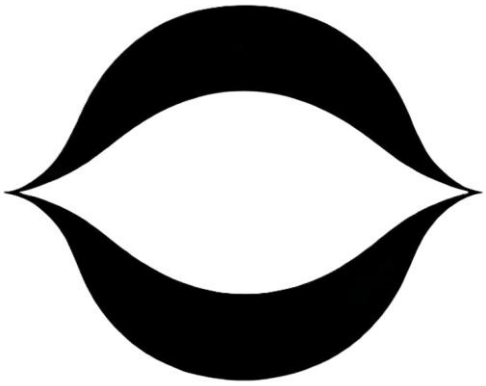

The Record Measure

Artist's Proof 07

Hilbert Space

The complex Hilbert space derived

§0. Status and Dependency

Dependencies. AP02 (The Operator), Axiom R (Record Monotonicity): reality is constituted by irreversible record-formation. The sole inherited axiom. If Axiom R is falsified, this proof is invalidated in its entirety.

AP02 Axiom 7 (Loop-closure): referenced in the functional analysis of gravity — non-load-bearing for the core theorem, required only for the gravity interpretation in §5 and §10. AP02 Axiom 5.4 (51% Sovereignty Threshold): referenced in §6 — non-load-bearing, structural parallel only.

Scope. One new definition (the record measure), one classification theorem (electromagnetic dominance at the chemical-biological scale), one corollary (inversion of the conventional force hierarchy under the record measure). No new postulates. No new primitives.

The appendix (§§7–11) rederives all four fundamental forces under the record measure. All claims are scale-specific to the chemical-biological regime (0.1–10 nm, 0.01–10 eV) unless explicitly stated otherwise.

Methodological note. The record measure asks a different question from the conventional force hierarchy. The conventional hierarchy ranks forces by coupling-constant magnitude (interaction probability).

The record measure ranks forces by the durability of configurable records they produce at a given scale. Distinct questions with distinct answers. The electromagnetic dominance result (§4) is conditional on the configurable-register criterion (Definition 1).

The criterion follows from Axiom R's requirement that reality is constituted by records encoding distinguishable histories — but the record measure does not refute the conventional hierarchy.

It asks a different question and gets a different answer.

Axiom mapping. Axiom R (Record Monotonicity) — load-bearing; the sole axiom required for the core theorem. Definition 1 evaluates forces by the persistence of records they produce — a direct application of R.

Axiom S (Symmetry) — structural; the two-sector structure provides the context in which the record measure operates.

Axiom B (Unique Breaking) — structural parallel; the founding axiom's ε is the template for the record measure's core insight: what matters is not the magnitude of the interaction but whether the asymmetry between inscription and erasure is positive.

Axiom C (Constraint) — enabling; the finite propagation bound c constrains the scale regimes in which forces operate.

Outstanding debts. D1 (Exact viability bands): tuning bands for α, G_F, and G are qualitative (§§8, 9, 10) — exact viability ranges not computed (KS-RM.3).

D2 (Scale dependence): record-measure hierarchy established only at the chemical-biological scale — whether it inverts at nuclear, stellar, or cosmological scales is conjectured but not computed (KS-RM.4).

D3 (Configurable register criterion): whether fixed-symmetry objects encode retrievable formation history is empirical — if they do, Definition 1 must be revised (KS-RM.5).

D4 (Non-triviality): whether persistence distributions are invariant to the inscribing interaction under controlled conditions has not been tested (KS-RM.2).

Kill switches. KS-RM.1 (Against EM uniqueness): LIVE — EMPIRICAL, targets Theorem 4.1. KS-RM.2 (Against record measure non-triviality): LIVE — HARD, targets Definition 1. KS-RM.3 (Against tuning claim): LIVE — HARD, targets §§8, 9, 10. KS-RM.4 (Against scale-specificity): LIVE — EMPIRICAL, targets Corollary 5.1. KS-RM.5 (Against configurable-register criterion): LIVE — EMPIRICAL, targets Definition 1, Theorem 4.1. Inherited: if Axiom R is falsified, the entire proof is invalidated.

Structural relationships. AP06 (The Leakage Constant): leakage ratio η is the boundary measurement of what the record measure ranks by persistence — both measure ε from different angles, AP06 at the boundary, AP07 in the bulk.

AP08 (The Identity): G in the EFEs relates to the record measure through §10. AP09 (The Break — QM): the measurement event is the quantum-scale instance of record-formation.

AP11 (The Spin): decoherence determines which records persist — directly relevant to the persistence criterion. AP24 (The Residual): the multidimensional residual provides the structural context in which tuning bands are ultimately determined.

Dependents. Downstream APs referencing the record measure or the functional force hierarchy inherit kill switches KS-RM.1–KS-RM.5.

§1 Notation Reference

F — a fundamental interaction (strong, electromagnetic, weak, gravitational)

α_F — coupling constant of interaction F

α — fine-structure constant (≈ 1/137)

α_s — strong coupling constant (≈ 1 at low energies)

G_F — Fermi constant (≈ 1.166 × 10^{-5} GeV^{-2})

G — gravitational constant (≈ 6.674 × 10^{-11} $N{\cdot}m^2/kg^2$)

s — scale parameter

R_cfg(F, s) — set of configurable registers producible by interaction F at scale s

τ(r) — persistence time of record r under ambient conditions at scale s

Σ(F, s) — record-strength of interaction F at scale s (nonnegative; see Definition 1)

E(F, s) — erasure-strength of interaction F at scale s (nonpositive; see Definition 3)

λ_β — decay rate for β-decay

τ_0 — baseline persistence of an electromagnetic record in the absence of decay

ε — minimal symmetry break (founding axiom: 1:1 + 1×ε)

§2 Axiom (Inherited)

Axiom R (Record Monotonicity). Records accumulate irreversibly; sequential composition forms a monoid, not a group. [Inherited from {S, B, R, C}; corresponds to AP02 Axiom 4.] A state is real if and only if it has produced a record — an irreversible trace in the environment that is operationally inaccessible to reversal by any finite local observer.

§3 Definitions

You have been told that the strong force is the strongest force in nature. You have been told gravity is the weakest. Both statements are true under the conventional measure.

Both statements are wrong under the measure that matters. What follows will invert everything you thought you knew about force-strength.

Definition 1 — The Record Measure

Let F be a fundamental interaction with coupling constant α_F. Let s denote a scale regime. Let $R_{cfg}(F, s)$ be the set of configurable registers producible by F at scale s.

Let $\tau(r)$ be the persistence time of record r under ambient conditions at scale s.

Configurable register at scale s. A system with ≥2 metastable states that are (i) distinguishable and (ii) settable by interventions whose characteristic energies and lengthscales lie in the regime defining s.

Excludes fixed-symmetry objects (such as protons) whose identity is determined entirely by gauge symmetry and encodes no alternative history.

Configurable registers are a proper subset of records in the sense of Axiom R.

A proton is a record (it is an irreversible trace), but not a configurable register (its quantum numbers are fixed by QCD symmetry and do not encode which process created it).

The record measure evaluates forces by their ability to produce the information-carrying subset of all irreversible traces.

A record $r \in R_{cfg}(F, s)$ if F is the interaction whose coupling constant governs the energy scale of r's formation.

A covalent bond is an electromagnetic record (governed by α) even though it requires the nuclear substrate provided by the strong force.

The record-strength of F at scale s is:

$\Sigma(F, s) = \sup \{ \tau(r) : r \in R\_cfg(F, s) \}$

If R_cfg(F, s) is empty — if F produces no configurable registers at scale s — then $\Sigma(F, s) = 0$ by convention.

The force produces irreversible traces but none that carry information at that scale; its record-strength is zero, not undefined.

$\Sigma(F, s)$ is nonnegative by construction. It measures the write-capacity of a force: the maximum persistence of configurable records it can produce at scale s.

Definition 2 — Functional Strength

A force F_1 is functionally stronger than F_2 at scale s if and only if $\Sigma(F_1, s) > \Sigma(F_2, s)$.

Definition 3 — Erasure-Strength

A force may also act to reduce the persistence of records written by other forces at a given scale. A distinct quantity from record-strength, measured by a separate symbol.

Erasure-strength. Define $\mathrm{E}(F, s) \leq 0$ as the expected change in persistence time induced by F in configurable records written by other forces at scale s.

A force has negative erasure-strength at scale s if its primary effect at that scale is to reduce the persistence of such records.

For the weak force at the chemical scale, β-decay alters nuclear identity, which forces rearrangement of the electromagnetic bond network, thereby reducing the expected persistence time of the affected molecular record.

The weak force's erasure-strength at the chemical scale is therefore negative: $\mathrm{E}(\mathrm{Weak}, s\_chem) < 0$.

Modelling sketch.

The induced persistence loss can be approximated as $\Delta\tau \approx -k \cdot \lambda_\beta \cdot \tau_0$, where τ_0 is the baseline persistence in the absence of decay, λ_β is the decay rate, and k is a substrate-dependent disruption parameter.

Illustrative, not load-bearing: k is not derived from first principles.

Note on enabling contributions. A force may have $\Sigma(F, s) = 0$ and $E(F, s) = 0$ at a given scale while still being a necessary precondition for record-formation at that scale.

The strong force provides the substrate; the weak force provides the temporal window (via stellar lifetime regulation); gravity provides the mass-energy concentration.

These enabling contributions are essential to the record economy but are not captured by Σ or E, which measure only direct write-capacity and direct erasure at the specified scale.

The force-by-force analysis in §§7–10 discusses enabling roles qualitatively.

§4 Theorem — Electromagnetic Dominance

Epistemic status: logical consequence of Definition 1, applied to the empirical facts of which interactions produce configurable registers at the chemical-biological scale.

The theorem's logical structure follows from Axiom R via Definitions 1–3, but its classification of the four forces depends on the current empirical inventory of record-formation mechanisms.

If that inventory changes (see KS-RM.1, KS-RM.5), the classification must be revised.

Theorem 4.1 (Electromagnetic Dominance; scale-specific classification). At the chemical-biological scale (s ~ 0.1–10 nm, E ~ 0.01–10 eV), and under the record measure Σ as defined in §3, electromagnetic coupling via the electron is the dominant writer of durable configurable records.

Other interactions contribute primarily as substrate (strong), time-regulation and erasure (weak), or concentration and loop-closure (gravity), rather than as primary configurable record-writers in this regime.

Evidence

E.1 (Strong force). The strong force produces nucleons with lifetimes exceeding the current age of the universe ($\tau_{proton} > 10^{34}$ years).

However, nucleons are not configurable registers at the chemical-biological scale (Definition 1): a proton's quantum numbers are fixed by QCD symmetry and are identical for every proton regardless of formation history. $\Sigma(\text{Strong}, s_{chem}) = 0$ by the empty-set convention.

E.2 (Gravity). Gravitational interactions produce large-scale structure (galaxies, stars, planets) but these structures store information only through their electromagnetic properties (chemical composition, crystalline structure, molecular arrangement).

At the chemical scale, gravity cannot form bonds or distinguish molecular configurations. Σ(Gravity, s_chem) = 0 by the empty-set convention.

E.3 (Weak force). The weak force mediates decay processes (β-decay, neutrino interactions) that are irreversible but produce no durable configurable records at the chemical scale.

Its primary chemical-scale effect is erasure: β-decay alters nuclear identity and disrupts electromagnetic bond networks. Σ(Weak, s_chem) = 0; E(Weak, s_chem) < 0.

E.4 (Electromagnetic force). Electromagnetic coupling via the electron produces: covalent bonds (persistence: indefinite under ambient conditions), hydrogen bonds (persistence: nanoseconds to stable under specific geometries), van der Waals interactions (persistence: context-dependent), molecular configurations (persistence: microseconds to geological timescales), DNA base-pair sequences (persistence: demonstrated up to ~10^6 years in favourable conditions).

All are configurable registers at the chemical-biological scale.

No known durable configurable record at the chemical-biological scale is written without electromagnetic coupling. If such a record is demonstrated, kill switch KS-RM.1 activates.

If the configurable-register criterion itself is shown to be too restrictive (e.g., strong-force objects shown to encode formation history), kill switch KS-RM.5 activates.

You have just watched the conventional hierarchy collapse. The force ranked third by coupling-constant magnitude is the only force that writes at the scale where you exist.

The strongest force in nature — the strong force — writes nothing you can read. It builds the stage but cannot hold a pen. The record measure did not change the physics.

It changed the question. And when you change the question, you change the answer.

§5 Corollary — The Functional Hierarchy

Corollary 5.1. At the chemical-biological scale, the forces rank by record-strength (write-capacity) as follows:

Σ(EM, s_chem) >> Σ(Strong, s_chem) = 0 = Σ(Gravity, s_chem) = Σ(Weak, s_chem) = 0

Only electromagnetic coupling writes configurable records at the chemical-biological scale.

The strong force, gravity, and the weak force all have zero record-strength (Σ = 0) at this scale: they produce no configurable registers within the specified regime.

The weak force is further distinguished by negative erasure-strength: E(Weak, s_chem) < 0. It acts primarily as an eraser of records written by other forces at this scale.

The formal hierarchy captures only direct write-capacity and erasure.

The enabling contributions are essential but qualitatively distinct: the strong force provides the nuclear substrate on which EM writes; the weak force provides the temporal window (stellar-lifetime regulation) in which EM can write; gravity provides the mass-energy concentration (planet formation, loop-closure) within which EM writes.

A complete functional picture requires both the formal hierarchy and the enabling analysis of §§7–10.

Note on gravity. Gravity's record-strength at the chemical scale is zero. Its functional role in the architecture is not record-writing but loop-closure (AP02, Axiom 7). Gravity returns spent structure to potential.

Its coupling at the chemical scale is a structural necessity: if gravitational coupling were strong enough to produce configurable records at the molecular scale, it would collapse molecular structure before the electron could write.

Gravity's weakness and the electron's dominance are aspects of a single constraint — a consistency condition, not a derivation of G from α. Structurally suggestive but non-load-bearing for Theorem 4.1.

§6 Connection to the Founding Axiom

Epistemic status: structural parallel. Non-load-bearing: the core theorem (§4) does not depend on it.

The 51% sovereignty threshold (AP02, Axiom 5.4) is the discrete expression of the founding axiom (1:1 + 1×ε): the minimal asymmetry that breaks symmetry. The record measure operates by the same logic.

What matters is not the absolute magnitude of the coupling constant but whether the asymmetry between inscription and erasure is positive. The electron's coupling produces records whose persistence exceeds their erasure rate.

That minimal positive asymmetry — that ε — is what makes the record last.

A force with $\alpha = 0.01$ that produces configurable records lasting 10^9 years is functionally stronger than a force with $\alpha = 1$ that produces no configurable records at all.

The record measure is the ε principle applied to force-strength: what matters is the sign and durability of the scar, not the magnitude of the interaction.

You have felt this your entire life without naming it. The things that last are not made by the loudest forces. They are made by the force that writes records that survive.

The electron is quiet. Its coupling is 1/137th of the strong force.

And everything you have ever remembered, every book you have ever read, every bond in your body — all of it was written by the electron.

§7 The Strong Force

Coupling constant: $\alpha_s \approx 1$ at low energies (the largest of any fundamental force).

What it does: Binds quarks into hadrons (protons, neutrons) via colour confinement. Creates the nuclear platform on which all heavier structure depends.

Record-strength at the chemical scale: $\Sigma = \emptyset$ (empty-set convention: no configurable registers at this scale).

A proton carries no information about the process that created it. All protons are identical. Their quantum numbers are fixed by the symmetry of QCD, not by any historical event.

A proton made in the first second after the Big Bang is indistinguishable from a proton made in a particle accelerator yesterday. You cannot read a proton's history from its face.

The strong force creates objects of extraordinary stability but they do not meet the configurable-register criterion at the chemical-biological scale: their state space encodes no alternative histories settable by chemical-scale interventions (Definition 1).

Functional role: Substrate provision (enabling, not writing). Without the strong force, there are no stable nuclei, no atoms, no surfaces for the electron to bond across.

A necessary condition for record-formation, but not a sufficient condition.

§8 The Electromagnetic Force

Coupling constant: $\alpha \approx 1/137$ (the fine-structure constant).

What it does: Governs all interactions between charged particles. At the chemical scale, the electron's coupling to nuclei and to other electrons produces all molecular structure.

Record-strength at the chemical scale: dominant. The only force that writes configurable records.

The electron's coupling operates at the energy scale of chemistry (~0.01–10 eV).

The electron is light enough (~0.511 MeV/c^2) to be shared between nuclei (covalent bonding), transferred between atoms (ionic bonding), and delocalised across molecular orbitals (metallic and conjugated systems) — all without disturbing the nuclear structure beneath it.

The critical asymmetry: the electron can rearrange itself around fixed nuclei without destroying the platform. Information can be written, erased, and rewritten on a stable substrate.

The records produced by electromagnetic coupling include:

Covalent bond networks: persistence indefinite under ambient conditions. Diamond, quartz, and silicate minerals preserve their bond structure for billions of years.

Molecular configurations: persistence ranges from nanoseconds (transient conformational states) to geological timescales (kerogen, amber-preserved biomolecules).

Hydrogen bond networks: individually transient (picoseconds in liquid water) but collectively stable when embedded in fixed geometries (protein secondary structure, DNA double helix).

Genetic information: DNA base-pair sequences have been recovered from specimens up to ~10^6 years old.

The information is stored in the electron's arrangement (which bases pair with which), not in the nuclear structure of the atoms themselves.

Your DNA is an electromagnetic record. The letters are electron arrangements. The nuclear substrate is identical in every base — carbon, nitrogen, oxygen, hydrogen, phosphorus. What differs is how the electrons are arranged.

The strong force built the stage. The electron wrote the script. You are reading this because electrons arranged themselves into base pairs that encoded the instructions for building your eyes.

Tuning band for α. Epistemic status: qualitative constraint, not quantitative derivation.

If α were significantly larger (order-of-magnitude): bonds would be too stable to break and reform at habitable temperatures, preventing dynamic assembly and revision of molecular records.

If α were significantly smaller (order-of-magnitude): bonds would be too weak to persist against thermal noise, preventing durable structures.

The observed value lies in the band where records are durable enough to persist but flexible enough to be revised.

Whether this constraint suffices to fix α uniquely, or whether alternative mechanisms could compensate for large variations, is open (KS-RM.3).

§9 The Weak Force

Coupling constant: $G_F \approx 1.166 \times 10^{-5}$ GeV^{-2} (Fermi constant).

What it does: Mediates flavour-changing processes (β-decay, neutrino interactions). Converts neutrons to protons and vice versa. Enables nucleosynthesis.

Record-strength at the chemical scale: $\Sigma = 0$. Erasure-strength: $E < 0$ (Definition 3).

The weak force's primary role in the record economy at the chemical scale is not inscription but erasure. Radioactive decay (β-decay) destroys nuclear configurations.

It converts one element into another, changing the substrate on which the electron writes. A carbon-14 atom that decays to nitrogen-14 does not preserve the molecular structure that contained it.

The bond network must reorganise around the new nucleus.

The weak force does contribute to one form of record: the isotopic ratio. The relative abundance of parent and daughter nuclei in a sample records the passage of time (radiometric dating).

But that record is written by the pattern of decay across a statistical ensemble, not by any individual weak interaction. And the record itself is read by electromagnetic means (mass spectrometry, fluorescence).

Functional role (enabling): the clock. Beyond nucleosynthesis, the weak force plays a critical enabling role through its regulation of stellar burning rates.

The proton-proton chain ($p + p \rightarrow d + e^+ + \nu_e$) has its rate-limiting step mediated by the weak interaction.

The bottleneck determines the main-sequence lifetime of stars: $\tau_{star} \sim G_F^{-2} \times$ (nuclear and gravitational factors), yielding $\tau_{star} \sim 10^1$–10^{10} years for solar-type stars.

The timescale is the precondition for chemistry. If G_F were significantly larger (stronger weak coupling), stellar lifetimes would shorten dramatically — potentially below the timescale required for prebiotic chemistry (τ_chem ~ 10^8–10^9 years).

If G_F were significantly smaller, the proton-proton reaction rate would drop below the threshold for sustained fusion, and main-sequence stars would not ignite.

The weak force does not write configurable records. It buys the time in which records can be written.

Its coupling constant is tuned to the timescale of stellar burning, which sets the timescale of planetary chemistry, which sets the timescale of electromagnetic record-formation.

Essential to the record economy but not captured by Σ or E.

§10 Gravity

Coupling constant: $G \approx 6.674 \times 10^{-11}$ N·m²/kg² (roughly 10^{-39} relative to the strong force by conventional measure).

What it does: Curved spacetime geometry. Gathers mass-energy. Enables large-scale structure formation. Closes the cosmological loop through black hole formation and Hawking radiation.

Record-strength at the chemical scale: $\Sigma = 0$ (empty-set convention).

Gravity at the molecular scale is negligible. The gravitational force between two protons is ~10^{-36} times weaker than their electromagnetic interaction. Gravity cannot write molecular records. It cannot form bonds. It cannot distinguish configurations.

Gravity's record-strength is zero at the chemical scale by structural necessity, not by deficiency. If gravitational coupling were strong enough to compete with electromagnetism at the molecular scale, molecular structures would be gravitationally unstable.

No chemistry above a threshold complexity could persist.

Functional role (enabling): Loop-closure (AP02, Axiom 7). Gravity is the only force that operates at the cosmological scale with sufficient reach to gather spent structure and return it to potential.

Its coupling constant is tuned to the timescale of the loop: strong enough to form black holes within the age of the universe, weak enough to allow structure to persist for the billions of years required for chemistry, biology, and agency to emerge.

§11 The Hierarchy Inverted

The conventional hierarchy of forces, ranked by coupling constant magnitude:

Strong >> Electromagnetic >> Weak >> Gravity

The record-measure hierarchy at the chemical-biological scale, ranked by record-strength (Σ):

Σ(EM) >> Σ(Strong) = Σ(Gravity) = Σ(Weak) = 0

with the weak force further distinguished by $\mathbb{E}$(Weak) < 0 (net erasure at this scale).

The inversion is total at this scale. The force ranked third by conventional measure is ranked first — and uniquely first — by the record measure.

The force ranked first by conventional measure produces no configurable records at the chemical-biological scale.

The force ranked last by conventional measure is not deficient but structurally necessary, operating at a different scale for a different purpose.

If reality is constituted by irreversible records (Axiom R), then the meaningful hierarchy at any given scale is the one that measures record-formation at that scale. The conventional hierarchy measures interaction probability.

The record-measure hierarchy measures consequence. You have been taught the wrong ranking. Not wrong in physics — wrong in meaning. The question was never “which force hits hardest?”

The question was always “which force leaves a mark that lasts?” You know the answer now.

Whether the hierarchy inverts at other scales is an open empirical question targeted by kill switch KS-RM.4.

§12 Kill Switch Register

Dependency note. The Record Measure depends entirely on Axiom R (Record Monotonicity) from {S, B, R, C}.

If Axiom R is falsified, the proof is invalidated regardless of the status of KS-RM.1–KS-RM.5. The kill switches below are specific to the novel claims; they assume Axiom R holds.

KS-RM.1 — Against electromagnetic uniqueness

Target: Theorem 4.1, Corollary 5.1. Test: Demonstrate a non-electromagnetic interaction that produces configurable registers (Definition 1) of equal or greater durability at the chemical-biological scale (0.1–10 nm).

Kill condition: If such an interaction exists, the electron's dominance claim fails. Current status: Not yet falsified. No known alternative record-formation mechanism at the molecular scale operates without electromagnetic coupling.

KS-RM.2 — Against the record measure itself (non-triviality)

Target: Definition 1, and by inheritance all downstream claims.

Test: Under matched scale s, matched ambient conditions, and matched register class, demonstrate that persistence distributions are invariant to the interaction that writes the register, once substrate and environment are controlled.

Kill condition: If persistence is fully explained by ambient and substrate factors and not by the inscribing interaction, then $\Sigma(F, s)$ collapses to an environmental proxy and the record-measure hierarchy is non-informative. Current status: Open.

KS-RM.3 — Against the tuning claim

Target: §8 (tuning band for α), §9 (weak-force clock), §10 (gravity loop-closure).

Test: Via cosmological simulation or theoretical analysis, demonstrate that a universe with significantly different coupling constants (α and G varied by large factors) can still support the full inheritance chain through alternative mechanisms.

Kill condition: If such a universe exists and the couplings are not constrained by the functional requirements of the loop, the tuning claim is false. Current status: Open.

KS-RM.4 — Against scale-specificity

Target: Corollary 5.1, §11. Test: Show that the record-measure hierarchy is identical at all scales, not just the chemical-biological scale.

Kill condition: If the hierarchy does not invert at different scales, then the claim is not about functional tuning but about a universal property of electromagnetism, requiring a different explanation. Current status: Open.

KS-RM.5 — Against the configurable-register criterion

Target: Definition 1, and by inheritance Theorem 4.1 and Corollary 5.1. Test: Demonstrate that strong-force-produced objects (e.g., protons, nuclei) or gravitationally-bound macrostates encode formation history in a manner that is distinguishable in principle — for instance through quantum decoherence records, nuclear isomer states, or other mechanisms not currently classified as configurable registers.

Kill condition: If fixed-symmetry objects carry retrievable formation history, the configurable-register criterion is too restrictive and the classification must be revised. Current status: Open.

Five kill switches. Each one an invitation to prove the record measure wrong. You know where to cut. If you can find a non-electromagnetic configurable record at the molecular scale, the theorem falls.

§13 Claim Summary

Definition 1 (Record Measure). Status: defined. $\Sigma(F, s)$ = sup persistence time of configurable registers producible by F at scale s. Nonneg by construction; zero when R_cfg is empty.

Includes operational criterion for “configurable register at scale s.”

Definition 2 (Functional Strength). Status: defined. F_1 functionally stronger than F_2 at scale s iff $\Sigma(F_1, s) > \Sigma(F_2, s)$.

Definition 3 (Erasure-Strength). Status: defined. $\mathrm{E}(F, s) \leq 0$ measures persistence reduction induced in records written by other forces. Modelling sketch ($\Delta\tau$ formula) is illustrative, not load-bearing.

Theorem 4.1 (Electromagnetic Dominance). Status: logical consequence of Definition 1, applied to current empirical inventory. At the chemical-biological scale, EM coupling uniquely writes durable configurable records. Conditional on configurable-register criterion (KS-RM.5) and current physics (KS-RM.1).

Corollary 5.1 (Functional Hierarchy). Status: derived from Theorem 4.1. $\Sigma(\mathrm{EM}) >> \Sigma(\mathrm{Strong}) = \Sigma(\mathrm{Gravity}) = \Sigma(\mathrm{Weak}) = 0$; $\mathrm{E}(\mathrm{Weak}) < 0$. Enabling roles discussed qualitatively in §§7–10.

§6 (ε-connection). Status: structural parallel, non-load-bearing.

§§8–10 (Tuning bands and enabling roles). Status: qualitative constraints and derived enabling roles. Open to KS-RM.3 and KS-RM.4.

§14 Conditionality Footer

Dependencies. Axiom R (Record Monotonicity) from {S, B, R, C} — load-bearing. AP02 (The Operator), Axiom 7 (Loop-closure) — required for gravity interpretation (§§5, 10) only.

AP02 (The Operator), Axiom 5.4 (Sovereignty Threshold) — structural parallel (§6) only; non-load-bearing.

Dependents. Any downstream AP referencing the record measure or the functional force hierarchy inherits KS-RM.1–KS-RM.5.

Open problems. Exact viability bands for α, G_F, G under the record measure (KS-RM.3). Scale-dependence of the record-measure hierarchy beyond the chemical-biological regime (KS-RM.4). Whether fixed-symmetry objects encode retrievable formation history (KS-RM.5).

Kill switches. KS-RM.1: Against electromagnetic uniqueness. KS-RM.2: Against the record measure itself — non-triviality. KS-RM.3: Against the tuning claim. KS-RM.4: Against scale-specificity. KS-RM.5: Against the configurable-register criterion.

Inherited: if Axiom R is falsified, the entire proof is invalidated.

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