

# The Layered Foundation of VERSF: Distinguishability, Potentiality, and the Architecture of Observation

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## A note to the general reader

This paper clarifies what the VERSF physics programme takes as its foundation, and — just as importantly — what it does not.

The intuitive starting point is simple. For anything to exist in a way we could ever observe, it has to be distinguishable from something else. Where there is no difference anywhere, there is nothing to notice. This is not the empirical claim that we happen to notice only distinguishable things; it is the structural point that observation *is* the registering of a difference. Take distinguishability away and there is nothing left of the notion of observation.

But distinguishability is always distinguishability *from* something. It is a relation, not a thing. That means it cannot be the whole story. There has to be a substrate — a field of possibility from which distinctions get drawn. VERSF calls this substrate the Void: not nothing, but pure potential, the unobservable background condition that makes there being observable things at all. The Void and distinguishability belong together; neither is intelligible without the other.

The paper separates three questions that are easy to run together. What is foundational *in being?* — both the Void and distinguishability, as complementary aspects of existence. What is foundational *in observation?* — distinguishability alone, because nothing enters the space of observation without it. What is foundational *for physics?* — the structural conditions distinguishability has to satisfy to support stable, accumulating records of what has happened. Those conditions turn out to be specific and restrictive, which is why VERSF can derive quantities like the fine-structure constant, particle masses, and the scale at which structure becomes stable from them without fitting parameters to the answers.

The paper also takes a further step. The physics the programme derives does not merely happen to sit on distinguishability — it sits on features distinguishability has to have, and any theory of the observable that supports records has to implement those same features. The argument takes the form of a chain of five eliminations: each step identifies what physics loses if a given feature is dropped, and the chain lands at the architecture VERSF realises. VERSF is therefore not one way among many to build physics on distinguishability; it is a realisation of the narrow class of ways that work.

The payoff of keeping the levels separate, and of showing the structural features are forced, is that physics rests only on what has been argued for, without pretending to have answered metaphysical questions it has not answered, and without pretending those questions are not there.

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## Abstract

The foundation of VERSF rests on a layered structure, not a single primitive. At the ontic level, existence requires two complementary principles: a field of pure potentiality (the Void) and an actualization principle (distinguishability realised as irreversible commitment). These are complementary in the strict sense — each is required for the intelligibility of the other, and no deeper describable unification is available within any theory of the observable. At the epistemic level, distinguishability is primitive in two steps: a transcendental argument secures that some minimal differentiation is primitive for observation; a structural argument secures that the differentiation adequate to support physics has substantive combinatorial, topological, and spectral content. An admissibility argument shows that any theory of the observable supporting stable, compositional records must implement five structural features: differentiation, irreversibility, compositional closure, a minimal architecture fixed at  $K = 7$ , and single-source functional representation. VERSF is a fully realised instance of the narrow equivalence class those requirements define. The admissibility chain, anchored by the programme's no-go theorem and Single-Source Theorem, is this paper's principal structural result.

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# 1. Three levels, stated directly

VERSF's foundation has three levels, each answering a different question and each carrying a different kind of warrant.

**Ontic level.** *What is foundational in being?* Existence has two complementary aspects: potentiality (the substrate capable of bearing distinctions) and actualization (the principle by which distinctions become fixed). These are co-primitive in a complementarity sense (made precise in §3): each is required for the intelligibility of the other, neither is reducible to the other, and no describable unification into a common substrate is available within any theory of the observable.

**Epistemic level.** *What is foundational in knowing?* Distinguishability is primitive. Nothing enters the space of data without being distinguishable; observation *is* differentiation. The claim has two components — a transcendental one and a structural one — which §2 and §5 separate. Running them together invites the objection that transcendental claims are too thin to support quantitative physics, and that objection has force against the conflated version.

**Methodological level.** *What is foundational for physics?* Physics is a science of the observable and must proceed from whatever is primitive there. Since distinguishability is primitive for the observable, the structural conditions on distinguishability are the governing constraint on any possible physical theory. §7 shows that these conditions are not optional: any admissible theory must implement them.

The three levels do different kinds of work. The ontic level does *coherence* work: it answers the question of what commitment events are events *of*, and what the Void is *as*. The epistemic level does *domain* work: it specifies what any theory of the observable must respect. The methodological level does *predictive* work: it yields the structural constraints the programme derives from. Keeping the levels distinct is not a retreat from a stronger unified claim; it is a recognition that three questions have three answers, each with its own warrant and its own role.

## 2. Distinguishability as epistemic primitive

### The transcendental step

Distinguishability is primitive for observation in a transcendental sense. To posit anything more basic is already to distinguish it from what it is not; the act of positing crosses the threshold. There is no view from beneath distinguishability because any view presupposes it. The claim is constitutive rather than empirical — "observable" and "distinguishable" pick out the same set at the foundation, and that coincidence is not a fact one could have found otherwise.

This argument is narrower than Descartes's cogito and does not inherit its problems. Descartes concluded from the self-refutation of doubt to the existence of a *substance* — *res cogitans*. The Lichtenberg objection (that "it is thinking" is all the cogito secures, not "I am a thinking thing") is fatal to that inference. The present argument concludes only to a *structural condition*: anything

observable is distinguishable. No substance is being inferred. The transcendental work here is domain-specifying, not substance-establishing, which is why the argument survives the objections that defeat stronger transcendental programmes.

The transcendental step by itself, however, secures only that *some* minimal differentiation is primitive for observation. Difference, contrast, relation, asymmetry all satisfy the same formal role. What picks distinguishability out from this family is not the transcendental argument but the structural argument of §5 and the admissibility argument of §7. The two-step structure — transcendental then structural — is the honest form of the epistemic claim.

### **The non-naturalist objection**

A naturalist reader will ask why a transcendental argument is needed at all. Observation is a physical process; physical processes are explained by physics; the domain does not need a separate grounding. The reply is that the transcendental argument is not grounding observation as a process but *specifying the domain* for the purpose of characterising what any theory of that domain must respect. Physics does not ground its own domain; the specification of what physics is the science of is not itself a physical task. That is the only work the transcendental argument is asked to do here.

### **Distinguishable by what?**

The natural first objection is that distinguishability is a relation, and a relation requires relation. *Distinguishable by what?* The answer is not "by an observer." VERSF is observer-free in the operational sense: the discriminators are commitment events themselves. A commitment is the actualisation of one possibility rather than another, and that actualisation *is* the distinction — there is no separate agent whose judgment supervenes on a pre-existing difference.

An expert objector will press further: what makes an event the event it is, prior to being distinguished? The answer VERSF gives is that distinguishability is not logically posterior to event-identity: the commitment *is* the event, and its identity is exhausted by what it commits. This is an austere identity condition — VERSF rejects haecceitism about commitment events, there is no bare this-ness prior to what an event commits — but it is not circular, for the same reason Wheeler's "no question, no answer" is constitutive rather than circular. A reader from a substance-metaphysics tradition will find this unsatisfying; the reply is that the dissatisfaction marks a commitment, not a flaw, and the commitment is one VERSF makes openly.

## **3. Potentiality and actualization as complementary primitives**

### **The complementarity**

The ontic level has two primitives because existence has two aspects that are mutually presupposing without either being reducible to the other.

**Potentiality** — the Void — is not nothing. It is the substrate of possible distinctions: the condition for there being something to actualize. The Void's unobservability is not incidental to its substrate role — it is what makes it a substrate. Anything that could be observed would, by the definitions here, be an actualised commitment, not the field from which commitments are drawn. An observable Void would be a contradiction. The correct question is not "why is it unobservable?" but "what work does an unobservable posit do?" — and that work is specified in §4.

**Actualization** — irreversible commitment — is the principle by which potential distinctions become fixed. Each commitment event is a crossing of the boundary between what could have been and what is, permanently.

The two are complementary in the strict sense: each requires the other for its own intelligibility. Potentiality without actualization is indistinguishable from nothing — "pure potentiality, never actualized" describes no state of affairs. Actualization without a substrate has nothing to actualize from — "commitment with no presupposed field of possibilities" is empty. The mutual requirement is *not* an argument that they are two aspects of a single deeper primitive.

### **Why the Void is not optional: the relational-closure argument**

A sceptic may ask why a substrate is needed at all. Why not a purely relational ontology, in which distinctions hold between other distinctions without any underlying field of potential?

The answer is that purely relational ontologies cannot support compositional closure. A theory of records requires that distinctions be *stable* — that a commitment once made remain available to be referred to and composed with later commitments. Stability requires *persistence* across the commitments that follow. Persistence, in turn, requires something that persists: either the relata (which are then the substrate, under another name) or a field of possibility across which the relata are drawn. A framework that denies both is left with nothing for its relations to relate. Purely relational frameworks therefore either import a substrate implicitly — calling it "the system of relations" or "the relational manifold" and treating it as though it were not a substrate — or fail to support compositional closure.

The Void is what that substrate is when named explicitly and given the minimal characterisation adequate to the role. Any framework that avoids explicitly positing a substrate must implicitly reintroduce one to support persistence and closure; the Void is that substrate named explicitly and given minimal characterisation. The difference between a framework that names it and one that does not is methodological, not structural, but naming it has the advantage of making its properties visible and available for analysis.

### **The two substrate roles**

One refinement is required at this point. The relational-closure argument just given warrants a substrate of *persistence for past commitments* — call this role (a). The Void, as characterised at the start of this section, plays an additional role: it is the *source of pre-actualised possibility* from

which new commitments are drawn — role (b). These are distinct and the relational-closure argument warrants (a) without by itself warranting (b).

Role (b) is secured by a separate consideration: actualization requires something to be actualized from. A framework with only past-fact persistence but no source of new possibility has no account of how new commitments enter the record; it treats the arrival of new facts as unexplained. A presentist or Humean with a historical-record ontology can accept role (a) without accepting role (b) — but what such a framework owes is an account of commitment-production without a field of possibilities to draw from. VERSF's Void unifies the two substrate roles. The unification is an economy, not a stipulation: one substrate doing the work of past-persistence and future-possibility is a more parsimonious ontology than two, and it is the ontology the framework adopts because nothing weaker supports both roles.

The relational-closure argument therefore establishes role (a); role (b) is established by the independent argument from the intelligibility of actualisation; and VERSF's Void plays both. A critic who accepts only (a) is not required to accept the VERSF Void as characterised here, but is required to supply a separate account of commitment-production.

### **Locating VERSF's potentiality in modal-metaphysics space**

VERSF's potentiality is stronger than Aristotelian potentiality-for-specific-actualities but weaker than Lewisian plenitudinous modal realism. It is a determinacy-bearing field of possibilities whose determinacy is structural (spectral, combinatorial) rather than qualitative. The closest extant analogue is the quantum-foundational notion of a pre-actualised state space in the decoherent-histories approach of Gell-Mann and Hartle [14], though VERSF does not inherit the formal apparatus and locates the determinacy in a non-relational substrate rather than a superposed state. This positioning gives the reader a map without committing the programme to the details of any adjacent modal-metaphysical framework.

### **Bohr as structural analogy**

The structural model for the complementarity claim is Bohr's complementarity in quantum mechanics: wave and particle descriptions are each required, neither reducible to the other, and no third description encompassing both is available in principle. The present claim uses the same structural pattern — two descriptions, mutual requirement, no third view — but does not pretend to derive the pattern from Bohr. Bohr's complementarity is narrower in scope (it concerns mutually exclusive measurement contexts in QM), and the present use is by analogy, not by inheritance. Whether the structural pattern recurs outside QM is a general philosophical question on which the paper takes a position without resolving.

### **The describable-substrate restriction**

The argument that no common substrate of potentiality and actualization is available is an argument about what can be said, not about what is. To describe a putative common substrate one would have to use terms that presuppose the distinction — a substrate *has* potentiality (or it is not a substrate), and describing it is already an actualization. The argument therefore rules out

only *describable* common substrates within any theory of the observable. Whether there is an indescribable common substrate is not a question the argument touches, and VERSF's methodology places that question explicitly outside the programme's scope.

A referee may object that the describable-substrate restriction warrants only agnosticism about deeper structure, not a positive commitment to complementarity. The reply is that complementarity is the most articulated position that can be held consistent with the restriction: any weaker position would be silence about what can be said, and any stronger position would violate the restriction itself. VERSF takes the most articulated tenable position, not a claim to have ruled out what cannot be discussed.

This two-primitive structure is therefore not Cartesian dualism of independent substances. Nor is it monism dressed in two labels. It is a structural complementarity whose warrant is domain-internal, and whose scope is explicitly restricted to what can be said.

## 4. Why the separation matters

Three questions, three levels, three different kinds of answer. Running them together produces confusions that separating them dissolves.

*The relational question* — "*distinguishable from what?*" — is ontic. At the ontic level the answer is definite: distinguishable from the Void, from other potentials within the Void, and from other actualized distinctions.

*The primitivity question* — "*primitive in what sense?*" — is a category question. Distinguishability is primitive epistemically but not ontically. Potentiality is primitive ontically but not epistemically accessible. Neither claim contradicts the other; they answer different questions.

*The derivational question* — "*why does the physics work?*" — is methodological. Physics works because its domain has distinguishability as its governing structural constraint, and any theory of that domain must be compatible with the structural conditions on distinguishability. The derivations are the working-out of those conditions.

### **The immunisation objection**

One objection to a layered foundation is that it immunises the framework by distributing its claims across levels, so that different objections attack different levels and none can reach the whole framework. The reply is that the three levels are not invented for the purpose of this paper: they track three philosophical questions that any philosophy of physics implicitly faces — what is, what we can know, what physics can derive. VERSF's move is not to multiply levels but to make them explicit where most programmes leave them conflated. A single-level foundation is not a virtue if the questions are genuinely distinct; it is a conflation masquerading as parsimony.

## Why mention the ontology if the physics does not need it?

A sceptical reader — particularly of a positivist cast — will ask: if the physics does not need the ontology, why mention it at all? The ontology does three kinds of work the physics does not.

First, it *adjudicates between otherwise-equivalent formulations* of the structural constraints. Two mathematical reformulations of the same dynamics can entail different answers to "what are these equations about," and the ontology rules some out. Second, it *explains why the derivational programme is stable under reformulation*: the same quantities recur because they track the same underlying primitives, not because the notation was lucky. Third, it *forbids certain extensions* that would be formally available but ontologically unmotivated. If the ontology did no work at all, any coherent story could replace it; the fact that specific extensions are blocked by it is evidence that it is load-bearing.

The two levels — physics and ontology — are therefore separable in warrant but jointly needed for the programme to be what it is. The positivist reply that ontology is idle is answerable in specifics, not by appeal to anchoring-as-virtue.

## 5. Why distinguishability has quantitative content

The epistemic claim of §2 — distinguishability is primitive for observation — is transcendental in its first step, and transcendental claims typically yield only structural constraints, not quantitative predictions. A reader sympathetic to the framework may still ask: how does a precondition of observation fix dimensionless numbers like  $\alpha^{-1}$ ?

The reply proceeds in two clearly labelled steps.

### Step 1: transcendental

Any theory of the observable presupposes that what is observed is distinguished from what is not. This is domain-specifying work, and it secures that *some* minimal differentiation is primitive. It does not by itself pick out distinguishability rather than a cognate notion, and it does not by itself carry quantitative content. Its role is to establish that a primitive of the right category is required, not to establish which primitive of that category.

### Step 2: structural

The minimal differentiation required for physics is not thin differentiation-in-general. Physics requires records of what has happened, and records in the relevant sense have a schematic form: a record is a structure that (i) distinguishes outcomes, (ii) persists under further dynamics, and (iii) composes with other records without erasure. Each condition is independently non-trivial; together they restrict the admissible architectures sharply. The no-go theorem ruling out  $K < 7$  [1] is the worked-out form of (i)+(iii); the spectral density derivation [6] is the worked-out form of (ii). These three conditions are not satisfied by thin differentiation-in-general — they are what separates "difference adequate to be registered" from "difference tout court."

Articulated in finer-grained form, the schematic three conditions unpack into four requirements that together constrain distinguishability into a structured combinatorial system:

- **Stability.** A recorded distinction must not come undone under the dynamics that follow it.
- **Composability.** Records must combine under operations that yield further records of the same kind, so that joint facts about distinct events are themselves available as facts.
- **Countability.** Records must be individuatable — distinguishable from one another — so that operations like ordering, enumeration, and ratio make sense.
- **Persistence.** Records must be re-accessible across the history in which they participate, or composition and reference fail.

These requirements fix the thick content that the transcendental step alone cannot supply. The differentiation adequate to support records in this sense has substantive combinatorial, topological, and spectral content. That content is what VERSF's papers derive:

- The selection of  $K = 7$  as the minimal fact-supporting structure, fixed by a no-go theorem ruling out lower-dimensional relational substrates [1].
- The closure scale  $\xi$  as a structural consequence of three axioms rather than a free parameter [2].
- The commitment barrier  $\Phi_{<sub>c</sub>}$  derived from the same architecture [3].
- The  $\kappa$ -field mass and its coefficient  $\sqrt{4/3}$  fixed by  $\text{PGL}(3,2)$  irreducibility on the 6D non-uniform subspace  $V_{<sub>6</sub>}$  [4].
- The fine-structure constant obtained from  $\xi$  and the commitment barrier with no coefficient fitted to its observed value [5].
- Non-Markovian corrections to decay and gravity as consequences of the commitment-event bath's spectral density [6].

Each is a consequence of *what distinguishability has to be* for it to support observation-as-physics-requires-it, not of what distinguishability would be in thin transcendental idealisation. The structural argument is therefore stronger than "any observation presupposes differentiation." It is: the minimal architecture adequate to support stable, compositional, countable, persistent records carries specific combinatorial and geometric consequences.

## How the derivational yield corroborates the claim

The pattern the derivations exhibit is *structure*  $\rightarrow$  *number*, not *fit*  $\rightarrow$  *prediction*. A parameter fitted to reproduce an observed value constitutes no test of the underlying framework; a number that falls out of the structure, fixed by the architecture before comparison with experiment, is a test — and the form of the number is as informative as its value. This inversion — from fitting parameters to deriving them — is the central empirical risk of the framework: each derived number is a point at which the framework can fail, and there is no free parameter to absorb the discrepancy if the structure yields a value inconsistent with the empirical one. Every derivation cited above is of the former kind: the numerical output is determined by the combinatorial architecture, not chosen to match the data.

The corroboration is therefore not self-justification. Internal consistency of a framework's derivations demonstrates coherence and generativity but not correctness. The external benchmarks matter: the derivations yield quantities also derivable from independent principles ( $\alpha$  from QED, particle masses from the Standard Model, the cosmological constant from  $\Lambda$ CDM), and they do so without parameter tuning. The convergence of two independently-warranted routes to the same number is what corroborates the claim that the underlying primitive has been correctly identified.

A disciplined note on  $\alpha$  is required. The fine-structure constant is known empirically to about 0.15 parts per billion; the VERSF derivation reaches about 15 parts per million at second order. This is not a precision-physics result. What it *is* is a structural derivation with no fit parameters and a specific combinatorial origin, whose numerical output is consistent with the empirical value at the precision the derivation reaches. The structural derivations of  $K = 7$ ,  $\xi$ , and the  $\kappa$ -field mass coefficient are stronger evidence of the framework's discipline than the  $\alpha$  numerical agreement, because they do not depend on precision matching and their form is fixed by the architecture rather than by a fit.

The physics therefore rests on the epistemic claim as articulated in both steps. Whether distinguishability is *ontically* primitive or is the actualization face of a deeper potentiality is a question the derivations are silent on. That silence is a feature: it is why the programme's results are not held hostage to the ontic question.

## 6. Position relative to cognate programmes

VERSF belongs to a broad tradition that takes operational or structural preconditions on observation as foundational, but the position it occupies within that tradition is distinct and worth locating precisely — including against programmes that would press the hardest questions.

**Wheeler's "it from bit"** [7] is closest to VERSF's operational spirit, but Wheeler's bit is ontologically strong: the bit is posited as the fundamental. VERSF does not treat distinguishability as the ontic fundamental; it treats it as the epistemic primitive, with potentiality as its ontic complement. The programmes agree that information-theoretic preconditions are generative, and disagree on whether those preconditions are themselves the bedrock of being.

**Rovelli's relational quantum mechanics** [8] also treats actualisation as event-like: Rovelli's "observers" are any physical systems, not agents with minds, and the relational facts he posits are system-indexed rather than mind-indexed. The real disagreement with VERSF is not about event-indexing; it is about (i) whether actualisation is non-relational — for VERSF a commitment is fact simpliciter, for Rovelli every fact is fact-relative-to-a-system, and the difference is not a matter of framing but of whether a commitment can stand independently of any system to which it is relativised — and (ii) whether there is a substrate aspect of existence — VERSF affirms the Void as non-relational substrate, Rovelli denies any non-relational ontology. The two programmes share a conviction that observation-like events are foundational; they differ on non-relational facts and on substrate.

**Hardy's reconstruction programme** [9] derives quantum mechanics from operational axioms while remaining deliberately metaphysics-neutral. VERSF shares the methodology of deriving structure from minimal preconditions but not the foundational commitments. Hardy is a methodological cousin of VERSF, not a foundational one; the alliance is on how to derive, not on what the primitives are.

**Zurek's existential interpretation and einselection** [10] derive distinguishability *from* quantum dynamics: environment-induced superselection picks out preferred states as an emergent consequence of decoherence. VERSF runs in the opposite direction. Distinguishability is the precondition, not the output; commitment dynamics are derived as consequences of the primitive rather than emerging from an underlying wavefunction. The two programmes are duals on the explanatory arrow.

**Scientific realists — Maudlin [11], Norsen [12], and Ladyman/Ross [15].** Realists will press a question about primitive ontology: what are commitment events — points, fields, particles, events at locations? VERSF's answer distinguishes itself from primitive-ontology realism (Maudlin) and from eliminativist structural realism (Ladyman/Ross). Commitment events are not located at pre-given spatial points, because space is itself derived from the pattern of commitments; but they are not merely structural either, because their content (spectral density, barrier height, architectural role, combinatorial architecture) is theoretically specified rather than operationally defined. The framework is closer to a moderate structural realism: structures are real, but the relata are not eliminated — they are the commitments themselves, with specified content. Whether this fully satisfies Maudlin is a separate question; whether it avoids the over-strong ontic commitments Ladyman/Ross reject is likewise a further question. What the position establishes is that VERSF's ontology is neither primitive-object realism nor pure structuralism, which is precisely the intermediate territory the programme's derivations occupy.

VERSF's distinctive position, then, is (i) a two-primitive ontic level with an explicit substrate aspect, (ii) non-relational actualisation — commitment as fact simpliciter rather than system-relative fact, (iii) commitment treated as a physical source entering the dynamics, and (iv) an epistemic primitive with substantive rather than merely formal structural content. These four together mark out a region of the foundational space that the cognate programmes individually occupy pieces of, but none occupies as a whole.

## **7. Admissibility and the structural necessity of VERSF-type structure**

Locating VERSF within a tradition (§6) is weaker than showing the tradition has to land where VERSF lands. A sharper question therefore remains: could a theory of the observable avoid VERSF-type structure?

The answer is that the structural features VERSF realises are forced by a short chain of eliminations. Each step rules out a would-be alternative by identifying what physics loses if the step's constraint is dropped.

**Step 1 — Without distinguishability, no observation.** A theory positing observable content without minimal differentiation has no observable content to theorise about. This is the §2 transcendental claim, stated as a closure condition on the domain.

**Step 2 — Without irreversibility, no records.** A reversible distinction can be undrawn. Records in the sense any physics requires demand architectural rather than dynamical stability: their continued availability must be guaranteed by the structure of the admissible dynamics, not left to the luck of which trajectory is realised. A distinction whose re-accessibility is contingent on dynamical accident is not a record; it is a transient pattern that happens to persist. Commitment-level irreversibility is what converts transient patterns into architecturally guaranteed records. Statistical irreversibility derived from reversible microdynamics plus initial-condition assumptions yields apparent macroscopic asymmetry but not the architectural irreversibility records require.

A defender of reversible dynamics may reply that initial conditions — a Past Hypothesis or equivalent — fix the realised trajectory so that records are stable along it. This reply relocates the irreversibility rather than dissolving it: the imposition of *which trajectory is actual* is itself the commitment-level posit the programme claims, moved from the dynamics' forward evolution to the choice of trajectory. Reversible-dynamics-plus-Past-Hypothesis is not a counterexample to Step 2 but a restatement of it at a different bearer. (See §9 Objection 2 for the full engagement with this family of replies.)

**Step 3 — Without compositional closure, no physics.** Records that cannot be composed — that yield no joint fact about the relation between event A and event B — give isolated facts without structure. Physics is a theory of relations among facts; it requires closure under the operations that combine records into further records. This is a substantive characterisation of physics, not a trivial one: instrumentalist frameworks that deny fact-level closure pay for the denial by losing the ability to state joint facts about distinct events, a cost the programme judges too high to bear. A framework that produces facts but no compositional algebra over them is not a physics in the required sense.

**Step 4 — Without a minimal architecture, closure fails or trivialises.** At Step 4 the argument passes from philosophical terrain to mathematical content: what was until now a structural demand becomes a constraint on combinatorial structure, to be worked out by theorem rather than by argument. Compositional closure is not automatic. It requires enough combinatorial and topological structure for the closing operations to yield a stable, non-trivial algebra. Concretely, closure demands three independent structural features: non-degenerate combinatorics (distinct records must not collapse into one under composition), non-trivial cycle structure (the algebra must support independent compositional paths rather than collapsing to a linear chain), and stable adjacency (local composition operations must yield globally consistent results). These three features are required jointly by Step 3: an algebra in which composition collapses distinct records to one, lacks independent compositional paths, or fails to support globally consistent local operations is not a theory of relations among facts but a theory of a single fact dressed up as many. Non-triviality is the content of Step 3; the three features are what non-triviality requires. Below a minimum architectural threshold, the combinatorial space is too small to sustain these three features simultaneously: closure either fails (the operations do not compose consistently) or

trivialises (the only closed algebra is degenerate). The programme's no-go theorem [1] establishes  $K = 7$  as that minimum — the smallest architecture on which non-degenerate combinatorics, non-trivial cycles, and stable adjacency coexist. It rules out  $K < 7$  and shows that higher- $K$  realisations reduce to  $K = 7$  at the level of fact-supporting structure. The number is not arbitrary; it is the floor at which closure has room to breathe without collapsing.

**Step 5 — Without single-source representation, observable content fragments.** Step 5 is not derived from Steps 1–4; it is a further admissibility condition whose warrant is independent and whose content is distinct from what Steps 1–4 secure. The warrant is this: a framework whose observable content decomposes into multiple independent functional sources does not have a definite answer to the question "what are observables functionals of?" — the answer depends on which source is queried, and there is no theory-internal fact that privileges one source over another.

This condition is not violated by effective field theory or analogous multi-scale formalisms. EFT's multiple effective descriptions are organisational rather than structural: underneath, EFT is committed to a single compositional content which the effective descriptions approximate at different scales. The single-source condition is therefore not "physics must look like a single equation" but "physics must have a single answer to what its observables are observables of." A framework that denies this is entitled to call itself a theory of multiple observable contents, but the programme is not obliged to count it as a theory of the observable in the singular sense Step 3's compositional closure requires.

Step 5 is not entailed by Step 3 but is continuous with it: Step 3 demands that facts compose, Step 5 demands that the composition has a unique underlying representation. The latter is a genuine further commitment whose warrant is independent, though once adopted it sharpens Step 3 by fixing what compositional closure is closure over.

The content of the Single-Source Theorem [16] is the formal establishment of this condition: any minimal admissible theory expresses its full observable content through a unique functional source — all observables as functionals of a single compositional record density  $\rho(x,t)$ , or an equivalent single-source representation. Alternative actualisation principles are correspondingly constrained: any alternative must yield the same  $\rho(x,t)$  functional dependence, or it does not count as an admissible realisation in the singular sense.

Any admissible theory of the observable therefore implements five features: differentiation, irreversibility, compositional closure, a minimal architecture supporting closure (fixed at  $K = 7$  by [1]), and a single-source functional representation of observables (fixed by [16]). VERSF implements these as the specific fold the programme derives.

The admissibility chain does not establish that VERSF is the *unique* realisation of these features. The correct claim is that admissible realisations lie in a narrow equivalence class, of which VERSF is a fully realised instance — and Step 5 pins the class further than the first four steps alone would: within the class, all admissible theories share a common single-source functional representation. The formal articulation — the Master Theorem establishing that any minimal admissible theory is equivalent, at the level of its fact-supporting structure, to the VERSF fold —

is the subject of the programme's Uniqueness Theorem [13]. The present paper relies on the admissibility chain for its conceptual force and points to [13] and [16] for the formal results.

The argument upgrades the standing of features the paper previously stated as commitments. In particular, irreversibility is not a chosen assumption but a structural precondition of physics-as-a-science-of-records: §8 reflects this upgrade.

## 8. Claimed, assumed, open

The standard VERSF discipline applies to the foundation itself.

**Claimed (epistemic).** Distinguishability is primitive for the observable. The claim has two components: a transcendental component securing that some minimal differentiation is primitive, and a structural component specifying that the differentiation adequate to support physics has substantive combinatorial, topological, and spectral content. Any theory of physical reality must respect this structure.

**Claimed (ontic).** Existence has two complementary aspects — potentiality and actualization — which are co-primitive in the sense of §3. Each requires the other for its intelligibility, and no describable unification into a common substrate *of potentiality and actualization* is available within any theory of the observable. (The unification of the Void's two substrate roles is a separate matter — §3 treats it as economy, not identity.) The Void's two substrate roles — persistence for past commitments and source of pre-actualised possibility — are together what the ontology posits; role (a) is forced by the relational-closure argument (§3), role (b) by the independent argument from the intelligibility of actualisation, and unification of the two in a single substrate is an economy, not a stipulation.

**Claimed (structural precondition).** The actualization principle takes the form of *irreversible* commitment. §7 promotes this from the status of an assumption to a structural precondition: without irreversibility there are no architecturally stable records, and without such records there is no physics in the sense the programme derives from. This is the load-bearing commitment of the programme, and it is forced by the admissibility chain rather than chosen.

### Open.

- *The coherence of potentiality as a distinct ontic category.* Aristotelian potentiality is defined relative to actualisation and on that reading collapses into co-definition with it. VERSF is committed to something stronger — a field of determinacy-bearing possibility that is not merely potential-for-specific-actualities — and this stronger notion is defended structurally in §3 (via relational-closure and the two-substrate-roles argument) and located in modal-metaphysics space, but its full metaphysical articulation remains open.
- *Whether the structural content derived in §5 is unique to distinguishability.* Difference, contrast, relation, and asymmetry satisfy the transcendental role equally; whether they also satisfy the structural role — generating the same combinatorial, topological, spectral consequences — is addressed by the Uniqueness Programme but remains open in the following sense: the programme shows that any minimal fact-producing theory contains

the VERSF fold, not that "distinguishability" uniquely names the primitive. The name matters less than the structural content, but the question of whether alternative names track alternative primitives is genuine.

- *Uniqueness strictly construed.* §7 establishes admissibility of VERSF-type structure, narrow-equivalence-class membership, and single-source representation within the class; strict uniqueness (that VERSF is the *only* realisation, not an instance of a pinned class) is a stronger claim the programme does not make in this paper. The Uniqueness Theorem [13] articulates the equivalence-class result; whether the class reduces to a single structure under further admissibility conditions is a further question.
- *Alternative actualisation principles.* Whether formulations of the actualisation principle other than irreversible commitment could support an equally generative programme. This question is bounded by the Single-Source Theorem [16]: any alternative would have to yield the same  $\rho(x,t)$  functional dependence of observables, which substantially narrows but does not exhaust the space of possible alternatives. Phenomenological differences, if any, would appear in predictions the theorem does not fix.
- *Mathematical articulation of the Void.* Whether the notion of the Void admits a sharper mathematical articulation than "substrate of possible distinctions supporting commitment events, playing both the persistence and source-of-possibility roles."
- *The complementarity's finer structure.* Whether the complementarity of potentiality and actualisation admits a more articulated structural characterisation than the one given here.

The programme's physics does not hinge on the resolution of these questions, but the programme acknowledges them as genuine and unresolved.

## 9. Anticipated objections

Five objections recur in this territory and are worth answering directly.

**Objection 1: Distinguishability is too weak to constrain physics. Any formal notion of difference would do; the transcendental argument does not single out anything of physical consequence.**

*Reply.* The transcendental step (§2 Step 1 and §5 Step 1) is weak on its own and does not purport to single out distinguishability by itself. The structural step (§5 Step 2) does the work: the schematic conditions (distinguishes outcomes, persists under dynamics, composes without erasure) and their articulated form (stability, composability, countability, persistence) constrain the primitive into a structured combinatorial system, and the admissibility chain (§7) shows that these requirements — together with single-source representation — are forced on any theory of the observable that supports records. The resulting constraints are strong enough to fix  $K = 7$ ,  $\xi$ ,  $\Phi_{<sub>c</sub>}$ , the  $\kappa$ -field mass coefficient, and  $\alpha$ 's structural origin. The objection holds against a framework that rested on the transcendental step alone; it does not hold against the two-step form backed by the five-step admissibility chain.

**Objection 2: Irreversibility could be emergent from reversible dynamics, in which case it is not a foundational commitment.**

*Reply.* Apparent macroscopic irreversibility can emerge from microscopic reversibility plus initial-condition assumptions (the H-theorem, and the thermodynamic arrow generally). This is well-understood and the programme does not deny it. The question is whether such emergence supplies irreversibility *at the commitment level* — the level at which records are architecturally stable, not merely the level at which statistical distributions evolve asymmetrically. A "record" that remains in-principle undoable under the underlying reversible dynamics is a pattern whose continued availability is a matter of dynamical luck rather than architectural guarantee. The §7 Step 2 argument bites here: if the admissible dynamics permit reversal, then for any such "record" there exists a valid trajectory along which it is undone, and its re-accessibility at later times is contingent rather than structural.

The stronger form of the objection — due to the Albert/Loewer tradition on the Past Hypothesis [18] — is that the actual trajectory is fixed by initial conditions, so along the realised trajectory the record is stable and there is a fact of the matter about whether it obtains. The reply is that "the realised trajectory" is not a fact available from within the reversible dynamics themselves; it is a boundary condition imposed externally. The imposition is the commitment-level irreversibility the programme claims, relocated from the dynamics' forward evolution to the choice of which trajectory is actual. The Past Hypothesis therefore does not dissolve Step 2; it restates it at a different bearer. This is a virtue rather than a defect of the Step 2 argument: the programme's structural posit recurs wherever one tries to locate it, which is what one would expect if the posit is correctly identified.

Any emergence story further presupposes prior commitment to the coarse-graining that generates the asymmetry — which is itself a commitment requiring irreversibility at the level the programme needs. The objection pushes the structural posit back a level, or sideways to a different bearer, rather than dissolving it.

### **Objection 3: The Void is not needed. Purely relational structure suffices to support physics.**

*Reply.* This is addressed directly in §3 under "Why the Void is not optional." Purely relational frameworks cannot support the persistence required for compositional closure without implicitly importing a substrate — whether called "the relational manifold," "the system of relations," or anything else. The implicit substrate plays the role VERSF's Void plays explicitly; the difference between a framework that names the substrate and one that does not is methodological, not structural. The "two substrate roles" subsection further sharpens the reply: a framework can accept the persistence-of-past role without the source-of-possibility role only by owing a separate account of commitment-production that it has not supplied.

### **Objection 4: Multiple structures could satisfy the admissibility requirements. Why VERSF specifically?**

*Reply.* The programme does not claim VERSF is the *unique* admissible realisation. It claims that admissible realisations lie in a narrow equivalence class — formally characterised by the Uniqueness Theorem [13], with the class further constrained by the Single-Source Theorem [16] — of which VERSF is a fully realised instance. The strength of the claim is calibrated to what has been established: structural necessity at the level of features (differentiation, irreversibility,

closure, minimal architecture, single-source representation), narrow-equivalence-class membership at the level of the concrete realisation, and an open question about whether further admissibility conditions would reduce the class to a single structure. This is weaker than "VERSF is inevitable" and stronger than "VERSF is one possibility among many." It is the position the arguments support.

**Objection 5: The admissibility chain posits modal-structural necessity that a Humean ontology denies. The programme's "structural preconditions" are regularities promoted to necessity without independent warrant.**

*Reply.* The chain does modal work, and that work is non-Humean. The programme does not argue the Humean out of Humeanism — a separate and longer battle — but it argues that for someone who holds that physics is a science of records that can be referred to and composed, the admissibility features are forced by that demand, not elevated from mere regularity. A Humean [17] who denies the demand is entitled to reject the chain, but owes an account of what physics is the science of if it is not the science of what the chain takes as its target. The programme's modal commitments are domain-internal and restricted to what physics-as-a-science-of-records requires. Whether Humean supervenience can accommodate even that restricted modal work is a separate philosophical question; if Humean supervenience cannot accommodate domain-internal modal commitments of this restricted kind, the programme takes the limitation to be Humean supervenience's rather than its own.

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## Conclusion

VERSF's foundation is a layered structure. Distinguishability is primitive for observation, and this is what the physics requires — transcendentally in warrant, structurally in content, and the two-step form of the claim is the honest form. Potentiality and actualization are complementary primitives in being, and this is what a coherent ontology requires; the complementarity is a structural claim about what can be said, and the Void's role as substrate — covering both persistence of past commitments and source of pre-actualised possibility — is forced by the requirements of compositional closure and the intelligibility of actualisation, not added as embellishment. The epistemic primitive carries substantive structural content — combinatorial, topological, spectral — which is why the derivations yield quantitative predictions rather than only formal constraints. The pattern the derivations exhibit is *structure* → *number* rather than *fit* → *prediction*; each derived number is a point at which the framework can fail, and the framework accepts that exposure as the form falsification takes for a fit-free architecture. The structural features the framework realises are not optional: any admissible theory of the observable must implement differentiation, irreversibility, compositional closure, a minimal architecture fixed at  $K = 7$ , and a single-source functional representation of observables. VERSF is a fully realised instance of the narrow equivalence class those requirements define. The physics proceeds from the epistemic claim alone, which is the claim the derivations corroborate through agreement with independently-established values; the ontic question is separately acknowledged and answered where the programme can, and explicitly flagged as open where it cannot. The layering is the position, not a retreat from a stronger one. Stated directly, with the

admissibility chain as its structural backbone, it is the foundation on which the rest of the programme rests.

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Additional foundational papers in the programme include the Causal-Coherence Compatibility condition and the Memory Kernel Reduction paper, available at versf-eos.com.

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## **Philosophical background**

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