

The Five Base Assumptions of VERSF

A Representation-Theorem-Like Result for Record-Bearing Physics

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Abstract

The VERSF (Variational Emergence of Record Structure and Fields) programme rests on five base assumptions: (1) a space of distinguishable possibilities exists, (2) some possibilities become irreversible facts (commitment is real), (3) commitment carries an intrinsic, non-bypassable cost, (4) the resulting record is consistent and non-contradictory, and (5) descriptions are invariant under arbitrary labelling.

This paper recasts these five not merely as defensible posits but as a *representation-theorem-like result* for record-bearing physics: **any system capable of supporting stable, intersubjective records must satisfy distinguishability, commitment, non-bypassable cost, consistency, and label-invariance — or else it collapses into triviality, inconsistency, or observer-dependence.** We make the supporting case for each assumption, identify its precise modal status, and assemble the five conditional impossibility results into a formal result we call the *No-Record Theorem*: any candidate framework $F = (S, D, C, R, T, G, P)$ supporting stable, intersubjective, label-invariant records must satisfy five axiomatic conditions A1–A5. We separate what is standard scientific common ground (#1, #4, #5) from what is distinctively VERSF (#2, #3), and we strengthen the joint case by showing that the five form a closed constraint system in which each assumption protects the others against degenerate alternatives.

We are explicit throughout about a critical division of labour: the five license *some* invariant structure capable of supporting descriptive physics; the *specific* architecture of physics (Hilbert space, the Born rule, gauge structure, gravitation) follows only when the five are combined with the downstream VERSF machinery — BCB, TPB, the fold, admissibility closure. The five are foundational, not derivational. They do not assume physics; they assume only the existence of records.

Epistemic labels used in the body: *Posit* (taken as primitive within the programme), *Standard* (uncontroversial across mainstream physics), *Distinctive* (a VERSF-specific commitment), *Conditional impossibility* (a sharpened "if not, then not" statement of the work the assumption does). The further labels *Theorem* and *Strong argument* are reserved for downstream papers in the programme that build on these assumptions.

1. Introduction

A foundational programme is judged not only by what it derives but by what it assumes. The fewer and more defensible the assumptions, the stronger the programme. VERSF claims to derive a great deal — quantum kinematics, the Born rule, gauge structure, gravitation, thermodynamics, the cosmological constant, the fine-structure constant — from a single primitive: irreversible distinguishability commitment. But that primitive does not stand alone. It is supported by a small number of structural posits that together form the foundational floor of the programme.

This paper is concerned with that floor. The aim is to upgrade the case for the five from a defensive posture ("these are reasonable to assume") to a constructive one ("these are forced on any framework that aims to describe a world with records"). The shift in framing matters. Instead of arguing each assumption on its own terms, we read the five as a single conditional claim:

If a framework is to support stable, intersubjective records, then it must include — under one name or another — the work done by distinguishability, commitment, non-bypassable cost, consistency, and label-invariance. A framework that omits any of the five must reintroduce an equivalent assumption elsewhere, or accept that it cannot support records.

We are explicit about modal status throughout. The five are not logical necessities in the strict modal sense — formally consistent alternatives can be constructed in which one or more is denied. What we argue instead is:

- Three of the five (#1, #4, #5) are already accepted, often tacitly, by every working physicist. Denying them does not yield an alternative physics; it yields no physics at all.
- Two of the five (#2, #3) are VERSF's distinctive commitments. Standard physics either treats them as emergent (decoherence-style accounts of measurement, statistical-mechanical accounts of the arrow of time) or leaves them unresolved (the measurement problem). VERSF takes them as primitive. The move is not arbitrary: it dissolves long-standing problems rather than relocating them.
- The five are mutually reinforcing. Removing any one weakens the others. The case for the package is stronger than the case for any individual assumption.
- The five license the *project* of describing a world that contains records, observations, and laws. They do not, alone, single out the *specific structures* of physics. The narrowing to Hilbert space, the Born rule, and the rest is the work of downstream papers in the programme.

We treat the five in order, then state and prove the *No-Record Theorem* that they jointly support, then turn to the conditional inevitability claim, objections, and the restraint that protects the result from overreach.

2. Assumption 1 — Possibilities Exist

2.1 Statement

There is a space \mathcal{S} of distinguishable possibilities. For any system, there are alternatives — at minimum, "this rather than that."

2.2 Status

Standard. Posit, but with a near-transcendental flavour.

2.3 Conditional impossibility

If no distinguishable alternatives exist, then no non-zero information can be encoded; therefore no record, prediction, or observable can exist.

This is the Shannon point in compressed form: no alphabet \rightarrow no entropy \rightarrow no physics. Every descriptive theory in the history of science presupposes a non-trivial alphabet. Newtonian mechanics presupposes a space of possible configurations. Statistical mechanics presupposes a phase space. Quantum mechanics presupposes a Hilbert space of states. Information theory presupposes an alphabet directly.

2.4 Why it is needed

A theory describes by selecting — by saying that the world is *this* way rather than *that* way. If there are no alternatives to select among, the act of description is empty. A world in which only one outcome is possible is not a world that can be talked about; it is a world about which there is nothing to say.

More formally: any predicate $P(x)$ presupposes the meaningfulness of $\neg P(x)$. If $\neg P(x)$ is incoherent or impossible by fiat, then $P(x)$ carries no information.

2.5 The strengthening argument

The strongest case for #1 is the self-undermining nature of denial. Consider an interlocutor who claims "there are no genuine alternatives; the world simply is what it is." This statement presupposes the distinguishability of the world-as-it-is from possible worlds-as-they-are-not. The denial of distinguishability cannot be coherently asserted without using distinguishability.

This is a transcendental argument in the Strawson–Stroud sense, and the genre is philosophically contested — transcendental arguments at best establish that *we cannot coherently think otherwise*, not that *the world cannot be otherwise*. We claim only the weaker reading: #1 is true in every world that admits a descriptive theory. That is all the foundational work requires.

2.6 What collapses without it

Without distinguishable possibilities, there is no state space, no observable, no measurement, no record. The world is either undefined (nothing to describe) or featureless (everything indiscriminate). Neither admits physics.

2.7 VERSF refinement

VERSF sharpens #1 by emphasizing *distinguishability* rather than mere multiplicity. The relevant primitive is not "many things exist" but "some things can be told apart from others." This refinement matters because it foregrounds the *act of distinction* as foundational — and the act of distinction is precisely what commitment (#2) makes definite.

3. Assumption 2 — Commitment Is Real

3.1 Statement

Some possibilities become irreversible facts. There exist transitions from "could be" to "is, and cannot be undone."

We define *irreversibility* operationally, in terms of record persistence: a transition is irreversible when the resulting record is robustly reproducible across observers, instruments, times, and frames. This operational definition is independent of cost (#3); the further claim that achieving such persistence is non-free is the substantive content of #3, not part of the definition of #2.

3.2 Status

Distinctive. Posit. The defining commitment of VERSF.

3.3 Conditional impossibility

If no irreversible commitment exists, then no persistent record exists. Without persistent records, no experiment has an outcome. Therefore no empirical science is possible.

This is the brutal version of the argument. The world contains records. There was a yesterday. This sentence was written before it was read. A physicist who denies that any past measurement is now definite cannot meaningfully report results. The denial is not just metaphysically awkward — it terminates the practice of empirical science at its operational core.

3.4 Why it is needed

Information requires irreversibility. A bit that can be freely unwritten carries no information. Shannon's framework presupposes that a transmitted symbol, once received, is received. Without commitment, there is no signal — only oscillation.

Standard quantum mechanics famously equivocates on commitment. Unitary evolution is reversible; measurement appears irreversible; the relationship between the two is the measurement problem. Various interpretations resolve this differently — many-worlds denies definite outcomes occur, decoherence-based accounts make irreversibility approximate and observer-relative, objective collapse models add irreversibility by hand. VERSF takes a different route: irreversible commitment is the primitive, and unitary evolution is what holds *between* commitments.

3.5 The strengthening argument

The strongest case for #2 is the *redundancy of records*. Across all observers, all instruments, all times after a measurement, the result is the same. If commitment were not real — if outcomes remained genuinely indefinite — this redundancy would require explanation as a cosmic conspiracy. Either the world is conspiring to produce the appearance of definite facts, or definite facts are what produces the appearance.

This argument has a notable parallel within decoherence-based orthodoxy. Zurek's quantum Darwinism takes the same redundancy as the marker of objectivity: classical states are precisely those whose information is redundantly proliferated through the environment. VERSF's move is to take the same operational marker and run it back to a primitive — instead of treating redundancy as a derived consequence of einselection, treat the irreversible commitment that *produces* the redundant record as foundational. The convergence is significant: even from within an interpretive framework that aims to dispense with primitive collapse, the operational signature of facts is the same one VERSF takes as definitional.

Decoherence reproduces the *appearance* of records but does not, by itself, explain why one outcome rather than another is the one experienced. The standard decoherence story produces a probabilistic distribution over apparent outcomes; the question of why a particular outcome is the one that happened is left to interpretation. VERSF removes this ambiguity by making commitment primitive: the outcome that happened is the one that was committed.

The standard alternative to commitment-as-primitive (no real commitment, just decoherence-driven branching or Everettian splitting) faces a well-known objection: it must explain why subjective experience tracks one branch rather than another, and it must explain the apparent emergence of probabilities in a deterministic theory. Both problems are intensely debated. VERSF's move is to take the appearance at face value: commitment is real, and the work of the theory is to derive what kind of structure a commitment-bearing world must have.

3.6 What collapses without it

If nothing becomes irreversible, there are no facts — only indefinite potential. There is no past, no record, no signal, no measurement outcome. The notion of "what happened" becomes incoherent. Any theory denying #2 must either smuggle commitment back in (as decoherence accounts arguably do via the environment, or as MWI does via branch-relative facts) or pay the price of having no observable predictions in the literal sense.

3.7 The honest cost

Taking commitment as primitive is not free. It commits VERSF to explaining what commitment is, when it occurs, and why the universe contains the kind of commitment-bearing structures we observe. The programme's response is the BCB / TPB / fold machinery and the admissibility closure papers. Whether that machinery succeeds is the substantive question of the programme. The point here is only that some account of commitment is unavoidable; VERSF's choice is to make it primitive rather than emergent.

4. Assumption 3 — Commitment Has Cost

4.1 Statement

Irreversibility carries an intrinsic, non-bypassable cost. No commitment is free.

Given the operational definition of irreversibility in §3.1, #3 is the further substantive claim that producing such a persistent record is non-free. The two assumptions are conceptually separable — one could imagine, formally, a world in which records persist costlessly. #3 says no such world is physically realisable.

4.2 Status

Distinctive in its primitive role; partially supported by independent results.

4.3 Conditional impossibility

If commitment has no non-bypassable cost, then irreversibility is not physically constrained. If irreversibility is unconstrained, records can be arbitrarily created and erased. If records are arbitrary, predictive structure collapses.

The structure of the argument is critical, and it must be stated carefully to avoid the legitimate objection that costlessness does not, by itself, immediately imply unconstrained accessibility. The chain is:

no cost \Rightarrow no constraint \Rightarrow no stable structure

Cost is the most economical name for the non-bypassable constraint that distinguishes a physically realised record from an arbitrary one. Without it, the persistence of facts becomes a brute regularity rather than a structural consequence. Something must underwrite the asymmetry between a record that holds and a record that does not. #3 names that underwriter.

4.4 Closing the loop: why constraint forces cost

A sharper objection remains: *why* should the absence of cost imply the absence of constraint? Could there not be costless constraints? The answer closes a loop back to #1 and #2, and shows that #3 is not an additional posit so much as a forced consequence of the others.

A constraint, to have physical content, must be physically encoded — it cannot be a fact merely about how we choose to describe the world (that would be an instance of #5 failure, not a physical constraint). Any physically encoded constraint must distinguish allowed from disallowed transitions. That distinction is itself a commitment — to *this* transition being available rather than *that* one — and any commitment, by #2 read in conjunction with #3, inherits cost. The chain is:

physical constraint → *requires distinction* (#1) → *requires commitment* (#2) → *therefore inherits cost* (#3)

This means #3 is not an *added* assumption but a *forced* one. Once #1 and #2 are accepted and constraints are required to have physical (rather than merely conventional) content, cost follows. The closure is what makes the five mutually entailing rather than merely mutually supporting: deny #3 and the only remaining option is to claim that constraints can be encoded without distinction or commitment, which is to deny #1 or #2.

4.5 Landauer as empirical confirmation, not derivation

Landauer (1961) showed that erasing one bit of information in a thermal environment requires dissipation of at least $k_B T \ln 2$ of heat. This bound has been experimentally confirmed (Bérut et al. 2012; Jun et al. 2014). The relationship to #3 is *specialisation, not derivation*: Landauer derives a lower bound on dissipation under thermal coupling; VERSF claims an intrinsic structural cost independent of the coupling. Thermal coupling is one realisation of the structural constraint, and Landauer's bound is the form the structural cost takes when that realisation is the only channel available. The structural reading explains *why* Landauer's bound holds — because the underlying cost is real and must manifest somewhere — and predicts that analogous bounds will appear in non-thermal commitment-bearing settings, which the VERSF response-functional and fold-dynamics papers develop.

4.6 The strengthening argument

The strongest support for #3 comes from the convergence of three independent lines:

1. *Landauer's principle* establishes that information erasure has an unavoidable thermodynamic cost under thermal coupling. This is proved and experimentally confirmed.
2. *The second law of thermodynamics*, in its statistical-mechanical form, asserts that entropy production accompanies irreversible processes. This is empirically and theoretically as robust as any principle in physics.
3. *VERSF's "Commitment Requires Cost" paper* derives entropy production directly from the irreversibility of commitment, recovering the second law as a structural consequence rather than a statistical regularity.

Three independent routes — thermodynamic, statistical-mechanical, structural — converge on the same conclusion. This is the kind of convergent abductive support that, elsewhere in physics, we treat as decisive evidence for a real underlying constraint. The convergence is what licenses elevating cost to a foundational posit rather than a derived regularity.

4.7 What collapses without it

A trivial structure: persistence is unexplained, asymmetry is unexplained, conservation is unexplained. In the limiting case where no constraint of any kind operates on commitment, every state is equally accessible from every other and the world contains no structure. This is the failure mode #3 rules out.

4.8 The honest cost

VERSF goes beyond Landauer in claiming cost is *intrinsic* — not merely a consequence of coupling to a thermal environment, but a structural feature of commitment itself. This is a stronger claim and bears its own justification, given in the cost-derivation papers in the programme. The minimal point we need here is the conditional one: *if commitment is real (#2), then some non-bypassable constraint on commitment is required, on pain of structural collapse.*

5. Assumption 4 — Consistency Is Required

5.1 Statement

Facts form a consistent, non-contradictory record. The same event cannot both have occurred and not occurred; the same observable cannot have two different definite values at the same time in the same frame.

5.2 Status

Standard. As close to logical necessity as anything in physics.

5.3 Conditional impossibility

If contradictions are permitted in the record, then under classical inference all propositions become simultaneously true and false — the principle of explosion (ex contradictione quodlibet) — collapsing predictive content to triviality.

This is the cleanest of the five impossibility statements because it follows directly from the structure of classical logic. Paraconsistent logics that admit contradictions must heavily restrict inference to remain useful, and no working physical theory uses such a logic.

5.4 Why it is needed

Probability requires consistency, together with further structural conditions. Cox's theorem shows that any system of plausibility assignments satisfying consistency, ordering, associativity of conjunction, and a continuity condition takes the form of probability theory. (Halpern (1999) clarified that these further structural conditions are non-trivial; consistency alone is not enough, but it is the condition without which the others have no purchase.) Dutch book arguments show that an agent whose credences violate the probability axioms can be guaranteed to lose money — again, consistency is the bedrock on which the further argument rests.

Stable regularities — the laws of physics — are pattern-claims about the record. If the record is inconsistent, no pattern can hold uniformly. There can be no laws.

5.5 The strengthening argument

The case for #4 is essentially transcendental: any reasoning whatsoever — including the reasoning by which one might attempt to deny #4 — presupposes it. To assert "the record is inconsistent" is to make a claim that is itself either true or not, and the speaker treats this claim as not simultaneously holding its own negation.

This is the cleanest of the five assumptions and the one most resistant to serious objection. It survives even radical revisions of physics.

5.6 What collapses without it

Without consistency: no probability calculus, no Bayesian inference, no induction, no laws, no science. The collapse here is total — by logical explosion, every proposition follows from any contradiction, so the record contains every claim and its negation simultaneously, which is to contain no information at all.

5.7 VERSF refinement and the observer-independence question

VERSF strengthens #4 in a specific direction: consistency is required across the *global* record once commitment has occurred. After a commitment, the resulting fact is observer-independent in the sense that any subsequent observer who interrogates the record encounters the same outcome.

This formulation engages a contested area of contemporary foundations. The Frauchiger–Renner no-go theorem (2018) and subsequent Wigner's-friend extensions (Bong et al. 2020; Healey 2018) show that *unrestricted* observer-independent consistency is in tension with standard quantum mechanics applied to observers as quantum systems. VERSF's response is principled rather than evasive: the moment of commitment is precisely the moment when a fact becomes observer-independent, and the tensions identified in the Wigner's-friend literature arise from treating ostensibly committed facts as still subject to coherent superposition. On the VERSF reading, the no-go results do not refute observer-independence — they identify the regime in which commitment has not yet occurred. Once commitment has occurred, the resulting fact is consistent across the global record. The substantive defence of this position is in the admissibility closure papers; the point here is that the strengthening of #4 to global consistency is a position one can hold, not a position the foundations literature has refuted.

6. Assumption 5 — Descriptions Are Label-Invariant

6.1 Statement

No physical description can depend on arbitrary labelling or choice of representation. Predictions must be invariant under relabelling, rechoosing of basis, or reparametrization.

6.2 Status

Standard. Universally accepted across modern physics.

6.3 Conditional impossibility

If physical predictions depend on arbitrary labels, then they depend on non-physical degrees of freedom. The theory then ceases to describe the world and instead describes the observer's encoding of it.

A "label" is by definition a free choice — something the labeller could have done differently without changing the world being labelled. If physical predictions track the label, they track something the world does not contain. They are predictions about our descriptive practice, not about nature. This is the failure mode that label-invariance rules out.

6.4 Why it is needed

Label-invariance is the structural skeleton of modern physics. Noether's theorem ties continuous symmetries to conservation laws. Gauge invariance underlies the Standard Model. General covariance is foundational to general relativity. Unitary equivalence is presupposed throughout quantum mechanics. The principle that physics cannot depend on arbitrary choices of representation is not in dispute.

If physics depended on labels, the world would have no objective structure. Two physicists using different coordinate systems would get genuinely different physical predictions. Reproducibility would fail. Science as a public, intersubjective practice would be impossible.

6.5 The strengthening argument

Two convergent lines support #5:

1. *The empirical success of symmetry-based physics.* Every successful modern physical theory respects label-invariance in some form. Theories that violated it (e.g., aether theories with a privileged frame) have been falsified or replaced.
2. *The mathematical inevitability of group structure.* Once one accepts label-invariance, the relevant invariances form groups. Group theory then constrains the available physical structures very tightly. Combined with #1–#4, label-invariance helps narrow the allowed mathematical frameworks.

6.6 What collapses without it

Predictions that depend on observer conventions; no unique mathematical structure; no objective reproducibility; no public science.

6.7 An important honest qualification

Label-invariance alone does not single out Hilbert space. It singles out *some* invariant structure capable of supporting descriptive physics, of which Hilbert space is one possibility among several. The narrowing to Hilbert space comes from VERSF's admissibility closure machinery, which uses all five assumptions together with the further structural posits of the programme.

This qualification strengthens rather than weakens the programme: it shows that the five assumptions do *interlocking* work, and that the joint case is more powerful than the sum of individual cases. It also clarifies the division of labour: the five license the project of descriptive physics; the downstream papers do the derivational work.

7. The Joint Structure: A Closed Constraint System

The five assumptions are not independent posits stacked side by side. They form a *closed constraint system* in which each plays a distinct, non-substitutable role:

- #1 defines the possibility space. Without it, there is nothing to be acted on.
- #2 selects realised elements from the possibility space. Without it, possibilities are inert.
- #3 constrains the transitions by which selection occurs. Without it, selection is arbitrary and persistence is unexplained.

- #4 enforces logical coherence on the selected elements. Without it, the record is empty by explosion.
- #5 removes representational arbitrariness from descriptions of the record. Without it, predictions track encoding rather than world.

Remove any one and the system no longer supports stable, objective records.

7.1 Each assumption protects the others

- #1 needs #2. A space of possibilities with no commitment is just a space — no facts populate it. Possibilities without irreversibility never become anything.
- #2 needs #1. Commitment is commitment to one possibility rather than another. Without distinguishable possibilities, there is nothing to commit to.
- #2 needs #3. If commitment carried no non-bypassable constraint, the persistence of the resulting record would be unmotivated. Cost is not what *defines* commitment (the operational definition in §3.1 is independent), but it is what makes commitment *physically realisable* in a non-arbitrary world.
- #3 needs #2. Cost without commitment is cost for nothing — there is no transition to incur it. Conversely, as shown in §4.4, #3 is forced by #1 and #2 once one requires that constraints have physical (rather than merely conventional) content. The five are mutually entailing in this sense, not merely mutually supporting.
- #4 needs #1, #2. Consistency is consistency of facts about possibilities. With neither possibilities nor facts, consistency has no subject.
- #5 needs #1–#4. Label-invariance is a constraint on descriptions of a structured world. Without the prior four, there is no structure for descriptions to be invariant about.

7.2 Mixed modal status, openly acknowledged

The five assumptions have a mixed status. #1 and #5 are claims about what *description* requires. #2 and #3 are claims about what the *world* contains. #4 spans both — it is at once a constraint on coherent description and a feature of the world being described. This mixing is not a flaw; it is part of the point. The five mark the boundary where the requirements of describing meet the requirements of being described, and a foundational programme that aims to derive physics from minimal posits must operate at precisely that boundary.

7.3 What "minimal preconditions" means

The five have a distinctive modal status:

- *Not logical necessities* in the strict modal sense. A formally consistent description of a world denying some of them can be constructed.
- *Not empirical hypotheses* in the standard sense. They are not directly tested by experiment in the way that a force law is.
- *Are the structural prerequisites* for any descriptive physics. Any theory aiming to describe a world containing records, observations, and laws must accept them, on pain of incoherence or trivialization.

This is a strong status — stronger than mere posit, weaker than logical theorem. It is the status of *foundational adequacy conditions*. The five are what one must assume to be in the business of physics at all.

7.4 The unifying statement

The five admit a single compressed characterisation that ties their roles together:

The five assumptions correspond to the minimal structure required for a non-degenerate mapping from possibility space to physical record.

Each axis controls a distinct way the mapping can degenerate. #1 ensures the domain is non-trivial. #2 ensures the mapping has an image (records exist). #3 ensures the mapping is constrained rather than arbitrary. #4 ensures the image is internally coherent. #5 ensures the mapping is well-defined independent of how the domain and image are labelled. Drop any one and the mapping collapses — into emptiness, ephemerality, arbitrariness, contradiction, or representational dependence. The five are precisely what is required for *possibility* to map to *physical record* in a way that supports physics.

This framing connects three traditions: information theory (which studies mappings from alphabets to messages), physics (which studies mappings from state spaces to observables), and representation theory (which studies mappings between structured systems that preserve the relevant structure). The five assumptions are what these traditions have in common when applied to record-bearing systems.

8. The No-Record Theorem

The conditional impossibility statements in §§2–6, taken together with the closed-constraint-system structure of §7, can be assembled into a formal result. We give the formalisation in three steps: primitive notions, the five required conditions as axioms, and the theorem with its proof sketch.

8.1 Primitive notions

Let S be a set of possible states or alternatives.

Let D be a distinguishability relation on S , such that for some $a, b \in S$, $D(a, b) = 1$ means that a and b are distinguishable alternatives.

Let C be a commitment map $C : S \rightarrow R$, where R is the space of records. A commitment takes a possibility and produces a record. Let $\rho \in R$ denote a record.

Let T_t denote time-evolution or interrogation after commitment, and let O_i denote an observer, instrument, or frame of access.

A record ρ is called **stable** if $T_t(\rho) = \rho$ for all relevant post-commitment times t , up to admissible transformations.

A record is called **intersubjective** if $O_i(\rho) = O_j(\rho)$ for all admissible observers O_i, O_j , again up to admissible transformations.

A record is called **label-invariant** if, for every relabelling transformation $g \in G$, $P(\rho) = P(g\rho)$, where P denotes the physical prediction extracted from the record.

A **record-bearing physical framework** is then a structure

$$F = (S, D, C, R, T, G, P)$$

capable of producing stable, intersubjective, label-invariant records.

8.2 The five required conditions

A framework F is *record-admissible* only if it satisfies the following five conditions.

A1. Distinguishability. There exist at least two distinguishable alternatives:

$$\exists a, b \in S \text{ such that } D(a, b) = 1.$$

Without A1, S has no non-trivial alphabet and no information-bearing content.

A2. Commitment. There exists at least one irreversible map from possibility to record:

$$\exists a \in S, \exists \rho \in R \text{ such that } C(a) = \rho,$$

and once $C(a) = \rho$, the record is not freely reversible back into uncommitted possibility (per the operational definition of irreversibility in §3.1).

Without A2, possibilities never become facts.

A3. Non-bypassable cost or constraint. For every non-trivial commitment $C(a) = \rho$, there exists a non-zero constraint functional K such that:

$$K(C(a)) > 0.$$

A3 does not yet specify whether K is thermodynamic, informational, geometric, or field-theoretic. It only states that commitment is not unconstrained.

Without A3, records are arbitrary rather than physically grounded.

A4. Consistency. For any committed record ρ , no proposition p encoded by that record may satisfy both $p \in \rho$ and $\neg p \in \rho$. Equivalently:

$$\rho \not\models (p \wedge \neg p).$$

Without A4, the record collapses under classical inference (logical explosion; §5.3).

A5. Label-invariance. For every admissible relabelling $g \in G$:

$$P(\rho) = P(g\rho).$$

Physical predictions may not depend on arbitrary representation.

Without A5, the framework describes the observer's encoding rather than the world.

8.3 The theorem

Theorem (No-Record Theorem — Necessity of Record Structure). Let $F = (S, D, C, R, T, G, P)$ be a framework. If F admits at least one stable, intersubjective, label-invariant record, then F satisfies A1–A5.

Equivalently:

$$\text{Stable, intersubjective, label-invariant records} \Rightarrow A1 \wedge A2 \wedge A3 \wedge A4 \wedge A5.$$

The contrapositive:

$$\neg A1 \vee \neg A2 \vee \neg A3 \vee \neg A4 \vee \neg A5 \Rightarrow \text{no stable, observer-independent record.}$$

Corollary (Universality of A1–A5). Any two record-bearing frameworks are equivalent with respect to A1–A5 up to relabelling of structure.

Remark. The corollary follows immediately from the theorem: if both frameworks admit stable, intersubjective, label-invariant records, both satisfy A1–A5. They may differ in every other respect — in the specific structure of S , in whether the dynamics are quantum or classical, in which gauge groups are realised, in whether spacetime is discrete or continuous — but they share the A1–A5 skeleton. The five conditions are therefore *universal invariants of record-bearing physics*: properties that any such framework exhibits regardless of its specific physical content. This is what makes the five foundational rather than merely typical, and it is what licenses calling the result a representation-theorem-like statement about the class as a whole rather than a list of features of any one member.

8.4 Proof sketch

Assume F supports a stable, intersubjective, label-invariant record ρ .

1. ρ must encode some content. Content requires distinction (no alphabet, no information; §2.3). Therefore at least two alternatives in S must be distinguishable. **Hence A1.**
2. ρ must arise from something becoming fixed rather than remaining merely possible. Therefore there must be a commitment map from possibility to record. **Hence A2.**
3. The commitment must be physically constrained. If no constraint functional K exists, then for any ρ there exists $\rho' \neq \rho$ such that $P(\rho') = P(\rho)$ and ρ' is reachable without constraint; hence record identity is not uniquely determined and ρ fails to be a record at all in the operational sense (§4.3, §4.4). **Hence A3.**
4. The record must be non-contradictory. If ρ contains both p and $\neg p$, then under classical inference every proposition follows from the contradiction and the record carries no information (§5.3). **Hence A4.**
5. The record must not depend on arbitrary labelling. If predictions differ under relabelling, the framework tracks representation rather than physical content (§6.3). **Hence A5.**

Therefore any framework capable of supporting stable, observer-independent records must satisfy A1–A5.

8.5 Failure modes

The theorem identifies five independent axes of collapse:

Missing condition	Failure mode
A1	No distinction \rightarrow no information
A2	No commitment \rightarrow no fact
A3	No constraint \rightarrow record identity not uniquely determined
A4	No consistency \rightarrow logical collapse
A5	No invariance \rightarrow observer-relative description

The five conditions are not decorative. Each blocks a distinct way in which record-bearing physics can fail. The exhaustiveness claim — that no sixth axis of failure exists — is what licenses calling the result a theorem rather than an enumeration: the proof in §8.4 walks through the five necessary requirements for record-bearing physics, and any further axis of failure would have to identify a requirement that the proof omits.

Completeness claim. Any further failure mode of record formation must reduce to a failure of information (A1), persistence (A2), constraint (A3), coherence (A4), or invariance (A5), since any record must (i) encode content, (ii) persist, (iii) be physically grounded, (iv) be logically coherent, and (v) be representation-independent.

A purported sixth axis would have to exhibit a failure mode not reducible to one of (i)–(v). The burden is therefore not on us to enumerate further axes but on a critic to break the classification.

8.6 What the theorem proves — and does not prove

The No-Record Theorem proves a necessity result:

record-bearing physics $\Rightarrow A1 \wedge A2 \wedge A3 \wedge A4 \wedge A5$.

It does not prove:

$A1 \wedge A2 \wedge A3 \wedge A4 \wedge A5 \Rightarrow$ *quantum mechanics* \vee *gravity* \vee *the Standard Model*.

That stronger direction (the sufficiency claim for our specific physics) requires the downstream VERSF machinery: BCB, TPB, the fold, admissibility closure, the master action, and the Single-Source structure. The theorem establishes the foundation, not the full architecture. (This is the division of labour preserved in §9 and protected in §10.)

8.7 Compact form

The theorem admits a compact restatement that captures all five axes in one line:

No distinction, no fact. No fact, no record. No cost, no grounding. No consistency, no truth. No invariance, no physics.

Each clause names one axis of collapse; the conjunction names the five conditions any record-bearing physics must satisfy.

8.8 Formal identity

The five conditions can be stated as a single defining identity for what counts as a physical record:

Constraint + Consistency + Invariance				Record \equiv Distinction + Commitment +
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The right-hand side is not a list of ingredients to be combined at will; it is an identity. Remove any term and what remains is no longer a record in the operational sense. Add any further term and it must reduce to one of the five (per the completeness claim of §8.5). This identity is the compressed content of the No-Record Theorem and the architectural core of the paper.

9. Conditional Inevitability: From Necessity to Architecture

The No-Record Theorem (§8) gives the necessity direction: any record-bearing framework must satisfy the five. The sufficiency direction — what specifically follows when the five are accepted — is the work of the downstream VERSF papers. Together they support the following.

Conditional Inevitability. Given the five base assumptions *and* the further structural posits made explicit in the VERSF papers (BCB, TPB, the fold, admissibility closure conditions, etc.), a unique architecture of physics follows: a state space carrying a Hilbert space structure, a unique probability measure (the Born rule), a unitary evolution, a thermodynamic arrow of time, an emergent spacetime with Lorentzian signature, and a gauge structure compatible with the Standard Model.

Each link in this chain is a separate theorem or strong-argument result, established in a distinct paper. The five base assumptions are doing *foundational* rather than *derivational* work: they license the project. The derivations are done by the downstream machinery.

This careful statement is stronger, not weaker, than a bald inevitability claim. It says exactly what is shown, where it is shown, and under what conditions.

10. Restraint: What the Five Do Not Do

It is essential to mark clearly what the five do not establish, in order to protect the result from overreach. The following restraint applies throughout:

The five assumptions do not uniquely determine Hilbert space, quantum theory, or gravity. They define the *admissible class* of physical descriptions. Uniqueness results arise only after imposing the additional structural constraints developed elsewhere in the VERSF programme.

This restraint matters because the No-Record Theorem and the Conditional Inevitability claim are easily run together. They must not be. The first is a necessity result for record-bearing physics in general. The second is a conditional sufficiency result for the specific architecture of our physics, conditional on the five plus the downstream structural posits. A reader who confuses the two will charge the paper with either circularity (the five secretly contain the architecture) or overreach (the five are claimed to entail the architecture by themselves). Neither charge applies once the division of labour is observed.

11. Objections and Replies

11.1 "You have just assumed what you need."

Reply. This is the most serious objection and must be answered directly. The five assumptions do not assume physics; they assume only the existence of records. The dialectical position is therefore a clean dichotomy:

Burden-shift dichotomy. Any framework that denies one of the five must either (i) reintroduce it in disguised form, or (ii) abandon stable, observer-independent records.

There is no third option: either the denied condition is reintroduced under another name, or the framework fails to support records. The major alternatives in foundations all fall under (i): decoherence-style accounts of #2 reintroduce commitment via the environment; many-worlds reintroduces commitment as branch-relative facts and consistency as branch-internal coherence; non-thermal extensions of #3 reintroduce cost as a more general structural constraint. None abandons records, because abandoning records terminates empirical science. The five are not what VERSF imports into physics; they are what any physics-of-records imports into itself, whether explicitly or under another name.

11.2 "These are not minimal — many-worlds denies #2 and works fine."

Reply. Many-worlds does not deny #2 so much as relocate it. Each branch contains records that, within the branch, are treated as definite. The cross-branch indeterminacy is invisible from within any branch. If "fact" is read branch-relatively, MWI accepts a branch-local version of #2; if "fact" is read absolutely, MWI faces well-known objections concerning the meaning of probability and the privileged-basis problem. VERSF's move is to make the branch-local fact primitive and global, dispensing with the branching apparatus. (The substantive defence of this move is in the Single-Source Theorem and Admissibility Closure papers.)

11.3 "#3 is not a posit; Landauer derives it."

Reply. Landauer derives a thermal lower bound on the dissipation cost of erasure under specific conditions. VERSF's #3 is broader: cost is intrinsic to commitment, not merely a consequence of thermal coupling. Landauer is supporting evidence and a special case, not a derivation of #3 in full generality. This refinement is what allows VERSF to derive structures (the response functional, the fold dynamics) that Landauer's principle alone does not.

11.4 "Why five and not four, or six? Are the five genuinely independent?"

Reply. Each of the five corresponds to a distinct, independent axis of failure for record formation:

- **Informational axis (#1):** record can fail to encode anything.
- **Temporal/persistent axis (#2):** record can fail to last.
- **Dynamical/constraint axis (#3):** record can fail to be physically anchored.
- **Logical axis (#4):** record can fail to be coherent.
- **Representational axis (#5):** record can fail to be objective rather than encoding-dependent.

Independence follows because each axis can fail while the others hold. The pairwise demonstrations exhibit this directly:

- *#1 without #2:* a space of possibilities with no commitment — formally consistent, describes nothing definite.
- *#1 without #5:* a labelled possibility space whose predictions depend on the labelling — formally consistent, fails reproducibility.

- #2 without #3: irreversible records by stipulation, but no account of why such irreversibility is physically constrained rather than arbitrary. The records persist because we say so; the world contains no structural reason for the persistence to hold.
- #4 without #5: a consistent record described in a label-dependent way — formally consistent within any one labelling, but yields different physics for different labellers.
- #5 without #4: invariant descriptions of an inconsistent record — the invariance is empty because the underlying record cannot support stable claims.

The axes are independent in the sense that no single axis dominates the others, and pairwise non-substitutable in the sense that the failure mode of one cannot be patched by adding more of another. Adding a sixth assumption would either be derivable from the five plus VERSF's downstream machinery (in which case it is not foundational) or would smuggle in substantive physical content that should be earned by derivation. The programme's discipline is that anything beyond the five must be earned.

11.5 "Aren't #1, #4, #5 just trivial restatements of doing physics at all?"

Reply. Yes, and that is the point. Their triviality is their virtue: they cost almost nothing to assume and are accepted by every working physicist. The non-trivial commitments are #2 and #3. By making the five explicit, VERSF clarifies which assumptions are doing distinctive work and which are common ground. A reader who accepts standard physics already accepts three of the five for free.

11.6 "Doesn't the strengthening of #4 in §5.7 just stipulate away the Wigner's-friend problem?"

Reply. No — it relocates it. The Wigner's-friend results show that *if* one treats observers as quantum systems whose internal records remain coherent, *then* observer-independent fact-assignment fails. VERSF accepts the conditional and denies the antecedent: at the moment of commitment, the relevant degrees of freedom cease to be subject to coherent superposition. The substantive question is whether the VERSF account of when commitment occurs is empirically and theoretically defensible. That question is addressed in the admissibility closure papers, not here. The point in this paper is only that the strengthening of #4 is a coherent position, not that the foundations literature has settled in its favour.

11.7 "The No-Record Theorem rests on operational definitions; the formalisation is therefore not as decisive as it appears."

Reply. The formalisation in §8 takes "stable, intersubjective, label-invariant record" as its operational characterisation of what record-bearing physics requires. A critic could in principle supply an alternative characterisation under which one of A1–A5 could be omitted while still supporting something the critic was prepared to call a "record." That would be a substantive challenge — but it would require *exhibiting* such a framework, not merely asserting that the operational definitions could be otherwise.

The operational definitions are not arbitrary. *Stable* tracks the requirement that records persist across post-commitment time. *Intersubjective* tracks the requirement that records are the same for different observers. *Label-invariant* tracks the requirement that physical predictions extracted from records do not depend on representation. Together these three properties are what every working physicist treats as the operational signature of a fact: it lasts, others can confirm it, and its content does not change under a change of coordinates. To weaken any of these three is to weaken the operational notion of a fact, not to evade the theorem.

The theorem is therefore as strong as the operational notion of a fact is. A critic who rejects the theorem must either accept a substantially weaker notion of fact than physics actually uses, or exhibit a framework in which one of A1–A5 fails while the operational definition is preserved. Neither, to our knowledge, has been done.

12. Conclusion

The five base assumptions of VERSF are not arbitrary. Three (#1, #4, #5) are accepted by every working physicist and survive any plausible revision of the discipline. Two (#2, #3) are VERSF's distinctive commitments, and each is independently supported: #2 by the manifest existence of records and the difficulties of theories that deny them, #3 by Landauer's principle, the second law, and the VERSF cost-derivation results.

The five form a closed constraint system. Each plays a distinct, non-substitutable role; each protects the others; removing any one collapses the rest. Together they support the No-Record Theorem (§8): any framework supporting stable, intersubjective, label-invariant records must satisfy all five conditions A1–A5. This is the necessity direction, and it is now formally stated. The sufficiency direction — what specifically follows when the five are accepted — is the work of the downstream VERSF programme, captured in the Conditional Inevitability claim of §9.

The division of labour matters. The five license the *project* of descriptive physics. They do not, alone, single out its specific structures. The narrowing to Hilbert space, the Born rule, gauge groups, and gravitation is the work of the downstream VERSF machinery — admissibility closure, the master action, the Single-Source Theorem, and the rest. Foundational and derivational work are distinct, and this paper is concerned only with the foundational floor.

The thesis, stated cleanly:

VERSF does not assume physics. It assumes the minimum structural conditions under which stable, objective physical records — and therefore physics itself — can exist: distinction, commitment, cost, consistency, and invariance. The rest must be earned downstream.

That is the right shape for a foundational claim. It is defensible, precise about its own status, restrained about what it does not show, and powerful enough to do the work the programme requires.

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(Selected; full programme bibliography at versf-eos.com)

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VERSF Programme — Master Action and Record Current Uniqueness Theorem.

VERSF Programme — Admissibility Closure: Quantum Kinematics from Finite Distinguishability.

VERSF Programme — Commitment Requires Cost: Entropy Production from Irreversibility.

VERSF Programme — The Overdetermined Born Rule.

VERSF Programme — The Single-Source Theorem.

VERSF Programme — No-Alternative Theorem for the Response Functional.