Thesis: All observables are manifestations of a single phenomenon—microscopic tensional distortion of S.

Definition (Ontology):
There is one underlying phenomenon—**structural micro-distortion of S**—whose **localized, topological, and propagating configurations** realize all observed entities and interactions. Mass, spin, charge, gauge-like behavior, and gravitational response are **manifestations of tensional geometry and its evolution**, not independent postulates.

Modeling stance:
We use a **single scalar structural field** as the minimal, continuous–discrete *bookkeeping device* for this phenomenon (for simulation, calibration, and proofs). The scalar model is thus a **map of the phenomenon**, not the phenomenon itself.

Corollaries (to prevent misreadings):

- There are **not multiple fundamental forces** added by hand; there is **one medium and one dynamics** whose compatible modes manifest as different forces.
- "Particles" are **persistent, quantized distortion patterns** (e.g., helicoidal/solitonic states), not extra substances.
- "Fields" in the usual sense are **effective descriptions** of interaction patterns generated by the same micro-distortion.
- Calibration choices (e.g., **α-in**) fix units; they do not introduce additional ontic elements.

What SFT is *not* claiming:

- Not that "a scalar field is the only thing that exists." The scalar is a **descriptor**; the **distortion is the ontic entity**.
- Not that discretization creates the physics. The lattice is a **numerical scaffold**; the physics is the **phenomenon**, which admits a continuum limit.
- Not that we assume the Standard Model by fiat. **Standard features** (charges, spectra, couplings) **must emerge** as constraints of tensional compatibility and topology.

The corpus adopts a single-pass calibration (α-in) and propagates the same parameter set through all staged validations. Each runner produces: (I) compact JSON with thresholds and verdicts; (II) SHA-256 manifests (including self-hash); (III) seed provenance. This design minimizes degrees of freedom and maximizes external auditability.

Abstract

We present Structural Field Theory (SFT), a unified discrete–continuous framework in which quantum and relativistic phenomena emerge from the dynamics of a single ***underlying phenomenon****—the microscopic tensional distortion of a structural medium—****modeled*** *via a scalar structural field.* In this formulation, space is modeled as an elastic lattice supporting solitonic excitations, collapse processes, and long-range stress gradients that mimic fundamental particles and interactions. The framework is calibrated using the fine-structure constant (α, treated as input), while all other quantities arise from internal consistency and numerical evolution.

We report quantitative validations across multiple physical domains. At the microscopic scale, simulations reproduce electron-like soliton signatures, g-factor (2.003 ± 0.004) (P), Coulomb's law, and the spin-½ signature via both Finkelstein–Rubinstein 2π phase inversion and rigid-rotor j(j+1) spectra ($R^2 \geq 0.99$). Radial solvers recover hydrogen and tritium energy levels with meV-level isotope shifts. At macroscopic scales, the theory reproduces classical relativistic tests: Mercury's perihelion (≈43″/century) and Venus' perihelion advance $\Delta\varpi$ (8.625 ± 0.020 ″/century), both in agreement with General Relativity, as well as PPN parameters. Synthetic and real pipelines are provided for reproducibility, including CPU-only smoke tests, GPU-based solvers, and Docker environments with complete provenance, manifests, and SHA-256 checksums.

We also outline SFT's present limitations (incomplete embedding of the full Standard Model content; possible discretization artifacts; and reliance on an α-in calibration discipline) and we state falsifiable predictions: (I) high-k modified dispersion (stringent tests of Lorentz invariance), (II) sub-mm Yukawa-like deviations in gravity, (III) cosmic birefringence, and (IV) the onset of nonlinear Breit–Wheeler pair production mapped in strong-field parameters (a_0, χ_γ) rather than a single intensity threshold. Together, these results establish SFT as a reproducible, falsifiable program that bridges lattice field simulations with quantum and relativistic observables.
We report $\beta = 1.000 \pm 1.0\times10^{-4}$ and $\gamma = 1.000 \pm 1.0\times10^{-4}$ (95% CI), consistent with GR; see procedure in Doc 4.

Language guardrail: mark figures/tables as (C) calibrated or (P) prediction; α is treated as input (α-in); **Naming guardrail:** use `alpha_like` for CI/synthetic estimator metrics (Doc 10.1) and `alpha_out` for the non-circular composition pipeline (Doc 10); β, γ are reserved for PPN; the structural potential uses {α_V, λ_4, λ_6}.

> "The reader should keep in mind that all physical phenomena addressed in this corpus—from the electron's g-factor to Mercury's perihelion precession, including quantum interference and structural collapse—are not postulated as separate entities. They are local expressions of a single phenomenon: the tensional distortion of the structural medium, **tracked by the scalar descriptor** S(**r**,t). This distortion, through its geometry and dynamics, gives rise to what we conventionally call mass, spin, charge, gravity, or time. **We**

do not postulate multiple fundamental forces; there is one medium and one dynamics whose compatible modes **manifest as** different forces.”

—

Observed Phenomenon	Structural Manifestation of S
Mass	Local tensional density
Spin	Helicoidal geometry of S
Electric charge	Structural asymmetry in collapse
Gravity	Sum of tensions across the mesh
Time	Structural frequency
Quantum interference	Tensional superposition

> “The stability of a configuration is not intrinsic to the object, but emerges from its tensional compatibility with the medium.”

—Document 0: Orientation and Structure of the SFT Corpus

Cross-links: DSM → 2_SFT_Discrete Structural Model (DSM); PPN Summary → 4_Quick_Summary_with_figures_with_PPN_integration.docx; Simulation Supplement → 3_SFT_Simulation_Supplement.

This introductory note provides readers and reviewers with a roadmap of the complete Structural Field Theory (SFT) package. The corpus is intentionally modular: each component addresses a different layer of the framework, from theoretical foundations to numerical validation and reproducibility infrastructure.

- Core Foundations (Docs 1–2): Glossary and discrete structural model, defining notation, calibration policy (α-in), and the basic lattice dynamics.
- Simulation Supplement (Doc 3): Numerical schemes (leap-frog, AMR, CFL stability), collapse protocols, and first-principle simulations of electron-like solitons, double-slit behavior, and Coulomb interaction.
- Quick Summary / Draft Paper (Doc 4): Condensed manuscript presenting headline results (g-factor, perihelion shift, PPN compatibility).
- Integrated Technical Report (Doc 5): Comprehensive reference unifying notation, derivations, validation checklists, and reproducible protocols.

- Validation Appendices (Docs 6–7): Synthetic convergence tests (EOC), radial hydrogen/tritium solvers, and Venus perihelion overlays.
- Limitations and Validation Plan (Doc 8): Scope discipline + preregistered acceptance bands and reviewer checklist, with explicit (C)/(P) labeling to prevent claim inflation; includes External Break Test #01 (field rescaling) as a Doc9/Doc10.1-style anti-post-hoc audit protocol.
- Reviewer Argument (Doc 9): A concise statement addressing common objections (α tuning, discretization, scope).
- Bundles and Pipelines (ZIPs): Unified release with Docker, configs, scripts, datasets, and fallback smoke tests for CPU-only environments.
- Spin Packages: Independent validation of spin-½ signatures via FR phase and rigid-rotor spectra.
- Reviewer Quick Start: A 5-minute guide enabling reviewers to reproduce core results with minimal setup.

Readers should therefore expect: (I) a coherent theoretical proposal; (II) quantitative results spanning atomic to orbital scales; (III) a reproducible software and data ecosystem; and (IV) an explicit plan for validation and falsification. This orientation document ("Doc 0") should be read first, before proceeding to the technical reports.

Addendum — Consistency Notes

• We use $\boldsymbol{\varphi \equiv U/c^2}$ (dimensionless) and $\mathbf{S \equiv -U}$ as consistent notation across the corpus.

• Convention: **Δϖ_Venus = 8.625±0.020″/century** (golden path); all reported figures are harmonized to this value.

• Tagging (C)/(P): example — **Δϖ of Venus (C); CMB birefringence (P).**

Quick Verify — Where is each claim checked?

• Electron g-factor → Docs 5 and 7 (artifacts and SHA-256).

• PPN (β, γ) and Venus perihelion → Docs 4 and 7 (PPN_RESULTS.json).

• $H/^3H$ (radial a.u.) → Doc 7 (Table E, virial, normalization).

• Reproducibility (EOC/CI, energy/continuity) → Docs 6 and 5 (ENERGY_REPORT.json).

• Double slit (phase and visibility) → Doc 7 (manifest + traces).

Ontological scale — one grid for micro & macro

• Δx is a numerical regulator, not a physical grain. SI units come from a single-pass calibration of {q^*, $\hbar^*$, ε^*, μ^*} (α-in), and the same Lagrangian governs both regimes.

• We report scale-invariant, locally extracted coefficients (e.g., PPN $\gamma=c1/a1$, $\beta=1+a2/a1^2$) and dimensionless ratios (e.g., g-factor). These do not depend on the absolute cell size as long as $ak \ll 1$ (continuum regime).

• Multiscale arises from intrinsic field lengths (core size, Yukawa tail, etc.), not from Δx. AMR increases dynamic range but does not retune physics.

• We decouple numerics from physics via dispersion fits ($\omega/(ck)=1+\xi(ak)^2+\ldots$), EOC/GCI across 3 grids (target $p\approx2$), and energy/continuity budgets (with a collapse ledger when freezing is active). Observables are quoted only once grid-independence is reached.

Thermal decoherence — what we test

• Phase dynamics under a thermal bath is modeled by a Langevin process with FDT: $\mathrm{Var}[\varphi](t)=2D\theta\, t$, $D\theta\propto\gamma\, k_B\, T/\hbar^*$. Visibility decays as $V=\exp[-D\theta(T)\, t]$.

• At fixed grid, ln V is linear in T and in path length/time-of-flight; at fixed T, V is grid-independent in the converged regime. This cleanly separates physics (T) from numerics (Δx).

• Artifacts: DECOHERENCE.json (T, γ, $\hbar^*$, V, CI, seed, SHA-256), plus the usual ENERGY_REPORT.json to certify conservation/continuity. Suggested gates: slope_T>0 for ln V vs T; mesh-independence at fixed T.

RC Table — additions (for reviewers)

• Mesh scaling & dispersion → Docs 5–6 (dispersion fits with $\xi\approx-1/12$; EOC/GCI $p\approx2$; ENERGY_REPORT.json).

• Thermal decoherence → Doc 7 (Appendix—Decoherence) with DECOHERENCE.json and figures ln V vs T and length.

Master Index — Extended (Docs 10–14)

10 — Appendix A-OUT (v0.3): Alpha-Out (non-circular)

1. Purpose: Estimate α without using α in calibration. CPU-friendly pipeline: c (dispersion, small-k) → $\hbar^*$ (rotor) → {q^*, ε^*} (Coulomb) → $\hat{\alpha}$ with uncertainty.
2. Inputs → Outputs: dispersion.csv, rotor_energy.json, coulomb_profile.csv → ALPHA_OUT.json (value, u95, tier) + HBAR_FROM_ROTOR.json, Q_EPS_SOLUTION.json.

3. Tiers/Gates: Tier-1 (1%), Tier-2 (100 ppm), Tier-3 (1e-5–1e-6). Saves small-k indices, robust fit method, and full provenance (commit, versions, hashes).
4. Status: Reviewer-ready (appendix-only; not part of the core RC).
5. ZIP runner: alpha_out_runner_pack.zip (README, MANIFEST, verify.py, checksums).

11 — One-Pager: Designed Matter via Tensional Compatibility (SFT)

6. Purpose: One-page landing for reviewers/collaborators/sponsors: thesis, what you get, how to verify (ZIP + JSON + PASS/FAIL).
7. Contents: Tagline; "Who is this for / What you get"; runners with uniform primary gates; output routes (REGION provided vs. synthesized from SCAN + thresholds); mini-JSON examples with schema_version; roadmap with clear "done" criteria.
8. Relations: Links to runner packs, the master validation table, and Appendix A-OUT for anti-circularity.
9. Status: Ready to share.

12 — Dialogue (English)

10. Purpose: Plain-language narrative of the SFT stance (compatibility of the medium), aligned with the RC: preserves SM predictions, reframes mechanism.
11. Reviewer hooks: Adds falsifiability pointers (dispersion O((ak)^2), sub-mm Yukawa, null optics, existence scans) and directs to runner packs for PASS/FAIL evidence.
12. Use: Executive/explanatory; no numeric claims beyond what the RC and runners certify.

13 — atomX: Step-by-Step Recipe (PASS-ready, amended v1)

13. Purpose: Worked example of an existence runner with reproducible thresholds and non-circular verdicts (natural vs maintained).
14. Gates: split_thr=0.19 meV, compat_thr=0.02, r2_thr=0.98; natural requires PASS without controls; maintained requires ablation FAIL when removing controls.
15. Artifacts: EXISTENCE_REPORT_atomX.json, EXISTENCE_REGION_atomX.json, synthetic_atom_scan.csv, checksums_SHA256.txt (schema-validated JSON; NaN/Inf→null).
16. ZIP runner: includes verify_atomX.py (schema check, region rebuild from CSV, PASS mask match, checksum verification).

14 — Capstone (Unified v6c)

17. Purpose: Consolidated code/standards manual for reviewers: JSON policy (schema_version, sanitize), MANIFEST policy (checksums with self-hash), helpers (json_sanitize, thresholds.propagate_thresholds, verdicts.compute_verdict, lifetime.tau_with_ci, units.provenance_scale_setting), and runners v1.0.3 (leptons, quarkonia, CKM, strong nulls, jitter, LOO).
18. External validation: CSV schemas, copy/paste commands, and reminders of α-in discipline (see atomX recipe).

19. Note: make_region_from_scan must rebuild PASS mask from the scan CSV using declared thresholds (placeholder noted in comments), (see atomX for reference).

10.1 — Appendix: Alpha-Elasticity CI Suite (Synthetic Verification Protocol)

20. **Purpose:** Verification-first CI protocol for an **alpha-like estimator** under synthetic inputs. Validates auditability (hashes/manifests), preregistered gates (gate_id + DECISION_RULE.json), anti-leakage discipline, and explicit null/adversarial failure modes. Includes a compact "toy visualization" companion to demonstrate the PASS/FAIL workflow and artifact contract.

21. **Outputs:** ALPHA_ELASTICITY_REPORT.json (GLOBAL_PASS + provenance), DECISION_RULE.json (hashed), MANIFEST_SHA256 / checksums, optional plots (e.g., sensitivity_sweep).

22. **Status:** CI / Synthetic (appendix-only). **Not** a physical validation of α; complements Doc 10 (Alpha-Out) by enforcing preregistered-gate discipline and audit semantics for alpha-like pipelines.

Cross-References — How to Read (Additions)

23. (→ Doc 10) Questions about predicting α without circularity: see Appendix A-OUT (Doc 10). Results live in ALPHA_OUT.json with uncertainty tiers; appendix-only (not part of the core RC).
24. (→ Docs 11–14) For a one-page overview and the review/implementation toolkit, see One-Pager (Doc 11); for pedagogical narrative see Dialogue (Doc 12); for a worked runner see atomX (Doc 13); for standards and code policy see Capstone (Doc 14).
25. (→ Doc 10.1) For the CI/synthetic verification protocol of an **alpha-like estimator** (preregistered gates, decision rule hashing, null/adversarial controls, and artifact contract): see **Doc 10.1**. This is a methodology/audit appendix and should not be interpreted as physical validation of α.

Quick Verify — Additional Pointers

26. Alpha-Out (non-circular) → Doc 10 (ALPHA_OUT.json, provenance + tiers).
27. Existence runner (atomX) → Doc 13 (EXISTENCE_REPORT/REGION; region rebuilt from CSV in verify_atomX.py).
28. Standards & MANIFEST policy → Doc 14 (JSON sanitize, schema_version, checksums with self-hash).
29. **Alpha-Elasticity CI suite (synthetic) → Doc 10.1** (ALPHA_ELASTICITY_REPORT.json + DECISION_RULE.json + decision_rule_sha256 + manifest/checksums; includes null/adversarial PASS/FAIL gates).

Consistency Notes (Additions)

30. Manifest name & format: use checksums_SHA256.txt with lines 'HASH ␠ RELATIVE_PATH', plus a final self-hash line for the manifest itself.
31. Schema discipline: every new JSON includes schema_version and passes schema validation (CI blocks otherwise).

Value of the Document

This text is not a final answer, but it is an honest, structured, and falsifiable one. It acknowledges conceptual tensions, documents them, and proposes an empirical path to resolve them: GPU simulations capable of distinguishing between genuine unification and numerical artifact.

Structural Field Theory. Complete theory, documents and runners at: https://github.com/Xaquer69/sft-theory-and-runners

https://doi.org/10.5281/zenodo.17608314