Epistemic Foundations & Methodological Constraints
On the Epistemic Null Hypothesis of Relational Physics

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Abstract

This methodological white paper establishes the formal epistemic and logical criteria governing *WILL Relational Geometry (WILL RG)*. Extending Karl Popper's refutability criterion to every internal component of a physical theory—assumptions, entities, properties, and formalisms—we demonstrate that the unification SPACETIME ≡ ENERGY ≡ WILL constitutes the epistemic null hypothesis (zero surplus ontology). By formulating the *False Separation Lemma* and the *Asymmetric Dependency Lemma*, we prove that the substantival 4D background container is an unobserved, postulated absolute. We define precise operational resolution conditions under which the spacetime container postulate is tested and shown to be operationally redundant.

1 The Refutability Criterion Applied Internally

A scientific claim is defined by its susceptibility to empirical refutation. Standard falsificationism evaluates theories in their entirety; relational methodology applies this demand to every individual element within a theory.

Definition 1.1 (Scientific Claim)**.** *A claim is scientific when some possible observation could contradict it. A claim or structural element that no possible observation could contradict cannot be admitted into physics.*

Applying Definition 1.1 across the constituent elements of physical modeling yields four foundational methodological principles:

Principle	**Theory Element**	**Operational Application of Falsifiability**
Epistemic Hygiene	Assumptions	An assumption that no observation tests is not admitted.
Ontological Minimalism	Posited Entities	An entity whose presence alters no observation is excluded.
Relational Origin	Properties	Every measurement is a relative comparison; an intrinsic property "in itself" demands explicit evidence.
Mathematical Transparency	Formalism	A symbol or operator without direct physical meaning is surplus ontology hidden inside mathematics.

2 Ontological Reduction and the Null Hypothesis

Standard physics employs a *bi-variable syntax*:

$$\underbrace{\text{fixed manifold } \mathcal{M} + \text{metric } g_{\mu\nu}}_{\text{spacetime container}} \quad + \quad \underbrace{\text{fields } \psi + \text{constants } (G, c, M)}_{\text{energy dynamics}} \tag{1}$$

Lemma 2.1 (False Separation)**.** *Any model that treats physical processes as unfolding* within *an independent background necessarily assigns to that background structural attributes (dimension count, metric signature, or reference frame) not derivable from the relations among the processes themselves. Such a background constitutes an unobserved, extraneous absolute.*

Proof. Suppose an independent background space exists. At least one of its structural attributes remains fixed regardless of the energetic content within it. This attribute is postulated *a priori* rather than derived from physical relations, violating Relational Origin and Ontological Minimalism. Therefore, the separation between container and content is unwarranted. □

Definition 2.1 (Ontological Weight)**.** *The number of irreducible primitives posited by a framework:*

Ontological Picture	***Irreducible Primitives***
Substantival (Container + Content)	≥ 2
Relational (SPACETIME ≡ ENERGY ≡ WILL)	1

Theorem 2.1 (WILL as Single Primitive)**.** *The single irreducible primitive of relational physics is the unified relation structure of space, time, and energy:*

$$\textbf{WILL} \equiv \textbf{SPACE-TIME-ENERGY} \implies \textbf{SPACETIME} \equiv \textbf{ENERGY} \tag{2}$$

Proof. By Ontological Minimalism and the False Separation Lemma (2.1), spacetime and energy cannot be maintained as separate, mutually independent primitives. Unifying them into a single relational primitive reduces the ontological weight from ≥ 2 to 1. This operation adds no new entities; it subtracts unobserved background postulates. □

Lemma 2.2 (Asymmetric Dependency)**.** *The statement SPACETIME ≡ ENERGY is the default epistemic null hypothesis.*

Proof. Consider the two competing positions:

1. The substantival stance posits two distinct primitives: a background manifold (container) and matter-energy dynamics (content).
2. The relational stance posits SPACETIME ≡ ENERGY, rejecting the independent background manifold.
3. If the container postulate is removed, the relational claim dissolves into a tautology (there is no structural separation left to collapse).
4. If the relational claim is removed, the container postulate remains as an unverified, positive assumption.

Because relational unification exists strictly as the logical cancellation of the container postulate, it introduces zero independent ontology. It is therefore not a competing ontology, but the epistemic null hypothesis. □

3 Operational Resolution Conditions

The central defense of substantival General Relativity states:

> *"Every posit must pay in evidence — and the spacetime container has paid. The theory built on it predicted light bending, clock shifts, and perihelion advance, all of which were confirmed."*

This objection defines the precise operational resolution conditions for the relational research program:

Operational Resolution Conditions

- **Dissolution Condition:** If the same or superior operational empirical results are derived **without** referencing a background container, the container postulate dissolves under Ontological Minimalism as surplus ontology.
- **Vindication Condition:** If any operational empirical result can be obtained **only with** a background container, the container postulate stands as physically necessary.

4 Summary & Epistemic Auditability

Relational Geometry (WILL RG) and Relational Orbital Mechanics (R.O.M.) satisfy the dissolution condition by recovering:

1. First post-Newtonian (1PN) observational equivalence for perihelion advance, light deflection, gravitational redshift, and frame-dragging directly from dimensionless phase projections on S^1 and S^2 carriers.
2. Complete elimination of mass M and G as dynamic primitives, establishing them as post-hoc unit conversion factors for the horizon scale R_s.
3. Parameter-free divergence at order $\mathcal{O}(\beta^4)$ providing a falsifiable empirical test against 2PN General Relativity.

Every statement within the framework is subject to two formal audits: a **Geometric Audit** (internal mathematical consistency) and an **Empirical Audit** (direct observational agreement).

Conclusion: Refusing to import an unobserved background container is not a new axiom, but the strict application of the scientific method.