\phi_S = -(\zeta/\Lambda)(n^\mu\nabla_\mu\mathcal{R})$$

2.2 Parameter Values

PARAMETER	VALUE	DERIVATION
ζ/Λ (curvature coupling)	$1.35 \times 10^{11} \text{ m}^2 (\pm 9\%)$	Lagrangian structure; confirmed by flyby data
m_s (scalar mass)	$3.94 \times 10^{-23} \text{ eV} (\pm 3\%)$	10D compactification over CICY #7447 via $\mathcal{D}_{\text{crit}}$ condition

2.3 Theoretical Classification

The STF Lagrangian belongs to the Degenerate Higher-Order Scalar-Tensor (DHOST) Class Ia family. DHOST Class Ia theories propagate gravitational waves at exactly $c_T = c$, consistent with the constraint $|c_T/c - 1| < 10^{-15}$ from GW170817/GRB 170817A.

3. The Derivation of $T = 3.32$ years

STEP	INPUT	RESULT
Compactification	CICY #7447 geometry	$m_s = 3.94 \times 10^{-23} \text{ eV}$
Threshold condition	$m_s, M_{\text{Pl}}, H_0, 4\pi^2$ topology	$\mathcal{D}_{\text{crit}} = 1.07 \times 10^{-27} \text{ m}^{-2}\text{s}^{-1}$

Peters formula

\mathcal{D}_{crit} , standard GR

$a = 730 R_S \rightarrow T = 3.32 \text{ yr}$ for $60 M_{\odot}$ BBH

4. The Framework Papers

The Backbone

PAPER	ROLE	KEY CONTRIBUTION
STF First Principles V7.7	Source of truth	Derives all parameters from CICY #7447 compactification without observational input. Jarlskog factor, Yukawa matrices, KK spectrum. Seven lepton/quark sector predictions. Authority for all STF physics.
STF Framework Guide V3.0	Navigation	This document.
Complexified Null Cone V0.9	Retrocausal geometry	Geometric language for STF retrocausality. Two ruling families, T^2 closure torus, CP^3 Fubini-Study measure.
Topological Closure V5.0	Pure mathematics	Heegaard transgression theorem. Proves $\int_{T^2} \omega_R \wedge \omega_A = 4\pi^2$ from Hopf torus boundary pairing. Foundation for the $4\pi^2$ normalisation in \mathcal{D}_{crit} .

Physical Consequences

PAPER	ROLE	KEY CONTRIBUTION
STF Cosmology V5.7	Cosmological domain	Complete cosmological lifecycle: inflation, dark energy, dark matter, MOND, Hubble tension.
STF SM Unification V3.6	Standard Model domain	Derives particle masses, gauge couplings, and baryon asymmetry from STF geometry.
STF Energy V0.5	Cosmological energy	Resolves cosmological constant, dark matter, and arrow-of-time problems from the T^2 structure.

Lepton & Quark Flavour

Five companion papers extending First Principles V7.7 into the complete lepton and quark flavour sector. All results derive from $\text{Im}(t_{res}) = 0.20913$ — the period integral at the STF resonance point $\psi_{res} = 0.420$ of CICY #7447/ Z_{10} — with zero additional parameters.

PAPER	VERSION	KEY CONTRIBUTION
BR(Z→μτ) from CICY #7447/Z₁₀	V3.0	Derives $BR(Z\rightarrow\mu\tau) \in [3\times 10^{-9}, 3\times 10^{-7}]$, NDA central 3×10^{-8} . Winding mode loop mechanism. The anchor result of the flavour series.
Lepton Mixing and CP Violation	V0.3	$C_{\text{Jarlskog}} = 0$ (Z ₁₀ theorem, exact); one massless generation (structural zero); $\delta_{\text{CP}} = 84.94^\circ$ (topological invariant); $\theta_{13} = 8.55^\circ \pm 2^\circ$ (0.2% from PDG); $\theta_{23} \in [27^\circ, 56^\circ]$ bracket.
The Z→μτ Operator	V0.1	Loop structure of the Z→μτ vertex. One-loop triangle diagram. Winding mode KK spectrum. Connects BR(Z→μτ) to the underlying Yukawa texture.
Radiative LFV Constraints	V0.1	$BR(\tau\rightarrow\mu\gamma) \approx 6\times 10^{-11}$, $BR(\tau\rightarrow e\gamma) \approx 2\times 10^{-11}$, ratio 3.6. MEG-II constraint on generation assignment (null eigenvector = electron, confirmed at 99.7% Gram alignment).
Experimental Programme	V0.1	Systematic falsification map across five experiments. Classifies all seven predictions by tier, timescale, and required precision.

The symmetric flavour result (Step 24 of derivations archive): The same $Y^\wedge(0)$ Yukawa matrix, under $Y_d = (Y_u)^*$, gives the Cabibbo angle $\theta_{12}(\text{CKM}) = 14.1^\circ$ (PDG: 13.04° , 8% agreement). Both θ_{13} and the Cabibbo angle emerge from the FS-normalised Yukawa at $\alpha=2$ without metric correction — the imaginary part of $Y^\wedge(0)$ entries, set by $\varphi_{\text{CP}} = 84.94^\circ$, produces $\sin(\theta) \approx |\text{Im}(Y)| / \|Y\|$ in both sectors.

Temporal & Ontological Consequences

PAPER	ROLE	KEY CONTRIBUTION
General Theory V2	Ontological authority	EXISTS/HAPPENS distinction. Constitutive claim. Departure conditions. Locality Theorem $\tilde{\lambda}_c \approx 0.53$ ly.
Consciousness, Time & Identity V3.6	Philosophical implications	Strong identity claim: temporal experience IS temporally self-referential structure. Hard problem dissolved.
Theory of Time V4.3	Physical implications	First physically grounded, empirically testable theory of time. Temporal Commensurability Principle.
Pretemporal Stasis / Cascade V1.0	Temporal emergence	Ontology of temporal becoming. Bridges activation physics to temporal emergence.

Temporal Workspace V0.5	Phenomenological measure	$\mathcal{W}_T(\tau) = (\tau^*/\tau)^{7/4} - 1$. Three STF timescales on a single Peters curve.
Retrocausality & Life V0.5	Biology domain	STF retrocausal boundary conditions applied to living systems.

Predictions & Validations

PAPER	STATUS	KEY CONTRIBUTION
Spacecraft Flyby Anomaly Resolved	HARD 99.99%	$\Delta K = (2\omega R/c)v_\infty$ confirmed across 12 measurements.
Tajmar Protocol	PROPOSED	STF coupling in rotating superconductors.
Lunar Orbit Eccentricity	MEDIUM 92%	
STF Coronal Heating	MEDIUM 96.4%	
Earth's Core	MEDIUM 95%	
Enceladus Heat Output	SOFT	
Hubble Constant Third Path	MEDIUM	
Uranus-Neptune Heat Paradox	HARD Binary	
Length-of-Day Anomaly	MEDIUM 96%	
Pulsar Glitch Timing	HARD 92.3%	
The Phantom Problem	THEOREM	$w = -1$ exact.

4.1 Dependency Structure

First Principles V7.7 is the source of truth for all physical constants ($m_s, \zeta/\Lambda, \mathcal{Q}_{crit}, \tau_c, \tilde{\lambda}_c, \text{Im}(t_{res}), \varphi_{CP}$) — all derived from compactification without observational input. The Cosmology, SM Unification, and Energy papers are domain-specific elaborations. The Topological Closure paper provides the pure mathematical foundation for the $4\pi^2$ normalisation.

The Lepton & Quark Flavour papers (08a–08e) depend on First Principles V7.7 for $\text{Im}(t_{res}) =$

0.20913, $\epsilon_K = 0.12074$, and $\varphi_{CP} = 84.940^\circ$. They are independent of the Cosmology, SM Unification, and temporal/ontological papers. They are the most technically demanding sub-series in the framework, requiring exact Picard-Fuchs ODE integration, Griffiths residue methods, Donaldson balanced metric computations, monad bundle cohomology, and worldsheet instanton analysis.

The Theory of Time and CTI build on the validated physics through two explicit bridges: Cosmology V5.7 Section XIV.E derives the pre-temporal ontology of the Big Bang, and the Complexified Null Cone paper formalises the retrocausal geometry. The General Theory V2 is the ontological authority.

5. Six Domains, One Field

All results below use $\zeta/\Lambda = 1.35 \times 10^{11} \text{ m}^2$ and $m_s = 3.94 \times 10^{-23} \text{ eV}$ except the flavour sector results, which additionally use $\text{Im}(t_{\text{res}}) = 0.20913$ from the Picard-Fuchs ODE integration. No additional parameters are introduced in any domain.

5.1 Spacecraft Anomalies

$$\Delta K = (2\omega R/c) \cdot v_\infty \cdot \sin(\delta_{\text{in}}) \cdot \cos(\varphi)$$

99.99% accuracy for $K = 2\omega R/c$ across 12 individual flyby measurements.

5.2 Standard Model Constants

CONSTANT	STF FORMULA	ACCURACY
Chirp mass M_c	$\sqrt{(50\pi\hbar c^5 / G^2 \alpha m_e)} = 18.54 M_\odot$	99.9%
Electron mass m_e	$(2\pi/\sqrt{30}) \cdot m_s^{(4/9)} \cdot M_{\text{Pl}}^{(5/9)}$	99.35%
Proton mass m_p	$(2\pi/\sqrt{30}) \cdot m_e \cdot \alpha^{(-3/2)}$	99.78%
Baryon asymmetry η_b	$(\pi/2)(\alpha/10)^3$	99.74%

5.3 Dark Energy

$V(\varphi_{\text{min}}) \rightarrow \Omega_{\text{STF}} \approx 0.71$. Equation of state $w = -1 \pm 10^{-21}$ proved as theorem (Phantom Problem V0.2).

5.4 Galactic Rotation

$\varphi_S(r) = \varphi_{\min} + \varphi_0 \ln(r/r_0) \rightarrow a_{\text{STF}} \propto 1/r \rightarrow$ flat rotation curves. MOND scale $a_0 = cH_0/2\pi \approx 1.2 \times 10^{-10} \text{ m/s}^2$.

5.5 Inflation

$r = 12/N^2 \approx 0.004$ ($N = 55$), $n_s = 1 - 2/N \approx 0.963$ (Planck: 0.965 ± 0.004).

5.6 Lepton & Quark Flavour

From $\text{Im}(t_{\text{res}}) = 0.20913$ alone, with $Y_d = (Y_u)^*$:

OBSERVABLE	PREDICTION	PDG	AGREEMENT
δ_{CP}	84.94° ($\sin \delta_{\text{CP}}$	$= 0.9961$)
θ_{13} (PMNS reactor)	$8.55^\circ \pm 2^\circ$	8.57°	0.2%
θ_{12} (CKM Cabibbo)	14.1°	13.04°	8%
C_Jarlskog (tree)	0 (exact)	—	Z_{10} theorem
σ_3 (massless gen.)	0 (structural)	—	Topology
$\text{BR}(Z \rightarrow \mu\tau)$	3×10^{-8} (NDA)	$< 10^{-6}$ (LEP)	Accessible at FCC-ee
$\text{BR}(\tau \rightarrow \mu\gamma)/\text{BR}(\tau \rightarrow e\gamma)$	3.6	—	Basis-independent

Both θ_{13} and the Cabibbo angle emerge from the FS-normalised Yukawa without metric correction. The remaining angles (θ_{23} , θ_{12} solar, CKM θ_{23} and θ_{13}) require the Yang-Mills PDE for the HYM fibre metric $h_V(x)$ on the rank-4 monad bundle $V \rightarrow F(h_V) \wedge J^2 = 0$ on X .

6. Falsification Conditions

OBSERVATION	INSTRUMENT / TIMELINE	WHAT IT FALSIFIES
$r > 0.01$ (tensor-to-scalar ratio)	LiteBIRD ~2032; CMB-S4	STF inflation mechanism
$C_6 > 0$ in GW waveform phase	LISA, Einstein Telescope	Retrocausal emission mechanism
Flyby anomalies not matching $K = 2\omega R/c$	Future precision flybys	Curvature coupling formula
SM constants	Future precision measurements	Geometric derivation of SM

deviating > 5%		
	$\sin \delta_{CP}$	< 0.95
$BR(Z \rightarrow \mu\tau) < 10^{-9}$	FCC-ee ~2035	LFV loop mechanism
MEG-II signal with $BR(\mu \rightarrow e\gamma) > 3.1 \times 10^{-13}$	MEG-II now	Electron generation assignment
Temporal experience persisting without temporal closure	Neuroscience	CTI identity claim
$\Omega_m \neq 0.322$ (precision > 0.005)	DESI BGS 2026; Euclid 2027–2030	T^2 curvature-dark energy link

7. Cross-Paper Architecture

7.1 The First Principles ↔ Companion Papers Relationship

First Principles V7.7 provides the theoretical foundation from which all parameters are derived. It is the declared source of truth for m_s , ζ/Λ , \mathcal{D}_{crit} , τ_c , $\bar{\lambda}_c$, $\text{Im}(t_{res})$, ε_K , and φ_{CP} . All companion papers take parameters from First Principles without additional fitting.

7.2 The Retrocausal Geometry Bridge

The Complexified Null Cone paper provides the geometric language for the retrocausal structure. Topological Closure V5.0 proves the $4\pi^2$ normalisation required by both.

7.3 The Cosmology → Theory of Time Bridge

Cosmology V5.7 Section XIV.E derives the pre-temporal ontology of the Big Bang directly from the STF activation condition $n^\mu \nabla_\mu \mathcal{R} > \mathcal{D}_{crit}$.

7.4 The EXISTS/HAPPENS Architecture

General Theory V2 introduces EXISTS/HAPPENS as the framework's foundational ontological binary. The constitutive claim — that the inside of a closed loop above threshold is not a further fact over and above the loop's structure — reframes what CTI, Theory of Time, and Temporal Cascade each individually instantiate.

7.5 The Biology Bridge

The Biology paper extends the framework's retrocausal boundary conditions to living

systems. Requires full physics from V7.7 and connects to General Theory V2 Chapters 6–8.

7.6 The Energy Paper

STF Energy V0.5 resolves three cosmological energy crises from the T^2 closed causal loop. The $\pi/4$ derivation requires only the nodal structure of $\cos(\theta)$ on the temporal S^1 . No new parameters.

7.7 The Zero-Parameter Claim

LEVEL	WHAT “ZERO PARAMETERS” MEANS
First Principles V7.7	All parameters derived from fundamental constants and compactification geometry — no observational input
Consequence	Parameters taken from First Principles; cascades derived — no additional fitting papers
Lepton/quark flavour series	$\text{Im}(t_{\text{res}}) = 0.20913$ is the sole input from First Principles; all seven flavour predictions follow
Philosophy	Framework cited as zero-parameter — appropriate; First Principles is the source papers

7.8 The Lepton & Quark Flavour Bridge

The five flavour papers (08a–08e) connect to First Principles V7.7 through the Picard-Fuchs period integral at $\psi_{\text{res}} = 0.420$ of CICY #7447/ Z_{10} . The derivation chain:

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CICY #7447 geometry
  ↓ Picard-Fuchs ODE (exact integration)
Im(t_res) = 0.20913
  ↓
ε_K = 0.12074   φ_CP = 84.940°   M_wind = m_Z
  ↓
Y^(0)_ij (Griffiths residue, monad bundle)
  ↓
Papers 08a-08e: BR(Z→μτ), PMNS, LFV rates, CKM

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The monad bundle specification ($B = Z_5$ -orbit of $O(-1,1,1,0,0)$, $C = O(1,1,1,1,1)$) and the generation assignment (A_1, A_2, A_3 are equivariant sections via the connecting homomorphism) were derived this series without external database input. The generation basis is complete. The remaining gap — physical mass hierarchy and full PMNS matrix — requires the Yang-Mills PDE $F(h_V) \wedge J^2 = 0$ on X .

8. Reading Guide

READER PROFILE	RECOMMENDED PATH
Physicist — astrophysics / GW	First Principles V7.7 §III (derivation chain) → Cosmology V5.7 → relevant validation paper
Physicist — cosmology	Cosmology V5.7 → First Principles V7.7 Appendix I (MOND)
Physicist — particle physics / BSM	SM Unification V3.6 → First Principles V7.7 Appendix K → Lepton Mixing (08b) → BR(Z→μτ) (08a)
Physicist — flavour / LFV	BR(Z→μτ) (08a) → Lepton Mixing (08b) → Experimental Programme (08e) → First Principles V7.7 Appendices Q–S
Physicist — CKM / quark sector	Lepton Mixing (08b) §5 (Cabibbo angle) → First Principles V7.7 Appendix S §5.6 → Radiative LFV (08d)
Philosopher of physics / time	Cosmology V5.7 §XIV.E → Theory of Time V4.3 → General Theory V2 → Temporal Cascade V1.0
Consciousness researcher	CTI V3.6 → Theory of Time V4.3 §VIII → Temporal Workspace V0.5 → General Theory V2 §3–5
Biologist / philosophy of biology	Retrocausality & Life V0.5 → General Theory V2 §6–8 → First Principles V7.7 §III
Referee or collaborator	Read this document → First Principles V7.7 → the paper most relevant to your domain

9. Open Questions and Current Frontiers

9.1 The $2\pi/\sqrt{30}$ Prefactor

Appears in the electron mass, proton mass, and chirp mass derivations. Physical origin identified (projection through 30-component fermionic Hilbert space of each SM generation) but not fully derived from first principles.

9.2 The Weak and Strong Coupling Empirical Factors

Strong coupling $\alpha_s = 2\pi/(\mathcal{L} + 10)$ and weak coupling $\alpha_W = 3/(2\mathcal{L})$ contain empirically

determined coefficients. Labeled “empirical” in all framework summary tables.

9.3 The Jarlskog Factor and Flavour Sector Boundary

First Principles V7.7 and companion papers 08a–08e derive $J_{\text{STF}} = 2.83 \times 10^{-5}$ vs $J_{\text{obs}} = 3.18 \times 10^{-5}$ (ratio 0.89). The generation assignment is resolved — A_1, A_2, A_3 are the Z_{10} -equivariant sections of $H^1(\tilde{X}, \tilde{V})$, confirmed by the connecting homomorphism of the monad long exact sequence.

Resolved this series: - Generation basis: A_1, A_2, A_3 are equivariant, no bundle data needed - Electron = null eigenvector (99.7% Gram alignment confirmed) - Monad specification: $B = Z_5$ -orbit $O(-1,1,1,0,0)$, $C = O(1,1,1,1,1)$ - $\theta_{13} = 8.55^\circ$ (lepton sector) at 0.2% from PDG - $\theta_{12} = 14.1^\circ$ (CKM Cabibbo angle) at 8% from PDG

Remaining open: The physical mass hierarchy $\sigma_1/\sigma_2 \rightarrow 16.8$, the full PMNS matrix (θ_{12} solar, θ_{23}), and CKM angles θ_{23} and θ_{13} require the Yang-Mills PDE $F(h_V) \wedge J^2 = 0$ for the HYM fibre metric $h_V(x)$ on the rank-4 bundle V . This is a PDE on the CY surface X requiring neural-network methods (Butbaia et al. 2024) or finite-element discretisation. All Donaldson T-operator variants have been exhausted — they converge to the Bergman kernel on global sections, not the fibre metric.

9.4 The Neutrino Mass Prediction

$m_\nu/m_e \sim \alpha^3$ consistent with observed neutrino mass scales. Labeled low-confidence pending geometric derivation.

9.5 The Qualia Extension

CTI V3.6 defers the qualia question as a promissory note. Labeled low-confidence.

9.6 The Departure Mass Threshold

General Theory §15.6 derives $M_{\text{dep}} \sim 10^{12} M_\odot$. Three open sub-problems: cross-channel interaction; precise mass prefactor; traversal conditions.

9.7 The $\alpha^{4/7}$ Timescale Structure

Temporal Workspace V0.5 establishes that $\tau^* = 3.32$ yr and α predict both flanking STF timescales to within 2.5%. Why consecutive \mathcal{D} ratio equals α^{-1} remains unresolved.

“One field. One coupling constant. Sixty-one orders of magnitude. Ninety-five percent of the universe. All Standard Model parameters. The Hubble tension resolved. GR extended. SM derived. MOND recovered. Dark sector replaced. Inflation identified. Reactor angle predicted to 0.2%. Cabibbo angle predicted to 8%.”

V3.0 changes from V2.3: First Principles updated V7.5 → V7.7. Section 1.5 added (From Jarlskog to Lepton Sector). Lepton & Quark Flavour paper group added (papers 08a–08e). Section 5.6 (flavour domain) added. Section 6 updated with LFV falsification conditions. Section 7.8 (Lepton/Quark Flavour Bridge) added. Section 8 reading guide updated with flavour/LFV and CKM reader paths. Section 9.3 updated: generation assignment resolved, Cabibbo angle established, YM PDE identified as sole remaining boundary. Abstract updated with seven predictions. Paper count: 31.

Citation

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